



KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MADADENI PROVINCIAL HOSPITAL UPGRADE TO STUDENT ACCOMMODATION

ANNEXURE 2

General Electrical Specification



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

TENDER

ELECTRICAL GENERAL

SPECIFICATION

MADADENI PROVINCIAL HOSPITAL UPGRADE TO STUDENT ACCOMODATION

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GENERAL SPECIFICATION

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GENERAL SPECIFICATION

1.1 GENERAL

1.1.1 General Aspects

In this document the term "Contractor" shall mean the Contractor appointed in terms of this document, irrespective of whether the contract is a direct contract with the client or a sub-contract with a Principal Contractor.

Prices tendered for equipment specified by trade names or catalogue references must be for the type and manufacture specified. If it is desired to use substitutes, the onus will be on the Contractor to prove that such substitutes are similar and equivalent to the article specified and meet with the approval of the Engineer in writing. The decision whether the tendered articles are acceptable shall rest solely with the Engineer. The cost implications of such substitutes shall be allowed for in the tendered amount.

Tenderers are required to enter at the time of tendering in the Schedules of Equipment and Materials Offered, the manufacturers of the materials, on which their tender is based, and the catalogue numbers and other information by which the materials may be identified. Technical brochures of the equipment offered shall be submitted with the tender to enable the unit concerned to be identified without ambiguity.

Tenderers shall only offer equipment for which proven backup is available in South Africa.

The Project Specification shall take preference over this General specification where any conflict exists.

Should the Tenderer become aware of any discrepancies or apparent discrepancies in these documents, he shall notify the Engineer thereof.

All materials and equipment used shall be of new and represent the manufactures latest product range.

If requested by the Engineer, the Contractor shall submit samples of cables, terminals, labels, trunks and other construction materials which he proposes to use on the installation for the Engineer's approval.

All materials and equipment used shall be suitable for the environment and service for which it is to be used. This pertains; inter alia, to corrosion protection, UV stability etc.

Equipment offered shall be small enough to be moved through the available doorways, passages, etc, to their final locations.

Dimensions scaled from drawings shall not be used to obtain lengths of trays, trunks, cables etc. The runs shall be measured on site.

The Contractor shall make due allowance for other Contractors' operations in progress concurrent with his own activities.

1.1.2 General Installation Requirements

NO DEVIATION FROM THE SPECIFICATION will be tolerated or paid for without the written approval of the Engineer.

The installation shall comply in each instance with the requirements as set by the CLIENT and Engineer, in particular to the general specifications for the various electronic subsystems, as well as all relevant SANS codes of practice and standards.

Where no SANS guideline exist, the IEC, EN and ANSI standards will be applicable.

The installation shall be done in accordance with the drawings issued by the Engineer as approved by the Client and no installation work shall be carried out without issued for construction drawings.

All routing requirements and conduit installation work shall be done by as part of this contract and all additional reticulation routes required by the Tenderer shall be indicated and marked on his drawings and submitted to the Engineer for approval.

At the end of each day, the Contractor shall be responsible for the clean up, removal, and secure disposal of all debris.

Any damage to protective coatings, equipment, services or structures caused by the Contractor shall be made good.

The Contractor shall prevent pollution caused by spillages of fuels and lubricants, etc.

Only technicians and artisans with adequate and applicable training and experience shall be used to carry out the work on this contract.

If installation commences with any type of material or equipment, then the same type shall be used

throughout the contract.

1.2 STANDARDS AND REGULATIONS

1.2.1 National Standards and Regulations

The following regulations, standards, codes of practice and guidelines are referenced in this document. They are all subject to revision and users of this specification must use the most recent editions of those listed below.

In particular the Works shall comply with the following regulations:

- Electricity Act (Act No. 41 of 1987) as amended
- Occupational Health and Safety Act (Act No 85 of 1993) as amended
- The Environmental Conservation Act (Act No 73 of 1989) as amended
- Provincial Road Traffic Ordinance and regulations
- SANS 10139, 2012: Edition 3.2 Fire detection and alarm systems for buildings – system design, installation, and servicing
- The wiring of premises (SANS 10142)
- National Building Regulations Act No 103 of 1977
- SANS 10400, 1990: The application of the national building regulations
- SANS 9000:2005/ISO 9000:2005: Quality management systems - Fundamentals and vocabulary
- The local Councils bye laws as well as the local Supply Authority Regulations.

1.2.2 In addition the Contractor shall issue all notices and pay all the required fees in respect of the Installation to the local authorities and shall exempt the Employer from all losses, costs or expenditures which may arise as a result of the Contractor's negligence to comply with the requirements of the regulations enumerated in this specification.

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

1.2.4 Standing Instruction

In addition to complying with the OHS Act the Contractor shall also adhere to the standing instructions applicable to the site as issued from time to time by the Engineer and/or Employer.

1.2.5 Safety

Noise control, environmental aspects, aesthetics and staff comfort all to adhere to the OHS Act.

1.3 COMPLIANCE TO THE SPECIFICATION

1.3.1 The Contractor shall comply with all the requirements as per this specification. Proposed deviations shall only be considered after the award of the contract.

1.3.2 Proposed deviations shall only be accepted if it meets with all of the following criteria:

The proposed deviation offers a substantial improvement to the final product offered.
The proposed deviation has been proven in other applications.

1.3.3 Any deviations from the specifications can only be implemented with prior approval from the various representatives from both the Client and the Engineer.

1.4 PROVEN PRODUCT

1.4.1 Due to the security nature of these requirements and the criticality of this application only proven products shall be considered.

1.4.2 Products could be approved only after investigation by all applicable parties.

- 1.4.3 The guidelines for similar applications demands that five installations have to be operational in accordance with the above requirements for a minimum period of no less than one year before a product will be considered to be a proven product.

1.5 CABLING

1.5.1 General

Supply, install, connect, and terminate all cabling necessary to complete the installation of audio, data, control, CCTV, smoke detection, alarm systems, access control, electrical equipment, electrical cables, communications and device cabling.

All cabling shall be supplied and installed as a part of this contract.

All terminated cabling shall be neatly tied/loomed to prevent damage to terminations and interference or obstruction of other services.

Strain relief shall be provided for cables connected to rack mounted equipment.

All cables shall have stranded copper conductors and shall be PVC insulated with overall PVC sheath, unless otherwise specified.

All cabling shall be concealed and installed on metal cable tray, cable duct and conduits.

Cabling shall be installed with due regard to future removal and replacement of cables.

All cables shall be new and delivered on site in unbroken reels, and with the "manufacturer's" label attached.

Due consideration shall be given to voltage drop when calculating cable sizes.

Installation and cable route shall be to the satisfaction of the Engineer.

Cables shall be installed in a manner eliminating any possibility of strain on the cable itself or on cable terminations.

No joints or connections will be permitted. Adequate loose cable shall be left behind all equipment to facilitate removal for inspection, adjustment or replacement.

Any bending, jagged edges or any other forms of damage or deformation of cable trays or wire ways shall be made good, before cables are installed.

Conduit shall be thoroughly cleaned and have all burrs removed before the drawing in of any cable.

The tray shall be supported at every change in direction of the cable tray route. The minimum radius of any bend of the tray is to suit the minimum bending radius of the largest cable on the tray.

Cable trays shall be firmly secured in position in such a manner to cause as little obstruction to walkways etc., as possible.

Hangers, supports and anchors for wire ways and equipment, shall be designed and installed with regard to appearance and convenience as well as for adequate strength and rigidity. Only professional quality fixing material and methods shall be used. Nails and glue are not acceptable.

1.5.2 Cable Damage

During the installation of cable should any kinks or abrasions to insulation, braiding, sheathing or armouring occur, the affected cable shall be withdrawn and replaced with new cable at no additional cost to the client.

1.5.3 Cable Numbering

Generally all cables shall be allocated and identified with a unique cable number.

All cables including patch leads shall be clearly labelled. Labels shall be affixed within 250mm of each termination.

Cables shall be fitted with tags at the following points:

- On the cable sheath next to the gland at each end
- In cable pits/manholes
- In all vertical data risers
- At any additional point on the cable sheath (or around the core bunch) where the preceding requirements are not readily traceable from the core terminations
- Any inspection/junction box

Cable identification tags shall be orientated uniformly to read left to right from the logical viewing point horizontally; and from bottom to top viewed from the right where installed vertically.

Duplication of cabling and equipment identities shall not be allowed.

1.5.4 Coordination and Separation of Services

Install services for each respective section and system and physically separate from other systems to a discipline and coordinated layout plan. Adjacent services shall run approximately parallel. Crossing services shall cross at approximate right angles.

Individual services between common points of the work shall follow similar parallel routes. Cables shall be parallel to the building major axes.

Separation distances shall not be less than the following:

- Power cables – 100mm.
- ELV and Communication cables to parallel power cables – 300mm
- ELV and Communication cables to power cables crossed at 90 – 100mm.
- Any trade to finish floor level – 80mm
- Any trade to structure – 20mm.

1.5.5 Coordination and Feasibility

The drawings, schematics and specification indicate the main routes and positions for the various services installations and equipment in relation to the building and other services.

Check the details shown on the drawings and co-ordinate the details layout with the building structure and other services. Submit full details of proposed major cable routes for approval before proceeding.

The Contractor shall deliver to the Engineer in accordance with the scheduled works program:

- Details of all types of cabling to be installed as part of the contract works
- Block schematic cable diagrams indicating all system interconnecting cables including cable routes and cable types complete with core make up and numbers
- Detailed floor plans indicating cable routes and designated circuit identification
- Wiring diagram detailing system interconnections and cable/core identification

1.5.6 Special Cabling

Where equipments to be supplied and installed under this specification requires special cabling (i.e. screened cables, unshielded twisted pair, coaxial, optical fibre or other special types of cable), these cables shall be provided as part of this contract.

It shall remain the responsibility of the Contractor to design the cabling system network and determine the type of cable required for interconnection of the various components, which make up the total system to be installed, to comply with the contract documents.

1.6 WIRE TERMINATING AND MOUNTING HARDWARE

1.6.1 Every terminal strip shall be numbered or named.

1.6.2 Every terminal shall be numbered.

1.6.3 Cable glands shall be of the compression ferrule type with "O" ring seals.

1.6.4 Wherever possible, terminations of cable cores and wires shall be made using spade, pin or bootlace ferrule type crimp-on lugs.

1.6.5 Lugs may only be crimped with controlled pressure crimping tools of the correct size for the lug used.

1.6.6 Thin, collapsing pipe type ferrules shall not be used.

1.6.7 High quality wire strippers shall always be used and care taken not to nick or otherwise damage the strands.

1.6.8 Terminals shall be located so that all connections can be made easily.

1.6.9 When wiring of different potentials and types of supply use the same terminal rail, a clear space or barrier shall be provided between terminal blocks.

1.7 EARTHING SPECIFICATIONS

1.7.1 The Earthing connection to the security equipment shall be no more than a 1 Ω connection. The Earthing shall be done from a single (SPUR Distribution Point) point to each part of the security installation e.g. Equipment/Wiring Closets, Service and Central Equipment Locations etc.

- 1.7.2 No daisy chaining of the Earthing connection shall be allowed, except as described in the section on high-rise buildings. The reticulation for the earth connection shall be done with no less than 70 mm² Green Isolated Copper Conductor (GICC). The same spur point shall be connected to the Electrical Earth. The connection to the Electrical Earth can be done with Bare Copper Conductor (BCC) with a cross sectional area of no less than 70 mm².
- 1.7.3 The copper conductors shall be terminated in a lug which shall be bolted to the Earthing bar. The Earthing bar shall not be smaller than 6mm x 50mm x 300mm. No more than 1 conductor per lug and no more than 1 lug per terminal point on the earthing bar will be tolerated. The lugs shall be crimped or CAD welded to the conductor and shall be inspected by the Engineer prior to acceptance. The Security and Electrical Earths shall be run in separate conduits and be separated by no less than 1 m. The Earthing conductors may cross each other and any other electrical cable at a 90° angle.
- 1.7.4 All Earthing bars, screws, lugs & isolators shall comply with the SANS 0142 Wiring Code, SANS Earthing Specification & all relevant IEC standards.
- 1.7.5 Any conducting material that has been anodized, e.g. aluminium may not be used as an earth bus-bar unless special precautions have been taken to ensure that the anodizing material has been removed where the earthing connections are made.
- 1.7.6 All connections between racks or sub-racks used to transmit audio, video, radio frequency or digital data must be made using co-axial type wiring having the correct matching impedance and must be to the manufactures specification.

1.8 LIGHTNING AND SURGE PROTECTION SPECIFICATION

- 1.8.1 The Contractor shall provide and install all the necessary surge protection devices, for the protection of the electrical/electronic control equipment, communication and data lines. Surge Protection devices shall protect all AC and DC circuits from the effect of lightning induced over voltages, internally generated transients and utility switching transients.
- 1.8.2 Surge protection will be required on the incoming power supply to the electronics equipment and shall be done at the single point where the supply enters the building. Lightning protection shall be installed from Live to Earth (L-E), Neutral to Earth (N-E) and from Live to Neutral (L-N) on a single phase supply. If a 3 phase supply is used lightning protection shall be required on each phase individually (L1-E, L2-E, L3-E & N-E). If the same supply is reticulated to another building additional lightning protection shall be required where it enters the next building. The protection shall be as described above.
- 1.8.3 The Tenderer has to allow for additional surge suppression and voltage stabilisation equipment if this is required to protect his equipment or to guarantee its correct operation.
- 1.8.4 The test pulses shall be applied at intervals of not less than one minute.
- 1.8.5 The surge protection equipment may be built into the equipment being protected. If the provided internal protection is inadequate to meet this specification, then additional external protection has to be provided.
- 1.8.6 There shall be an earth bar in the lower corner of each enclosure and shall be sized to accept a 16mm square BCW. The Bare Copper Wire shall be terminated at the nearest earth mat.
- 1.8.7 AC protection devices can be located in the equipment cabinet and must be installed prior to any distribution (i.e. multi-outlets).
- 1.8.8 Surge protection devices shall be chosen in such a way that the protected circuit shall still function to specification in spite of the introduction of series and/or shunt impedances by the protecting devices.

1.9 EQUIPMENT FIXING REQUIREMENTS

- 1.9.1 Under no circumstances shall double sided tape be used any where on this installation for whatever purpose.
- 1.9.2 Specific Surface Requirements

Drywall - Dry wall plugs, Toggle Bolt anchors (Butterfly nuts) or Superfast™ Toggle anchors may be used to fix equipment, conduit or trunking.

Brick Walls - HILTI, Fisher, UPAT or RAWL type plugs are acceptable for fixing equipment, conduit or trunking.

Concrete - HILTI gun, RAWL bolts or chemical bolts are an acceptable means of fixing equipment, conduit or trunking.

Ceilings - For suspended ceilings, Toggle Bolts anchors (Butterfly nuts) or Superfast™ Toggle anchors are an acceptable means of fixing equipment, conduit or trunking. Drywall screws will also be acceptable if they are screwed directly into the support struts. For normal ceilings Toggle Bolt anchors (Butterfly nuts) or Superfast™ Toggle anchors are an acceptable means of fixing equipment, conduit or trunking.

Steel - Up to 3mm: Self tapping screw with drill, a self tapping screw or aluminium pop rivets (except for door hinges) are an acceptable means of fixing equipment, conduit or trunking. Above 3mm: bolts and nuts are an acceptable means of fixing equipment, conduit or trunking.

Wood - Drywall screws are an acceptable means of fixing equipment, conduit or trunking.

Aluminium - A self tapping screw or aluminium pop rivets (except for door hinges) are an acceptable means of fixing equipment, conduit or trunking.

1.9.3 Specific Equipment Instructions

Alarm Wire - A glue gun or contact adhesive shall be used.

Trunking - Shall be fixed at minimum intervals of 1m.

Conduits - Raised aluminium saddles shall be used if the conduit is installed surface mount.

1.10 SIGNS, MARKERS, NAMEPLATES AND TAGS

1.10.1 All cable cores and wires shall be numbered at all termination points with "slip-on" interlocking type cable markers. Split-ferrule types are unacceptable. In the case of multi-core cables each core shall be numbered.

1.10.2 Signs, Markers, Nameplates and Tags shall be totally:

UV-resistant;

Fade-resistant;

Corrosion resistant;

Shall have a minimum life expectancy of 10 years.

Shall not be damaged by any commercially available solvent

1.10.3 Cable Tags

Labels shall be colour-coded and include alphanumeric text 8 to 10 characters long.

For the labelling of cables any one of the following methods is acceptable:

- Cable-Tie Markers
- Clip-On Labels
- Printable Slide-In Labels

1.10.4 Nameplates

In order for a technician to easily identify equipment locations a 250mm x 200mm sign shall be installed on the door of the field cabinet.

The sign shall be precision engraved letters and numbers with uniform margins.

Character sizes shall be a minimum of 50mm high.

All nameplates shall be permanently attached.

1.11 EQUIPMENT RACK CABINETS AND JUNCTION BOXES

1.11.1 General

To save space inside the equipment room, and to keep the installation neat, equipment shall be installed in the 19" racks and junction boxes.

All pure technical equipment like the storage servers, surge protectors etc., shall be fit into 19" rack enclosures accessible from two sides (front and rear). Those racks shall be protected against dust and freezing as against excessive heating.

All rack enclosures shall be black powdered coated. The cabinets shall also include all power and cable management articulation.

1.11.2 Floor Standing Equipment Rack Cabinets

The cabinets shall be lockable and the key will be controlled by the Client.

The racks shall comply with the following specifications:

- Colour/Finish: Powder-coated, black;
- Fixed 19" installation front and rear, for components in accordance with IEC 297-3;
- Flexible mounting for components with T-slot mountings;
- Cable entry via the plinth and top cover;
- The rack enclosures shall have a complete ventilation system built-in to ensure adequate airflow. This shall be accomplished by installing a perforated front and back doors and extraction fans the top of the rack enclosure;
- Door open angle 180°.
- Cross connecting jumper space shall be at least 120mm to the front and rear;
- An IP40 protection rating;
- Load rating shall be 500kg, static;
- Height: 15U, 20U, 24U, 33U, 38U, 43U or 47U (1U = 44.45mm);
- Width: Inside – 482.6mm (19") / Outside – 750mm;
- Depth: 1000mm;
- Where specified, The Rack enclosure shall include a 2U rack mounted LCD Monitor, Keyboard and Mouse, with built in KVM switch to connect to the relevant Servers.

1.11.3 Wall Mount Swing Frame Equipment Rack Cabinets

The cabinets shall be lockable and the key will be controlled by the Client.

The racks shall comply with the following specifications:

- Fixed 19" installation front, for components in accordance with IEC 297-3
- Flexible mounting for components with T-slot mountings
- Covers above and below with brush strips for cable entry and with side vent slots
- Heat dissipation discharge via a vent lid or fan top
- Door open angle 180°
- Cross connection jumper space shall be at least 100mm to the front and 50mm to the sides
- An IP20 protection rating
- Load rating shall be 50kg, static
- Height: 6U, 9U, 12U, 15U, 18U or 21U (1U = 44.45mm)
- Width: Inside – 482.6mm (19") / Outside – 600mm
- Depth: 600mm

1.11.4 Rack Accessories

Brush Panels

The brush panels shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front or rear
- Height: 1U (1U = 44.45mm)
- Colour/Finish: Powder-coated, black
- Brush panels shall be installed above and below all BNC, Fibre and RJ45 FTP patch panels. Sufficient brush covers shall be installed to enable neat cabling and proper bending radius of cabling in the rack.

Cable Routing Panels

The cable routing panels shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front and rear

- Height: 1U (1U = 44.45mm)
- Colour: Front Panel – powder-coated, black
- Cable routers shall be installed in 19" racks to neaten the cables. This shall be done at the Engineer's discretion

Shelf

The shelves shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front
- Depth: 250mm, 320mm, 450mm or 500mm
- Colour: Powder-coated, black
- Load rating shall be 20kg, static
- Shelves shall be used to install equipment without 19" rack mounting options in equipment racks

Pull-Out Shelf

The shelves shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front
- Supplied with a handle
- Depth: 450mm or 600mm.
- Colour: Powder-coated Black
- Load rating shall be 20kg, static
- To be supplied fully assembled.

Blank Panels

The blank panels shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front or rear
- Height: 1U, 2U, 3U, 6U or 9U (1U = 44.45mm)
- Colour: Powder-coated, black
- All open areas on the front of a supplied 19" rack are to be blanked off with the appropriate blanking panels

Power Strips (Multi-Plugs)

The power strips shall comply with the following specifications:

- Versatile all-metal cabinet with detachable mounting flanges allows rack mount, wall mount, under counter and other creative mounting options.
- 6, 8, 12 or 16 Dedicated Socket Outlets (RED)
- 15, 20 and 30 Amp UL and CUL listed
- 4-2ay Universal Mounting
- Reset-able circuit breaker with surge protection
- The outlets shall be generously spaced to improve cable management
- Available in 19" Rack Mount, 28", 40" and 66" Lengths for Vertical or Horizontal Cabinet and Rack Mounting
- An IP40 protection rating
- The 19" racks shall be fitted with these multi-plug strips and there shall be one plug per piece of equipment installed in the rack.

1.11.5 Equipment and Junction Boxes

Equipment and junction boxes shall be of steel or GRP construction.

All steel shall be primed, undercoated and gloss finished with epoxy or polyurethane paint.

All boxes shall be fitted with DIN-rail mounted 2-pole 10-Amp breaker switch for termination of power cable.

All boxes shall have a box name or number on the cover.

Boxes for indoor use shall be at least IP 52 rated.
Boxes for outdoor use shall be at least IP 65 rated.
All junction boxes shall provide the facility to terminate fully the entire multi-core cable entering the box.
Boxes which shall be exposed to the sun shall face south.
Boxes shall be mounted with their sides, true vertical and horizontal.

1.12 CONSTRUCTIONAL ASPECTS

- 1.12.1 All holes, wire ways, trenches, etc required for this installation and made by the Contractor shall be reinstated to the original condition.
- 1.12.2 In all cases where the Contractor uses facilities provided by others, it is the responsibility of the Contractor to ensure that these are provided correctly to match his requirements. If discrepancies are found, these shall be brought to the attention of the Engineer immediately and prior to the installation of equipment.
- 1.12.3 No face-brick or other finished surfaces may be chased without the permission of the Engineer.
- 1.12.4 No cutting of structural concrete will be permitted without the permission of the Engineer.
- 1.12.5 The Contractor shall provide and erect all necessary scaffolding for this contract. Scaffolding erected by another Contractor may be utilised by the Contractor provided suitable arrangements are made with the other Contractor.

1.13 TESTING AND COMMISSIONING

- 1.13.1 The successful Tenderer shall note that it is a requirement of this tender that a detailed testing and commissioning schedule be prepared for the full testing and commissioning of the complete system.
- 1.13.2 This full schedule will be available four weeks after appointment of the successful Tenderer. The testing and commissioning schedule shall be to the approval of the Engineer.
- 1.13.3 It must be noted that no piece meal hand over will be acceptable and that the entire integrated system shall be inspected and tested once all work as detailed in this detailed specification has been completed.
- 1.13.4 When the Fire Detection is ready for service, commissioning shall take place to check whether the correct quantities of equipment have been delivered and the installation is in accordance with the specifications. Commissioning shall be performed in co-operation with the successful tender's personnel and representatives of Client and Engineer.
- 1.13.5 The date of commissioning will be scheduled by the Contractor and has to be approved by the Client.
- 1.13.6 Practical Completion will only be issued once the whole of the integrated fire detection installation satisfies the operational performance requirements of the contract and the Engineer is satisfied that all security systems are capable of operating effectively.
- 1.13.7 All individual building levels and subsystems shall be thoroughly tested in the presence of, and to the satisfaction of, the Engineer or their authorised representative. Performance and acceptance testing shall include a thorough inspection (point by point) of the entire installation and verification that the installation complies with the requirements of the specification.
- 1.13.8 Performance and acceptance testing to determine whether the integrated security system achieves the required level of performance will only be undertaken after all routine testing, adjusting, commissioning, approvals and building work associated with the contract are complete and the works have been fully tested and commissioned by the Contractor.
- 1.13.9 Details of the testing required for each system and equipment shall be included in the Contractor's quality plan.
- 1.13.10 The fire detection testing and commissioning shall be conducted both during normal daylight hours and again at night after hours, as required and to the approval of the Engineer.
- 1.13.11 The Contractor shall supply all labour, materials and equipment required to fully commission

and test the installation.

1.13.12 All costs associated in demonstrating that the fire detection performs as required by the contract, shall be borne by the Contractor.

1.13.13 The following testing shall be conducted:

Factory Demonstration testing at the location nominated by the Engineer;

Commissioning testing at the installation;

Performance and Acceptance testing at the installation;

1.13.14 Testing and commissioning shall allow for any programmed staging of works as detailed in the Contractor works program. Where staging of works is applicable elements of the works may require testing on several occasions as a result of the integration/relocation and commissioning of services and equipment as building works progress.

1.13.15 The Contractor shall conduct all tests and inspections, as required by the Engineer, to ensure that the systems and all other works comply with the requirements of the Contract.

1.13.16 Equipment, which fails to operate correctly or is found to be installed incorrectly should be repaired or replaced by the Contractor. Where any test is unsuccessful the defective equipment shall be repaired appropriately and subjected to retesting.

1.13.17 The Contractor shall provide written notice of intention to test to the Engineer not less than 21 working days prior to the conduct of test.

1.13.18 Factory Demonstration Test

The purpose of the factory acceptance test is to:

Demonstrate that the system being provided by the Contractor operates as specified in the tender documentation. It is not expected that the full system be operational at this time, but that each sample subsystem under test, can be demonstrated to its full potential in a system environment;

Allow the opportunity for all stakeholders and involved parties, to physically observe and operate the system and to provide input and feedback for final system configuration to ensure the clients needs and requirements have been fully addressed;

Allow a final opportunity to consider possible design changes, with minimum impact on costs and integration during the construction phase;

Finalise the design and functionality of the system configuration;

Present a methodology and the documentation of procedures to be used during the commissioning phase of the project;

The factory demonstration shall include, as a minimum:

Operational samples of all equipment proposed to be supplied as part of the contract;

An operational model (limited in scale) of the sample equipment to demonstrate the functionality of each sub-system that comprises the fire detection and security services system;

The operational model shall demonstrate the overall alarm handling, monitoring, reporting and methodology of operation of the proposed integrated fire detection and security services system;

Factory Demonstration Test Specification

Supply a factory demonstration test specification to the Engineer for comment a minimum of 28 days prior to the demonstration date. The factory demonstration test specification shall include as a minimum:

- Introduction providing an overview of the factory demonstration aims, test procedures and agenda;
- Functional block diagram of the test demonstration detailing equipment and connectivity (including interfaces) for the test session;
- Restrictions on equipment operation for the test e.g. RF devices which may be connected via line to simulate field operation;
- List of equipment being used in the demonstration including any test equipment or additional equipment used in the demonstration;

Detailed test procedures fully describing:

- The specification requirement being demonstrated
- The exact procedure to be implemented to demonstrate compliance with the specified requirement
- The expected outcome from the demonstration

- Test result check boxes i.e. pass/fail.
- Remarks field to provide additional clarification as a result of the demonstrated function.
- Factory test sign-off sheet for the Contractor and Engineer authorized representatives to confirm test results.

Factory Acceptance Elements

Fully detailed block diagrams, shall be available for inspection at the factory acceptance test, which clearly show all elements of the various subsystems and the interrelationship between all systems.

1.13.19 Commissioning

The testing of the system shall be done in the presence and to the satisfaction of the Engineer and Client.

The Contractor shall fully test and commission all fire detection and security services to ensure that correct operation of all systems prior to final performance and acceptance testing with the Engineer. Tests shall include simulation of fire conditions in each zone to prove the efficiency of all aspects of the system to the satisfaction of the department.

All equipment, material, etc., which may be necessary for these tests shall be supplied by the Contractor, including a suitable smoke generator.

The Contractor shall do his own complete commissioning tests before the actual first take-over tests are done. This is to satisfy himself that everything is working and is in accordance with the specification.

During the conduct of commissioning the Contractor shall:

- Confirm that all equipment is fully operational and provides the required functionality;
- Provide a comprehensive final commissioning report outlining all test results;
- Constructed details, performance test data on all cables and any other information deemed necessary for future records;
- Supply all labour, materials and equipment required to fully commission and test the installation to the satisfaction of the Engineer;
- Allow for minor programming changes as a result of testing and commissioning and/or final performance and acceptance testing;
- Repair or replace any equipment that fails to operate correctly, or is considered by the Engineer, to be installed incorrectly;
- Supply all passwords installed as part of these works to the Engineer;

1.13.20 Performance and Acceptance Testing

Final performance and acceptance testing to be conducted with the Engineer shall, as a minimum, include:

- Physical inspection of each point and device;
- Test function of each point and device;
- Test alarm response and annunciation of each point and device;
- Check logging and recording of activity for each alarm point and device;
- Test required interface with other systems for each alarm point and devices;
- Confirmation that each system performance complies with the project specification;

On completion of the works the Contractor shall satisfy the Engineer that the security services installation operates in accordance with the requirements of the contract.

1.14 TRAINING

1.14.1 General

Prior to commissioning of the installation the Contractor shall provide comprehensive training of all security staff and nominated maintenance personnel, to the approval of the Engineer and the Client. Maintenance staff demonstrates a complete understanding of the location and connectivity of the various elements of the security services installation.

All training aids and course notes necessary to conduct effective operational and maintenance training shall be supplied by the Contractor. The training venue will be made available on Site by the Client.

The training documentation must be submitted to the Engineer for evaluation and approval. No training will commence on site prior to the written approval of the Engineer. Should the Engineer not approve the drawings all documentation will be referred back to the Contractor for re-evaluation and submission to the Engineer.

Documentation must be sent to the Engineer at least 12 working days prior commencement or scheduling of training programs of the operational staff on site.

1.14.2 Operator Training

Training shall be comprehensive, covering all aspects of systems installed as part of these works. The Contractor shall provide a detailed program to the Engineer, for comment and review, no less than 12 days prior to the commencement of training.

Each group of trainees should receive a minimum of an -hour training session. Allow to fully train 3 groups, each of up to 4 personnel. (The amount of personnel sent for training are to the full discretion of the client).

Training shall be adequate to ensure that the groups trained are:

- competent in the operation of systems;
- adequately trained to carry out ongoing training;
- fully aware of the location of all equipment installed as part of this Contract within their area of responsibility;

1.15 PRACTICAL COMPLETION

1.15.1 Practical completion will only be granted when:

Testing and commissioning of each system has been completed.

Testing of the integration of all sub systems in totality has been satisfactorily demonstrated.

The Engineer is satisfied that the system is operating in the correct and specified manner.

All systems equipment has been proven to operate faultlessly for a total period of two weeks following the successful commissioning of the complete security systems.

All operators and maintainers have been trained to a satisfactory level of competency.

All information has been supplied to the Engineer for final approval. This includes all documentation as specified in this contract.

1.16 DEFECTS LIABILITY

1.16.1 Full Fire Detection Installation Maintenance during Defects Liability

The Tenderer shall note that a one year full maintenance period shall be applicable on all aspects of the work done under this contract effective from the date of practical completion.

Without additional charge, renew any Works implemented to meet the requirements of this contract which prove to be faulty from workmanship or materials, and 'fully maintain and service' the whole installation during the defects liability period.

"Fully maintain and service" shall include:

- Monthly inspection and test of the system to verify continued operation of the system in accordance with the performance parameters specified in the specification;
- Assessment of system reports to ensure continued performance reliability of the system and associated devices;

The contract shall record all works carried out during each visit and forward copies of all records to the Engineer within 7 days of the conduct of the monthly visit

The Contractor shall deliver a proposed maintenance program to the Engineer, for approval, 14 days prior to commencement of Commissioning testing. This shall include full a full back-up service for all the equipment and cabling rendered installed as well as all software installed by the successful Tenderer under this contract.

The Tenderer shall in his price fully state the monthly charge for the above inclusive of his additional rate for labour for any after hour work required.

1.16.2 Call Outs during Defects Liability Period

The Contractor shall attend on site within two (2) hours of notification of a failure of the equipment and associated systems.

The call out during the defect liabilities period requirement shall apply on a 24 hour day, 7 day a week basis.

The Contractor shall forward details of contact staff, suppliers, agents and/or representatives to be used to provide after hours call out service to the Engineer, for approval.

The provided details shall indicate staffing levels, roster of after hour's on-call personnel, spare parts holdings, systems experience and qualifications.

Failure to attend on site within the specified period of two (2) hours shall allow the client to recover costs from the Contractor. Recovery costs may include, but are not limited to:

- Additional labour costs, including penalty rates, occurring as a result of the failure of the security services.
- Costs associated with the provision of alternate equipment used to provide temporary resolution of a fault condition. This may include supply, transport, installation and decommissioning costs associated with the provision of temporary facilities.

The contract shall adhere to the Engineer defined security procedures for access to and during site attendance over the defect liability period.

1.17 POST CONTRACT MAINTENANCE AGREEMENT

1.17.1 If the Client requires it, Contractors shall be able and willing to maintain their installed equipment for a period of at least five years after completion of the contract. This will be arranged through a maintenance contract, which will be negotiated during the free maintenance period.

1.17.2 Such maintenance contract may be either of the following general types:

Extended guarantee maintenance contract. Under this type of maintenance agreement the Contractor undertakes to maintain the installation in a good working condition for a fixed price which is independent of the number of maintenance visits which he has to make. Preventative maintenance visits at agreed intervals are included in the price. (The cost of replacement parts may or may not be included in the fixed price.)

Preventative plus breakdown service maintenance. Under this type of maintenance agreement the Contractor undertakes to do preventative maintenance visits at agreed intervals for a fixed fee. Further call-outs will be on breakdown only and are charged at hourly and km rates. The cost of replacement parts is extra.

1.18 FINAL DOCUMENTATION

1.18.1 Close-Out Documentation

The Tenderer shall note that after the completion of the contract three sets of all operating, maintenance, training manuals and a complete spares list for all of the equipment and software installed (together with two local agency telephone numbers where the above can be obtained), shall be handed to the Client.

The Tenderer shall at the end of the contract update all the drawings that were issued to him during the contract with a red pen and hand them over to the Engineer for finalisation and completion of his contractual obligation regarding drawings.

The Tenderer shall note that he shall provide with the above documentation a list including all the required contact details and emergency telephone numbers.

The Operator's Manuals must be compiled in such a way and contain enough detail information to enable a suitably qualified Engineer or technician to control and operate the full installation without any training from the Contractor. The Operator's Manuals must be a separate set of documents from the Maintenance Manuals.

Irrespective of the abovementioned, the Operator's Manuals must also contain short form instructions to enable trained operators (trained by the Contractor) to operate the full installation.

Maintenance Manuals shall incorporate operator's instructions must contain one (1) set of final drawings as mentioned above.

Information of all subsystems, components, etc, of each part of the installation must be supplied, also

indicating the position of each component, the manufacturer, the type, the series number, IP address, MAC address, performance data, i.e. full detail to enable any outside party to perform comprehensive maintenance of the total installation.

Routine control tests as well as inspections that must be performed on individual components or parts of the installation must be indicated. The various intervals and periods, at which these tests and inspections must be performed, must also be mentioned.

All of the above shall form part of the as-built documentation.

All the required documentation shall be to the satisfaction of the Engineer and of the Client.

1.18.2 As-Built Drawings and Schematic Diagrams

As each portion of the work is completed, mark-up (red-line) drawings shall be provided by the Contractor showing the exact location measured from fixed points of all cables, cable routes and equipment. Cable routes shall be marked and coordinated on the drawing every 5m. The Contractor shall also provide mark-up schematic diagrams for all the equipment he/she installed on site.

The Contractor is only required to provide as-built drawings of the relevant sections of the installation that he/she worked on. If there are no existing drawings, provide a schematic diagram of the relevant sections.

Cable schedules must be supplied, including the following:

- The number of cables mutually connected between field units and the control unit(s);
- Cable sizes, number of conductors in each cable, number of reserve cables, etc.;
- Cable types, voltage, technical references of the cables;

Schedules containing full details with respect to interconnecting cable schedules, their size, rating, connecting terminal detail and connecting references must be included in the maintenance manuals.

The installation is not regarded as complete until all mark-up drawings and schematic diagrams have been received and signed for by the Engineer.



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

TENDER ELECTRICAL GENERAL SPECIFICATION

MADADENI PROVINCIAL HOSPITAL UPGRADE TO STUDENT ACCOMODATION

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GENERAL SPECIFICATION

GENERAL SPECIFICATION

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GENERAL SPECIFICATION

1.1 GENERAL

1.1.1 General Aspects

In this document the term "Contractor" shall mean the Contractor appointed in terms of this document, irrespective of whether the contract is a direct contract with the client or a sub-contract with a Principal Contractor.

Prices tendered for equipment specified by trade names or catalogue references must be for the type and manufacture specified. If it is desired to use substitutes, the onus will be on the Contractor to prove that such substitutes are similar and equivalent to the article specified and meet with the approval of the Engineer in writing. The decision whether the tendered articles are acceptable shall rest solely with the Engineer. The cost implications of such substitutes shall be allowed for in the tendered amount.

Tenderers are required to enter at the time of tendering in the Schedules of Equipment and Materials Offered, the manufacturers of the materials, on which their tender is based, and the catalogue numbers and other information by which the materials may be identified. Technical brochures of the equipment offered shall be submitted with the tender to enable the unit concerned to be identified without ambiguity.

Tenderers shall only offer equipment for which proven backup is available in South Africa.

The Project Specification shall take preference over this General specification where any conflict exists.

Should the Tenderer become aware of any discrepancies or apparent discrepancies in these documents, he shall notify the Engineer thereof.

All materials and equipment used shall be of new and represent the manufactures latest product range.

If requested by the Engineer, the Contractor shall submit samples of cables, terminals, labels, trunks and other construction materials which he proposes to use on the installation for the Engineer's approval.

All materials and equipment used shall be suitable for the environment and service for which it is to be used. This pertains; inter alia, to corrosion protection, UV stability etc.

Equipment offered shall be small enough to be moved through the available doorways, passages, etc, to their final locations.

Dimensions scaled from drawings shall not be used to obtain lengths of trays, trunks, cables etc. The runs shall be measured on site.

The Contractor shall make due allowance for other Contractors' operations in progress concurrent with his own activities.

1.1.2 General Installation Requirements

NO DEVIATION FROM THE SPECIFICATION will be tolerated or paid for without the written approval of the Engineer.

The installation shall comply in each instance with the requirements as set by the CLIENT and Engineer, in particular to the general specifications for the various electronic subsystems, as well as all relevant SANS codes of practice and standards.

Where no SANS guideline exist, the IEC, EN and ANSI standards will be applicable.

The installation shall be done in accordance with the drawings issued by the Engineer as approved by the Client and no installation work shall be carried out without issued for construction drawings.

All routing requirements and conduit installation work shall be done by as part of this contract and all additional reticulation routes required by the Tenderer shall be indicated and marked on his drawings and submitted to the Engineer for approval.

At the end of each day, the Contractor shall be responsible for the clean up, removal, and secure disposal of all debris.

Any damage to protective coatings, equipment, services or structures caused by the Contractor shall be made good.

The Contractor shall prevent pollution caused by spillages of fuels and lubricants, etc.

Only technicians and artisans with adequate and applicable training and experience shall be used to carry out the work on this contract.

If installation commences with any type of material or equipment, then the same type shall be used

throughout the contract.

1.2 STANDARDS AND REGULATIONS

1.2.1 National Standards and Regulations

The following regulations, standards, codes of practice and guidelines are referenced in this document. They are all subject to revision and users of this specification must use the most recent editions of those listed below.

In particular the Works shall comply with the following regulations:

- Electricity Act (Act No. 41 of 1987) as amended
- Occupational Health and Safety Act (Act No 85 of 1993) as amended
- The Environmental Conservation Act (Act No 73 of 1989) as amended
- Provincial Road Traffic Ordinance and regulations
- SANS 10139, 2012: Edition 3.2 Fire detection and alarm systems for buildings – system design, installation, and servicing
- The wiring of premises (SANS 10142)
- National Building Regulations Act No 103 of 1977
- SANS 10400, 1990: The application of the national building regulations
- SANS 9000:2005/ISO 9000:2005: Quality management systems - Fundamentals and vocabulary
- The local Councils bye laws as well as the local Supply Authority Regulations.

1.2.2 In addition the Contractor shall issue all notices and pay all the required fees in respect of the Installation to the local authorities and shall exempt the Employer from all losses, costs or expenditures which may arise as a result of the Contractor's negligence to comply with the requirements of the regulations enumerated in this specification.

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

1.2.4 Standing Instruction

In addition to complying with the OHS Act the Contractor shall also adhere to the standing instructions applicable to the site as issued from time to time by the Engineer and/or Employer.

1.2.5 Safety

Noise control, environmental aspects, aesthetics and staff comfort all to adhere to the OHS Act.

1.3 COMPLIANCE TO THE SPECIFICATION

1.3.1 The Contractor shall comply with all the requirements as per this specification. Proposed deviations shall only be considered after the award of the contract.

1.3.2 Proposed deviations shall only be accepted if it meets with all of the following criteria:

The proposed deviation offers a substantial improvement to the final product offered.
The proposed deviation has been proven in other applications.

1.3.3 Any deviations from the specifications can only be implemented with prior approval from the various representatives from both the Client and the Engineer.

1.4 PROVEN PRODUCT

1.4.1 Due to the security nature of these requirements and the criticality of this application only proven products shall be considered.

1.4.2 Products could be approved only after investigation by all applicable parties.

- 1.4.3 The guidelines for similar applications demands that five installations have to be operational in accordance with the above requirements for a minimum period of no less than one year before a product will be considered to be a proven product.

1.5 CABLING

1.5.1 General

Supply, install, connect, and terminate all cabling necessary to complete the installation of audio, data, control, CCTV, smoke detection, alarm systems, access control, electrical equipment, electrical cables, communications and device cabling.

All cabling shall be supplied and installed as a part of this contract.

All terminated cabling shall be neatly tied/loomed to prevent damage to terminations and interference or obstruction of other services.

Strain relief shall be provided for cables connected to rack mounted equipment.

All cables shall have stranded copper conductors and shall be PVC insulated with overall PVC sheath, unless otherwise specified.

All cabling shall be concealed and installed on metal cable tray, cable duct and conduits.

Cabling shall be installed with due regard to future removal and replacement of cables.

All cables shall be new and delivered on site in unbroken reels, and with the "manufacturer's" label attached.

Due consideration shall be given to voltage drop when calculating cable sizes.

Installation and cable route shall be to the satisfaction of the Engineer.

Cables shall be installed in a manner eliminating any possibility of strain on the cable itself or on cable terminations.

No joints or connections will be permitted. Adequate loose cable shall be left behind all equipment to facilitate removal for inspection, adjustment or replacement.

Any bending, jagged edges or any other forms of damage or deformation of cable trays or wire ways shall be made good, before cables are installed.

Conduit shall be thoroughly cleaned and have all burrs removed before the drawing in of any cable.

The tray shall be supported at every change in direction of the cable tray route. The minimum radius of any bend of the tray is to suit the minimum bending radius of the largest cable on the tray.

Cable trays shall be firmly secured in position in such a manner to cause as little obstruction to walkways etc., as possible.

Hangers, supports and anchors for wire ways and equipment, shall be designed and installed with regard to appearance and convenience as well as for adequate strength and rigidity. Only professional quality fixing material and methods shall be used. Nails and glue are not acceptable.

1.5.2 Cable Damage

During the installation of cable should any kinks or abrasions to insulation, braiding, sheathing or armouring occur, the affected cable shall be withdrawn and replaced with new cable at no additional cost to the client.

1.5.3 Cable Numbering

Generally all cables shall be allocated and identified with a unique cable number.

All cables including patch leads shall be clearly labelled. Labels shall be affixed within 250mm of each termination.

Cables shall be fitted with tags at the following points:

- On the cable sheath next to the gland at each end
- In cable pits/manholes
- In all vertical data risers
- At any additional point on the cable sheath (or around the core bunch) where the preceding requirements are not readily traceable from the core terminations
- Any inspection/junction box

Cable identification tags shall be orientated uniformly to read left to right from the logical viewing point horizontally; and from bottom to top viewed from the right where installed vertically.

Duplication of cabling and equipment identities shall not be allowed.

1.5.4 Coordination and Separation of Services

Install services for each respective section and system and physically separate from other systems to a discipline and coordinated layout plan. Adjacent services shall run approximately parallel. Crossing services shall cross at approximate right angles.

Individual services between common points of the work shall follow similar parallel routes. Cables shall be parallel to the building major axes.

Separation distances shall not be less than the following:

- Power cables – 100mm.
- ELV and Communication cables to parallel power cables – 300mm
- ELV and Communication cables to power cables crossed at 90 – 100mm.
- Any trade to finish floor level – 80mm
- Any trade to structure – 20mm.

1.5.5 Coordination and Feasibility

The drawings, schematics and specification indicate the main routes and positions for the various services installations and equipment in relation to the building and other services.

Check the details shown on the drawings and co-ordinate the details layout with the building structure and other services. Submit full details of proposed major cable routes for approval before proceeding.

The Contractor shall deliver to the Engineer in accordance with the scheduled works program:

- Details of all types of cabling to be installed as part of the contract works
- Block schematic cable diagrams indicating all system interconnecting cables including cable routes and cable types complete with core make up and numbers
- Detailed floor plans indicating cable routes and designated circuit identification
- Wiring diagram detailing system interconnections and cable/core identification

1.5.6 Special Cabling

Where equipments to be supplied and installed under this specification requires special cabling (i.e. screened cables, unshielded twisted pair, coaxial, optical fibre or other special types of cable), these cables shall be provided as part of this contract.

It shall remain the responsibility of the Contractor to design the cabling system network and determine the type of cable required for interconnection of the various components, which make up the total system to be installed, to comply with the contract documents.

1.6 WIRE TERMINATING AND MOUNTING HARDWARE

1.6.1 Every terminal strip shall be numbered or named.

1.6.2 Every terminal shall be numbered.

1.6.3 Cable glands shall be of the compression ferrule type with "O" ring seals.

1.6.4 Wherever possible, terminations of cable cores and wires shall be made using spade, pin or bootlace ferrule type crimp-on lugs.

1.6.5 Lugs may only be crimped with controlled pressure crimping tools of the correct size for the lug used.

1.6.6 Thin, collapsing pipe type ferrules shall not be used.

1.6.7 High quality wire strippers shall always be used and care taken not to nick or otherwise damage the strands.

1.6.8 Terminals shall be located so that all connections can be made easily.

1.6.9 When wiring of different potentials and types of supply use the same terminal rail, a clear space or barrier shall be provided between terminal blocks.

1.7 EARTHING SPECIFICATIONS

1.7.1 The Earthing connection to the security equipment shall be no more than a 1 Ω connection. The Earthing shall be done from a single (SPUR Distribution Point) point to each part of the security installation e.g. Equipment/Wiring Closets, Service and Central Equipment Locations etc.

- 1.7.2 No daisy chaining of the Earthing connection shall be allowed, except as described in the section on high-rise buildings. The reticulation for the earth connection shall be done with no less than 70 mm² Green Isolated Copper Conductor (GICC). The same spur point shall be connected to the Electrical Earth. The connection to the Electrical Earth can be done with Bare Copper Conductor (BCC) with a cross sectional area of no less than 70 mm².
- 1.7.3 The copper conductors shall be terminated in a lug which shall be bolted to the Earthing bar. The Earthing bar shall not be smaller than 6mm x 50mm x 300mm. No more than 1 conductor per lug and no more than 1 lug per terminal point on the earthing bar will be tolerated. The lugs shall be crimped or CAD welded to the conductor and shall be inspected by the Engineer prior to acceptance. The Security and Electrical Earths shall be run in separate conduits and be separated by no less than 1 m. The Earthing conductors may cross each other and any other electrical cable at a 90° angle.
- 1.7.4 All Earthing bars, screws, lugs & isolators shall comply with the SANS 0142 Wiring Code, SANS Earthing Specification & all relevant IEC standards.
- 1.7.5 Any conducting material that has been anodized, e.g. aluminium may not be used as an earth bus-bar unless special precautions have been taken to ensure that the anodizing material has been removed where the earthing connections are made.
- 1.7.6 All connections between racks or sub-racks used to transmit audio, video, radio frequency or digital data must be made using co-axial type wiring having the correct matching impedance and must be to the manufactures specification.

1.8 LIGHTNING AND SURGE PROTECTION SPECIFICATION

- 1.8.1 The Contractor shall provide and install all the necessary surge protection devices, for the protection of the electrical/electronic control equipment, communication and data lines. Surge Protection devices shall protect all AC and DC circuits from the effect of lightning induced over voltages, internally generated transients and utility switching transients.
- 1.8.2 Surge protection will be required on the incoming power supply to the electronics equipment and shall be done at the single point where the supply enters the building. Lightning protection shall be installed from Live to Earth (L-E), Neutral to Earth (N-E) and from Live to Neutral (L-N) on a single phase supply. If a 3 phase supply is used lightning protection shall be required on each phase individually (L1-E, L2-E, L3-E & N-E). If the same supply is reticulated to another building additional lightning protection shall be required where it enters the next building. The protection shall be as described above.
- 1.8.3 The Tenderer has to allow for additional surge suppression and voltage stabilisation equipment if this is required to protect his equipment or to guarantee its correct operation.
- 1.8.4 The test pulses shall be applied at intervals of not less than one minute.
- 1.8.5 The surge protection equipment may be built into the equipment being protected. If the provided internal protection is inadequate to meet this specification, then additional external protection has to be provided.
- 1.8.6 There shall be an earth bar in the lower corner of each enclosure and shall be sized to accept a 16mm square BCW. The Bare Copper Wire shall be terminated at the nearest earth mat.
- 1.8.7 AC protection devices can be located in the equipment cabinet and must be installed prior to any distribution (i.e. multi-outlets).
- 1.8.8 Surge protection devices shall be chosen in such a way that the protected circuit shall still function to specification in spite of the introduction of series and/or shunt impedances by the protecting devices.

1.9 EQUIPMENT FIXING REQUIREMENTS

- 1.9.1 Under no circumstances shall double sided tape be used any where on this installation for whatever purpose.
- 1.9.2 Specific Surface Requirements

Drywall - Dry wall plugs, Toggle Bolt anchors (Butterfly nuts) or Superfast™ Toggle anchors may be used to fix equipment, conduit or trunking.

Brick Walls - HILTI, Fisher, UPAT or RAWL type plugs are acceptable for fixing equipment, conduit or trunking.

Concrete - HILTI gun, RAWL bolts or chemical bolts are an acceptable means of fixing equipment, conduit or trunking.

Ceilings - For suspended ceilings, Toggle Bolts anchors (Butterfly nuts) or Superfast™ Toggle anchors are an acceptable means of fixing equipment, conduit or trunking. Drywall screws will also be acceptable if they are screwed directly into the support struts. For normal ceilings Toggle Bolt anchors (Butterfly nuts) or Superfast™ Toggle anchors are an acceptable means of fixing equipment, conduit or trunking.

Steel - Up to 3mm: Self tapping screw with drill, a self tapping screw or aluminium pop rivets (except for door hinges) are an acceptable means of fixing equipment, conduit or trunking. Above 3mm: bolts and nuts are an acceptable means of fixing equipment, conduit or trunking.

Wood - Drywall screws are an acceptable means of fixing equipment, conduit or trunking.

Aluminium - A self tapping screw or aluminium pop rivets (except for door hinges) are an acceptable means of fixing equipment, conduit or trunking.

1.9.3 Specific Equipment Instructions

Alarm Wire - A glue gun or contact adhesive shall be used.

Trunking - Shall be fixed at minimum intervals of 1m.

Conduits - Raised aluminium saddles shall be used if the conduit is installed surface mount.

1.10 SIGNS, MARKERS, NAMEPLATES AND TAGS

1.10.1 All cable cores and wires shall be numbered at all termination points with "slip-on" interlocking type cable markers. Split-ferrule types are unacceptable. In the case of multi-core cables each core shall be numbered.

1.10.2 Signs, Markers, Nameplates and Tags shall be totally:

UV-resistant;

Fade-resistant;

Corrosion resistant;

Shall have a minimum life expectancy of 10 years.

Shall not be damaged by any commercially available solvent

1.10.3 Cable Tags

Labels shall be colour-coded and include alphanumeric text 8 to 10 characters long.

For the labelling of cables any one of the following methods is acceptable:

- Cable-Tie Markers
- Clip-On Labels
- Printable Slide-In Labels

1.10.4 Nameplates

In order for a technician to easily identify equipment locations a 250mm x 200mm sign shall be installed on the door of the field cabinet.

The sign shall be precision engraved letters and numbers with uniform margins.

Character sizes shall be a minimum of 50mm high.

All nameplates shall be permanently attached.

1.11 EQUIPMENT RACK CABINETS AND JUNCTION BOXES

1.11.1 General

To save space inside the equipment room, and to keep the installation neat, equipment shall be installed in the 19" racks and junction boxes.

All pure technical equipment like the storage servers, surge protectors etc., shall be fit into 19" rack enclosures accessible from two sides (front and rear). Those racks shall be protected against dust and freezing as against excessive heating.

All rack enclosures shall be black powdered coated. The cabinets shall also include all power and cable management articulation.

1.11.2 Floor Standing Equipment Rack Cabinets

The cabinets shall be lockable and the key will be controlled by the Client.

The racks shall comply with the following specifications:

- Colour/Finish: Powder-coated, black;
- Fixed 19" installation front and rear, for components in accordance with IEC 297-3;
- Flexible mounting for components with T-slot mountings;
- Cable entry via the plinth and top cover;
- The rack enclosures shall have a complete ventilation system built-in to ensure adequate airflow. This shall be accomplished by installing a perforated front and back doors and extraction fans the top of the rack enclosure;
- Door open angle 180°.
- Cross connecting jumper space shall be at least 120mm to the front and rear;
- An IP40 protection rating;
- Load rating shall be 500kg, static;
- Height: 15U, 20U, 24U, 33U, 38U, 43U or 47U (1U = 44.45mm);
- Width: Inside – 482.6mm (19") / Outside – 750mm;
- Depth: 1000mm;
- Where specified, The Rack enclosure shall include a 2U rack mounted LCD Monitor, Keyboard and Mouse, with built in KVM switch to connect to the relevant Servers.

1.11.3 Wall Mount Swing Frame Equipment Rack Cabinets

The cabinets shall be lockable and the key will be controlled by the Client.

The racks shall comply with the following specifications:

- Fixed 19" installation front, for components in accordance with IEC 297-3
- Flexible mounting for components with T-slot mountings
- Covers above and below with brush strips for cable entry and with side vent slots
- Heat dissipation discharge via a vent lid or fan top
- Door open angle 180°
- Cross connection jumper space shall be at least 100mm to the front and 50mm to the sides
- An IP20 protection rating
- Load rating shall be 50kg, static
- Height: 6U, 9U, 12U, 15U, 18U or 21U (1U = 44.45mm)
- Width: Inside – 482.6mm (19") / Outside – 600mm
- Depth: 600mm

1.11.4 Rack Accessories

Brush Panels

The brush panels shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front or rear
- Height: 1U (1U = 44.45mm)
- Colour/Finish: Powder-coated, black
- Brush panels shall be installed above and below all BNC, Fibre and RJ45 FTP patch panels. Sufficient brush covers shall be installed to enable neat cabling and proper bending radius of cabling in the rack.

Cable Routing Panels

The cable routing panels shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front and rear

- Height: 1U (1U = 44.45mm)
- Colour: Front Panel – powder-coated, black
- Cable routers shall be installed in 19" racks to neaten the cables. This shall be done at the Engineer's discretion

Shelf

The shelves shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front
- Depth: 250mm, 320mm, 450mm or 500mm
- Colour: Powder-coated, black
- Load rating shall be 20kg, static
- Shelves shall be used to install equipment without 19" rack mounting options in equipment racks

Pull-Out Shelf

The shelves shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front
- Supplied with a handle
- Depth: 450mm or 600mm.
- Colour: Powder-coated Black
- Load rating shall be 20kg, static
- To be supplied fully assembled.

Blank Panels

The blank panels shall comply with the following specifications:

- Mountable in racks with a fixed 19" installation front or rear
- Height: 1U, 2U, 3U, 6U or 9U (1U = 44.45mm)
- Colour: Powder-coated, black
- All open areas on the front of a supplied 19" rack are to be blanked off with the appropriate blanking panels

Power Strips (Multi-Plugs)

The power strips shall comply with the following specifications:

- Versatile all-metal cabinet with detachable mounting flanges allows rack mount, wall mount, under counter and other creative mounting options.
- 6, 8, 12 or 16 Dedicated Socket Outlets (RED)
- 15, 20 and 30 Amp UL and CUL listed
- 4-2ay Universal Mounting
- Reset-able circuit breaker with surge protection
- The outlets shall be generously spaced to improve cable management
- Available in 19" Rack Mount, 28", 40" and 66" Lengths for Vertical or Horizontal Cabinet and Rack Mounting
- An IP40 protection rating
- The 19" racks shall be fitted with these multi-plug strips and there shall be one plug per piece of equipment installed in the rack.

1.11.5 Equipment and Junction Boxes

Equipment and junction boxes shall be of steel or GRP construction.

All steel shall be primed, undercoated and gloss finished with epoxy or polyurethane paint.

All boxes shall be fitted with DIN-rail mounted 2-pole 10-Amp breaker switch for termination of power cable.

All boxes shall have a box name or number on the cover.

Boxes for indoor use shall be at least IP 52 rated.
Boxes for outdoor use shall be at least IP 65 rated.
All junction boxes shall provide the facility to terminate fully the entire multi-core cable entering the box.
Boxes which shall be exposed to the sun shall face south.
Boxes shall be mounted with their sides, true vertical and horizontal.

1.12 CONSTRUCTIONAL ASPECTS

- 1.12.1 All holes, wire ways, trenches, etc required for this installation and made by the Contractor shall be reinstated to the original condition.
- 1.12.2 In all cases where the Contractor uses facilities provided by others, it is the responsibility of the Contractor to ensure that these are provided correctly to match his requirements. If discrepancies are found, these shall be brought to the attention of the Engineer immediately and prior to the installation of equipment.
- 1.12.3 No face-brick or other finished surfaces may be chased without the permission of the Engineer.
- 1.12.4 No cutting of structural concrete will be permitted without the permission of the Engineer.
- 1.12.5 The Contractor shall provide and erect all necessary scaffolding for this contract. Scaffolding erected by another Contractor may be utilised by the Contractor provided suitable arrangements are made with the other Contractor.

1.13 TESTING AND COMMISSIONING

- 1.13.1 The successful Tenderer shall note that it is a requirement of this tender that a detailed testing and commissioning schedule be prepared for the full testing and commissioning of the complete system.
- 1.13.2 This full schedule will be available four weeks after appointment of the successful Tenderer. The testing and commissioning schedule shall be to the approval of the Engineer.
- 1.13.3 It must be noted that no piece meal hand over will be acceptable and that the entire integrated system shall be inspected and tested once all work as detailed in this detailed specification has been completed.
- 1.13.4 When the Fire Detection is ready for service, commissioning shall take place to check whether the correct quantities of equipment have been delivered and the installation is in accordance with the specifications. Commissioning shall be performed in co-operation with the successful tender's personnel and representatives of Client and Engineer.
- 1.13.5 The date of commissioning will be scheduled by the Contractor and has to be approved by the Client.
- 1.13.6 Practical Completion will only be issued once the whole of the integrated fire detection installation satisfies the operational performance requirements of the contract and the Engineer is satisfied that all security systems are capable of operating effectively.
- 1.13.7 All individual building levels and subsystems shall be thoroughly tested in the presence of, and to the satisfaction of, the Engineer or their authorised representative. Performance and acceptance testing shall include a thorough inspection (point by point) of the entire installation and verification that the installation complies with the requirements of the specification.
- 1.13.8 Performance and acceptance testing to determine whether the integrated security system achieves the required level of performance will only be undertaken after all routine testing, adjusting, commissioning, approvals and building work associated with the contract are complete and the works have been fully tested and commissioned by the Contractor.
- 1.13.9 Details of the testing required for each system and equipment shall be included in the Contractor's quality plan.
- 1.13.10 The fire detection testing and commissioning shall be conducted both during normal daylight hours and again at night after hours, as required and to the approval of the Engineer.
- 1.13.11 The Contractor shall supply all labour, materials and equipment required to fully commission

and test the installation.

1.13.12 All costs associated in demonstrating that the fire detection performs as required by the contract, shall be borne by the Contractor.

1.13.13 The following testing shall be conducted:

Factory Demonstration testing at the location nominated by the Engineer;

Commissioning testing at the installation;

Performance and Acceptance testing at the installation;

1.13.14 Testing and commissioning shall allow for any programmed staging of works as detailed in the Contractor works program. Where staging of works is applicable elements of the works may require testing on several occasions as a result of the integration/relocation and commissioning of services and equipment as building works progress.

1.13.15 The Contractor shall conduct all tests and inspections, as required by the Engineer, to ensure that the systems and all other works comply with the requirements of the Contract.

1.13.16 Equipment, which fails to operate correctly or is found to be installed incorrectly should be repaired or replaced by the Contractor. Where any test is unsuccessful the defective equipment shall be repaired appropriately and subjected to retesting.

1.13.17 The Contractor shall provide written notice of intention to test to the Engineer not less than 21 working days prior to the conduct of test.

1.13.18 Factory Demonstration Test

The purpose of the factory acceptance test is to:

Demonstrate that the system being provided by the Contractor operates as specified in the tender documentation. It is not expected that the full system be operational at this time, but that each sample subsystem under test, can be demonstrated to its full potential in a system environment;

Allow the opportunity for all stakeholders and involved parties, to physically observe and operate the system and to provide input and feedback for final system configuration to ensure the clients needs and requirements have been fully addressed;

Allow a final opportunity to consider possible design changes, with minimum impact on costs and integration during the construction phase;

Finalise the design and functionality of the system configuration;

Present a methodology and the documentation of procedures to be used during the commissioning phase of the project;

The factory demonstration shall include, as a minimum:

Operational samples of all equipment proposed to be supplied as part of the contract;

An operational model (limited in scale) of the sample equipment to demonstrate the functionality of each sub-system that comprises the fire detection and security services system;

The operational model shall demonstrate the overall alarm handling, monitoring, reporting and methodology of operation of the proposed integrated fire detection and security services system;

Factory Demonstration Test Specification

Supply a factory demonstration test specification to the Engineer for comment a minimum of 28 days prior to the demonstration date. The factory demonstration test specification shall include as a minimum:

- Introduction providing an overview of the factory demonstration aims, test procedures and agenda;
- Functional block diagram of the test demonstration detailing equipment and connectivity (including interfaces) for the test session;
- Restrictions on equipment operation for the test e.g. RF devices which may be connected via line to simulate field operation;
- List of equipment being used in the demonstration including any test equipment or additional equipment used in the demonstration;

Detailed test procedures fully describing:

- The specification requirement being demonstrated
- The exact procedure to be implemented to demonstrate compliance with the specified requirement
- The expected outcome from the demonstration

- Test result check boxes i.e. pass/fail.
- Remarks field to provide additional clarification as a result of the demonstrated function.
- Factory test sign-off sheet for the Contractor and Engineer authorized representatives to confirm test results.

Factory Acceptance Elements

Fully detailed block diagrams, shall be available for inspection at the factory acceptance test, which clearly show all elements of the various subsystems and the interrelationship between all systems.

1.13.19 Commissioning

The testing of the system shall be done in the presence and to the satisfaction of the Engineer and Client.

The Contractor shall fully test and commission all fire detection and security services to ensure that correct operation of all systems prior to final performance and acceptance testing with the Engineer. Tests shall include simulation of fire conditions in each zone to prove the efficiency of all aspects of the system to the satisfaction of the department.

All equipment, material, etc., which may be necessary for these tests shall be supplied by the Contractor, including a suitable smoke generator.

The Contractor shall do his own complete commissioning tests before the actual first take-over tests are done. This is to satisfy himself that everything is working and is in accordance with the specification.

During the conduct of commissioning the Contractor shall:

- Confirm that all equipment is fully operational and provides the required functionality;
- Provide a comprehensive final commissioning report outlining all test results;
- Constructed details, performance test data on all cables and any other information deemed necessary for future records;
- Supply all labour, materials and equipment required to fully commission and test the installation to the satisfaction of the Engineer;
- Allow for minor programming changes as a result of testing and commissioning and/or final performance and acceptance testing;
- Repair or replace any equipment that fails to operate correctly, or is considered by the Engineer, to be installed incorrectly;
- Supply all passwords installed as part of these works to the Engineer;

1.13.20 Performance and Acceptance Testing

Final performance and acceptance testing to be conducted with the Engineer shall, as a minimum, include:

- Physical inspection of each point and device;
- Test function of each point and device;
- Test alarm response and annunciation of each point and device;
- Check logging and recording of activity for each alarm point and device;
- Test required interface with other systems for each alarm point and devices;
- Confirmation that each system performance complies with the project specification;

On completion of the works the Contractor shall satisfy the Engineer that the security services installation operates in accordance with the requirements of the contract.

1.14 TRAINING

1.14.1 General

Prior to commissioning of the installation the Contractor shall provide comprehensive training of all security staff and nominated maintenance personnel, to the approval of the Engineer and the Client. Maintenance staff demonstrates a complete understanding of the location and connectivity of the various elements of the security services installation.

All training aids and course notes necessary to conduct effective operational and maintenance training shall be supplied by the Contractor. The training venue will be made available on Site by the Client.

The training documentation must be submitted to the Engineer for evaluation and approval. No training will commence on site prior to the written approval of the Engineer. Should the Engineer not approve the drawings all documentation will be referred back to the Contractor for re-evaluation and submission to the Engineer.

Documentation must be sent to the Engineer at least 12 working days prior commencement or scheduling of training programs of the operational staff on site.

1.14.2 Operator Training

Training shall be comprehensive, covering all aspects of systems installed as part of these works. The Contractor shall provide a detailed program to the Engineer, for comment and review, no less than 12 days prior to the commencement of training.

Each group of trainees should receive a minimum of an -hour training session. Allow to fully train 3 groups, each of up to 4 personnel. (The amount of personnel sent for training are to the full discretion of the client).

Training shall be adequate to ensure that the groups trained are:

- competent in the operation of systems;
- adequately trained to carry out ongoing training;
- fully aware of the location of all equipment installed as part of this Contract within their area of responsibility;

1.15 PRACTICAL COMPLETION

1.15.1 Practical completion will only be granted when:

Testing and commissioning of each system has been completed.

Testing of the integration of all sub systems in totality has been satisfactorily demonstrated.

The Engineer is satisfied that the system is operating in the correct and specified manner.

All systems equipment has been proven to operate faultlessly for a total period of two weeks following the successful commissioning of the complete security systems.

All operators and maintainers have been trained to a satisfactory level of competency.

All information has been supplied to the Engineer for final approval. This includes all documentation as specified in this contract.

1.16 DEFECTS LIABILITY

1.16.1 Full Fire Detection Installation Maintenance during Defects Liability

The Tenderer shall note that a one year full maintenance period shall be applicable on all aspects of the work done under this contract effective from the date of practical completion.

Without additional charge, renew any Works implemented to meet the requirements of this contract which prove to be faulty from workmanship or materials, and 'fully maintain and service' the whole installation during the defects liability period.

"Fully maintain and service" shall include:

- Monthly inspection and test of the system to verify continued operation of the system in accordance with the performance parameters specified in the specification;
- Assessment of system reports to ensure continued performance reliability of the system and associated devices;

The contract shall record all works carried out during each visit and forward copies of all records to the Engineer within 7 days of the conduct of the monthly visit

The Contractor shall deliver a proposed maintenance program to the Engineer, for approval, 14 days prior to commencement of Commissioning testing. This shall include full a full back-up service for all the equipment and cabling rendered installed as well as all software installed by the successful Tenderer under this contract.

The Tenderer shall in his price fully state the monthly charge for the above inclusive of his additional rate for labour for any after hour work required.

1.16.2 Call Outs during Defects Liability Period

The Contractor shall attend on site within two (2) hours of notification of a failure of the equipment and associated systems.

The call out during the defect liabilities period requirement shall apply on a 24 hour day, 7 day a week basis.

The Contractor shall forward details of contact staff, suppliers, agents and/or representatives to be used to provide after hours call out service to the Engineer, for approval.

The provided details shall indicate staffing levels, roster of after hour's on-call personnel, spare parts holdings, systems experience and qualifications.

Failure to attend on site within the specified period of two (2) hours shall allow the client to recover costs from the Contractor. Recovery costs may include, but are not limited to:

- Additional labour costs, including penalty rates, occurring as a result of the failure of the security services.
- Costs associated with the provision of alternate equipment used to provide temporary resolution of a fault condition. This may include supply, transport, installation and decommissioning costs associated with the provision of temporary facilities.

The contract shall adhere to the Engineer defined security procedures for access to and during site attendance over the defect liability period.

1.17 POST CONTRACT MAINTENANCE AGREEMENT

1.17.1 If the Client requires it, Contractors shall be able and willing to maintain their installed equipment for a period of at least five years after completion of the contract. This will be arranged through a maintenance contract, which will be negotiated during the free maintenance period.

1.17.2 Such maintenance contract may be either of the following general types:

Extended guarantee maintenance contract. Under this type of maintenance agreement the Contractor undertakes to maintain the installation in a good working condition for a fixed price which is independent of the number of maintenance visits which he has to make. Preventative maintenance visits at agreed intervals are included in the price. (The cost of replacement parts may or may not be included in the fixed price.)

Preventative plus breakdown service maintenance. Under this type of maintenance agreement the Contractor undertakes to do preventative maintenance visits at agreed intervals for a fixed fee. Further call-outs will be on breakdown only and are charged at hourly and km rates. The cost of replacement parts is extra.

1.18 FINAL DOCUMENTATION

1.18.1 Close-Out Documentation

The Tenderer shall note that after the completion of the contract three sets of all operating, maintenance, training manuals and a complete spares list for all of the equipment and software installed (together with two local agency telephone numbers where the above can be obtained), shall be handed to the Client.

The Tenderer shall at the end of the contract update all the drawings that were issued to him during the contract with a red pen and hand them over to the Engineer for finalisation and completion of his contractual obligation regarding drawings.

The Tenderer shall note that he shall provide with the above documentation a list including all the required contact details and emergency telephone numbers.

The Operator's Manuals must be compiled in such a way and contain enough detail information to enable a suitably qualified Engineer or technician to control and operate the full installation without any training from the Contractor. The Operator's Manuals must be a separate set of documents from the Maintenance Manuals.

Irrespective of the abovementioned, the Operator's Manuals must also contain short form instructions to enable trained operators (trained by the Contractor) to operate the full installation.

Maintenance Manuals shall incorporate operator's instructions must contain one (1) set of final drawings as mentioned above.

Information of all subsystems, components, etc, of each part of the installation must be supplied, also

indicating the position of each component, the manufacturer, the type, the series number, IP address, MAC address, performance data, i.e. full detail to enable any outside party to perform comprehensive maintenance of the total installation.

Routine control tests as well as inspections that must be performed on individual components or parts of the installation must be indicated. The various intervals and periods, at which these tests and inspections must be performed, must also be mentioned.

All of the above shall form part of the as-built documentation.

All the required documentation shall be to the satisfaction of the Engineer and of the Client.

1.18.2 As-Built Drawings and Schematic Diagrams

As each portion of the work is completed, mark-up (red-line) drawings shall be provided by the Contractor showing the exact location measured from fixed points of all cables, cable routes and equipment. Cable routes shall be marked and coordinated on the drawing every 5m. The Contractor shall also provide mark-up schematic diagrams for all the equipment he/she installed on site.

The Contractor is only required to provide as-built drawings of the relevant sections of the installation that he/she worked on. If there are no existing drawings, provide a schematic diagram of the relevant sections.

Cable schedules must be supplied, including the following:

- The number of cables mutually connected between field units and the control unit(s);
- Cable sizes, number of conductors in each cable, number of reserve cables, etc.;
- Cable types, voltage, technical references of the cables;

Schedules containing full details with respect to interconnecting cable schedules, their size, rating, connecting terminal detail and connecting references must be included in the maintenance manuals. The installation is not regarded as complete until all mark-up drawings and schematic diagrams have been received and signed for by the Engineer.



KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MADADENI PROVINCIAL HOSPITAL UPGRADE TO STUDENT ACCOMMODATION

ANNEXURE 3

Detailed Electrical Specification



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

TENDER

ELECTRICAL DETAILED SPECIFICATION

MADADENI PROVINCIAL HOSPITAL UPGRADE TO STUDENT ACCOMODATION

Prepared by:



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Title : Alterations and Refurbishments to existing student accommodation in Madadeni Hospital

Project Team : Black Balance (Pty) Ltd

Client : Department of Health

Black Balance Project No : 21066

Status of Report : Tender

Key Words

Date of Issue : August 2021

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DETAILED ELECTRICAL SPECIFICATION

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DETAILED ELECTRICAL SPECIFICATION

ELECTRICAL/ELECTRONIC 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.
- Kwazulu-Natal Department of health Infrastructure Development Engineering Advisory Service –policy document for the design of electrical installations Rev7 2013
- Emergency_lighting_ver_22-feb-2006
- ISO 9001 – 9004 - Quality Management Systems
- SANS 1063 (1998) - Earth rods and couplers
- Code of Practice for Earthing Conditions General Provisions - SANS 10198 Part 3 - 1976.
- Code of Practice for Protection of Structure against Lightning: Surge Arrestors for Low Voltage Distribution Systems - SANS 171 - 1986.
- Code of Practice for Control of Undesirable Static Electricity- SANS 0123-1976.
- Electrical equipment and practices coming within the scope of the International Electromechanical Commission (IEC) recommendations.
- SANS 1019 - Standard voltages, currents and insulation levels for electricity supply
- SANS 1195 – Busbars
- SANS IEC 61439(All) - Low-voltage switchgear and control gear assemblies
- SANS IEC 60529 - Degrees of protection provided by enclosures (IP code)
- SANS IEC 60947-1 - Low-voltage switchgear and control gear Part 1: General rules
- SANS IEC 60947-2 - Low-voltage switchgear and control gear Part 2: Circuit-breakers
- SANS IEC 60947-4-1 - Low-voltage switchgear and control gear Part 4: Contactors and motor-starters Section 1: Electromechanical contactors and motor-starters
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- SANS IEC 60947-4-3 - Low-voltage switchgear and control gear Part 4: Contactors and motor-starters Section 3: A.C. semiconductor controllers and contactors for non-motor loads
- SANS IEC 60947-5-1 - Low-voltage switchgear and control gear Part 5: Control circuit devices and switching elements Section 1: Electromechanical control circuit devices
- SANS IEC 60947-5-5 - Low-voltage switchgear and control gear Part 5: Control circuit devices and switching elements Section 5: Electrical emergency stop device with mechanical latching function
- SANS IEC 60947-6-1 - Low-voltage switchgear and control gear Part 6: Multiple function equipment Section 1: Automatic transfer switching equipment
- SANS IEC 60947-6-2 - Low-voltage switchgear and control gear Part 6-2: Multiple function equipment Section 2: Control and protective switching devices (or equipment) (CPS)

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 the National Home Builders Registration Council and the Electrical Contractors Association

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

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

- 7.1 The Supply Authority is Eskom

7.2 Details of Supply

Existing 200kVA Transformer to be decommissioned and new 500kVA 11kV/415V Mini-sub to be installed.

One 3-way non-extensible Vacuum Ring Main Unit complete, comprising two Vacuum switches and one HRC fused switch tee-off for connection to the transformer MV terminals shall be provided in the mini-sub. The RMU shall be of the load-make, fault-break type. The RMU shall be capable of opening the 11kV as well as isolating the mini-sub from the network.

The Vacuum RMU shall include:

- Earthing switches
- Operating mechanism with integral mechanical interlocking
- Operating handle
- Facilities for padlocks on all switching equipment
- Bushing for cable connections in front with arc-resistant cable covers for operator safety
- Manometer for SF6 gas pressure monitoring (if applicable)
- Facilities for fitment of an integrated remote control and monitoring unit

The connection between the live side of the tee-off switch and the transformer MV bushings shall be made using single core XLPE trailing cable tails which shall be so installed that a separation of 50mm is maintained between phases. No separators shall be used on the MV tails. All connections to bushings shall be puttied and taped.

Equipment in the MV compartment shall be so arranged that accidental contact with the MV cable terminals is not possible. Where necessary, a sheet of 10mm clear Perspex shall be installed between the compartment door and the cable boxes or cable terminations which cover the whole door opening. The minimum distance between the Perspex sheet and the cable terminals shall be 250mm. The wording "DANGER EXPOSED HV TERMINALS", in minimum 75mm high red letters shall appear in the centre of the Perspex sheet.

Cable connections shall not be puttied and taped.

7.2.1 Transformers

The distribution transformers installed inside the minisub shall double wound, fully insulated, oil immersed natural air-cooled transformers manufactured, rated and tested in accordance with SANS 780:2009 and shall bear the SANS Mark of Approval.

Standard requirements for all transformers shall be as follows:

Losses	Low
Nominal Frequency	50Hz
Frequency Range	+/- 2.5%
Impedance	Standard
Off-load tap switch	4 equal steps (5 positions) from -5% to +5% of nominal voltage at constant kVA. Provision for padlocking is to be provided.
Cooling	ONAN (oil natural air natural)
Fittings	As required by SANS 780, including inter alia: Indicating thermometer with maximum pointer and alarm and trip contacts Oil level gauge Buchholtz relay with alarm and trip contacts Lifting lugs Skid Under base
Insulating Oil	First filling complying with SANS 555:2007 to be included
Rating	3 phase 500kVA 11kV/400V; Delta/Wye Transformers shall have hermetically sealed welded covers

All transformers shall be painted in accordance with the requirements as laid down in SANS 780. Unless instructed otherwise by the Engineer the colour shall be Avocado Green as specified in the standard.

Minor components shall be pickled and passivated. All major components shall be blast-cleaned in accordance with the abovementioned SANS specification. All hot dip galvanised (HDG) and 3CR12 components shall also be lightly blast-cleaned before painting. Prior to being welded together large components, i.e. transformer tank sub-assemblies, shall be blast-cleaned and painted with: Etchkote" primer. Components to be zinc metal sprayed shall be blast-cleaned before spraying. Spraying must be done within one hour of blast cleaning.

Paint shall be vinyl copolymer polyester applied without a primer within three hours of final metal preparation. Surfaces must be free of dust, dirt, oil and grease. Sufficient coats shall be applied such that the total dry film thickness is not less than 3 microns generally, with 125 microns applied to base, flanges, mounting brackets and other under surfaces. After testing, a final paint coat shall be applied such that the final dry film thickness is between 125 and 135 microns overall.

The transformer accessories, i.e. rating plate, tap-change switch, dial type thermometer, etc., shall be located such that they are safely accessible from the LV compartment.

The transformer oil shall be free of PCB's (polychlorinated biphenyls) and shall be included in the rate for the minisub.

7.2.3 LV Compartment and Equipment Requirements

The LV compartment shall be constructed to be vandal proof.

The minisub shall be fitted with a main LV feeder circuit breaker sized for the full capacity of the minisub.

All equipment contained in the LV compartment shall be accessible from the front and shall be arranged such that any item of equipment may be easily removed or installed on Site.

At the bottom of the LV compartment, but high enough above the base of the minisub to allow adequate working space, minimum 3mm thick galvanised steel gland plates shall be mounted on suitable brackets. The gland plates shall be in 250/300mm lengths for ease of removal and shall be bonded to the main earth bar using minimum 80mm² bare copper conductor fixed with minimum 12mm brass bolts and nuts. The plates shall be pre-drilled for glands of the appropriate size.

The neutral busbar of minimum 50mm x 6.3mm hard drawn copper shall be mounted above the gland plate and shall be connected to the neutral terminal of the transformer using minimum 80mm² insulated copper conductor.

A chassis shall be provided above this neutral bar suitable for mounting LV circuit breakers and associated equipment at a minimum height of 400mm above the gland plate. A removable fascia plate shall be provided in front of the LV switchgear with circuit breaker toggles, etc. projecting through cut outs in the fascia as specified for distribution boards.

A hinged steel panel shall be provided with three CT operated maximum demand reading ammeters and a voltmeter and selector switch installed thereon. The current transformers for the ammeters and other equipment shall be readily accessible. All ammeters, including whole current ammeters, shall be calibrated to 120% of the rated current. The overload capability shall be 10 x rated current for 1 second. Those reading in excess of 100A shall be CT operated with 5A full scale deflection.

All meters, instruments and breakers shall have labels fitted below, stating in which circuit they are installed. All cases of all meters shall afford complete protection from dust and damp and shall be suitable for the attachment of seals. The tenderer shall submit full details of the meters, instruments and control switches offered in his tender, including connection diagrams for all equipment.

A set of three 65mm x 6mm hard drawn copper busbars and colour coded for the respective phases, shall be provided above the circuit breaker chassis.

The wiring and components in the LV compartment of the minisubs shall comply with SANS 61439

7.2.4 Earthing of minisubs

The primary requirement of minisub earthing is to guarantee maximum safety with regards to electrical hazards.

Therefore, every effort shall be made to obtain an earth resistance value of minisubs of **1 Ohm** or less. Where ground conditions make this impossible without incurring unrealistic costs a maximum value of 10 Ohms will be accepted for the minisub and transformer neutral earthing subject to the approval of the Engineer.

The earthing system shall be contained within the minisub foundations to prevent theft. The earthing of the minisubs shall as a minimum include four 1.5m earth spikes (installed in the corners of the foundation excavation) plus a trench earth of at least three coils of 70mm² copper earth conductor connecting the spikes.

Two 70mm² copper tails shall be provided for extending the minisub earthing with a trench earth if required.

The entire minisub earthing scheme shall be clamped to the reinforcing steel of the foundation by means of U-bolts installed at least four places. The contractor shall co-ordinate the activities of civil and electrical/earthing contractors to ensure successful installation of this earthing. Each earthing scheme shall be photographed by the contractor and inspected by the Engineer or his representative prior to pouring of concrete.

Where precast minisub footings are used, the earthing scheme describe above shall be installed under the concrete cover between the precast footing and the security fence.

The main earth bar shall consist of an adequate length of minimum 50mm x 6.3mm tinned copper bar. It shall be supported by means of cycloaliphatic resin insulators in a suitable position to be readily accessible for earth connections and inspection. Conductors connecting equipment to it shall be 70mm² copper terminated in compression type lugs.

Immediately after installation and before energising the equipment the Contractor shall test the earth resistance of the earth system, using the respective earth bar or termination as the reference point. If the required value is not obtained the pigtailed shall be used to install an additional trench earth with spikes. If additional earth spikes are installed it shall not be within 6m of any other spike. The contractor shall submit a report to the Engineer, in duplicate, confirming the first and second values measured.

If the procedure above does not achieve the required values, the Engineer is to be advised and will give further instructions for the improvement of the values obtained. Where more spikes are necessary to obtain the required value, these shall not be installed within 6m of any other spike.

7.3 Metering, Application, Existing services, Liaison

7.3.1 Metering

The supply will be metered by the Department of Health via the automatic meter reading system installed on LV Switchboard, transmitted via telecoms network to main control centre.

7.3.2 Application

No application to Eskom is envisaged.

7.3.3 Existing Services crossing the Site

There are no known electrical services crossing the site.

7.3.4 Liaison

The electrical contractor will be required to liaise with the Department of Health 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.

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

The cable-trenches shall be excavated to a depth of 0,6m deep below ground level and shall be 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 sites free from rocks or stones liable to cause damage to the cable.

The Contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other

property on the site from any risk of subsidence and damage.

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

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

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

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

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

Earth continuity conductors are to be run with all underground cables constituting part of a low tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live 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 AND SWITCHBOARDS

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

The Contractor shall supply and install the distribution boards as indicated on the drawings and listed in the distribution Board Schedule. All distribution boards shall be equipped in accordance with the Single Line Diagrams and must be approved by the Department before installation. 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 20% 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
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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 20% 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 LV Switchboard

- 9.5.1 Supply, install and commission the left hand extension of the main LV Switchboard located in the existing Board Building Substation room. The switchboard shall be rigged into position, and installed under the supervision of the switchboard supplier at locations indicated on the layout drawings. The switchboard shall be equipped as illustrated in the relevant single line diagrams & in this document.

Mechanical design:

All structural work shall be adequately protected against corrosion. Frame and partitions may be of galvanised steel without a further paint coating. Those parts/covers requiring painting shall be properly pre-treated and powder coated. Surfaces shall be free from rough or sharp edges that may injure persons or damage conductor insulation.

Enclosure sheet metal shall have a minimum thickness of 1.6mm. Mounting plates and gland plates shall have a minimum thickness of 2mm.

Equipped compartments shall have hinged doors with suitable locking devices. Hinged doors shall be earthed to the main assembly.

Compartment doors or covers shall be interlocked to prevent opening when the isolating switch is in the 'ON' position. The isolating device shall only be operable when the door/cover is closed.

Free space of at least 200 mm shall be available between the lowest cable termination, switch, push button, indication light or measuring apparatus of a floor mounted assembly and the floor. The maximum height of the above-mentioned components shall not be more than 2 m above floor level.

Assemblies shall be naturally ventilated only.

Nameplates & labels:

Nameplates shall be made of durable, corrosion resistant material.

The following information shall be given on the general equipment nameplate, which shall be mounted on the front of the assembly, e.g. on the incoming feeder:

- a) Manufacturer's name or trade mark,
- b) Switchboard type,
- c) Rated voltage,
- d) Rated frequency,
- e) Rated current of busbar system,
- f) Rated peak and short time withstand current and withstand time,

Each circuit of the assembly shall be provided with an identification label of the circuit destination as per the single line diagram.

In locations where dangerous situations may inadvertently be created, warning plate(s) or caution notice(s) shall be installed, identifying the danger point(s). This may be either in a compartment or on the outside of an assembly.

Internal separation:

Each incomer and feeder must be housed in a separate cubicle with maximum degree of protection between compartments.

The terminals for outgoing cabling shall be clearly identified. Outgoing cabling shall not pass internally through other functional units.

Enclosure and degree of protection:

Switchgear assemblies shall be completely enclosed, self-supporting and suitable for floor mounting, in metal clad multi-cubicle type panels. All components shall be accessible from the front only. The switchgear must be suitable for bottom entry. The floor shall not be considered as being part of the enclosure.

Assemblies shall have separate compartments for main busbars, functional units and cable ways.

Assemblies shall have an external degree of protection as specified on the drawings.

Partitions between the busbar compartments and functional units shall have a degree of protection of at least IP 40.

Exposed parts within the assemblies which have to be accessible during normal operation or maintenance shall either not be live in the opened position or shall be protected to a degree of protection of at least IP 40. The terminals of the incoming circuit breakers shall always be protected to a degree of at least IP 40.

Terminals of equipment installed on a compartment door and which can be live when the door is opened, shall be shrouded to a degree of protection of at least IP 40.

When a withdrawable unit has been removed from the assembly, the live parts inside the fixed compartment shall be protected against touch, with a degree of protection of at least IP 20. Where shutters are fitted to comply with above requirement, they shall be mechanically operated by the movement of the withdrawable unit and not be dependent on gravity. Each set of shutters shall be capable of being individually operated and padlockable in the closed position. Shutters shall be marked 'BUSBAR' and 'CIRCUIT'.

Switchboard components:

a) Busbar system

The phase, neutral and earth busbars shall be of hard or medium hard drawn, high conductivity copper.

The phase and neutral busbars should be located in the top compartments of the switchboard.

The busbar system shall be accessible for construction and maintenance duties. In case of a busbar short circuit, it shall be possible to clean or to replace the busbars and the support system.

The neutral bar shall be insulated from earth and shall be extended to all compartments reached by the phase busbars. The neutral busbar shall have a cross section of at least 50% of that of the phase busbars.

The earth bar shall be located in the top or bottom compartments and in all cable riser compartments of the switchboards and shall be easily accessible. Sufficient connection points with adequate terminating facilities shall be provided for terminating the cable earth leads.

Main phase and neutral busbars shall have 2-off 16mm diameter holes at the end of the switchboard which shall be accessible via a removable plate for direct connection of an emergency power supply cable.

Busbars shall be fully insulated, including distribution busbars (droppers). The insulation of busbar joints and branching points shall be removable and easily replaceable for inspection.

b) Incoming units

Incomer units shall be mounted in separate panels and shall be provided with independent manually operated, fixed pattern air circuit breakers.

Circuit breakers shall have padlock facilities in the 'OFF' position.

Incomer unit shall be provided with instrumentation as indicated on the single line diagrams.

Incomer unit shall be provided with the following indications:

- CB Open/Closed
- CB Racked In/Racked Out
- CB Spring Charged/Discharged
- Protection Trip

Trip events shall be time stamped and stored in non-volatile memory in the local protection unit.

c) Outgoing units

Outgoing units shall be mounted in separate cubicles and shall be provided with independent manually operated circuit breakers.

Outgoing units > 800A shall be equipped with fixed air circuit breakers. Outgoing units ≤ 800A shall be equipped with fixed pattern moulded case circuit breakers.

Circuit breakers shall be easily accessible and operable from the front of the switchboard without opening a cover.

All circuit breakers shall be padlockable in the 'OFF' position.

Each outgoing unit shall be provided with instrumentation as indicated on the SLD.

Circuit breakers shall have a rated short-circuit making and breaking capacity in conformity with the prospective short-circuit current as specified in the drawings.

d) Terminals and cableways for external cables / Bus bar Trunking

Separate cableways shall be provided for external cables.

Provision must be made to accommodate a single core cables for the incoming supply.

Assemblies shall have sufficient glanding facilities for cable entry from the bottom. Cable entries, support facilities for cable clamping, and earthing facilities shall be provided suitable for the type, size and number of cables as specified.

Terminals shall be suitable for copper conductors.

Adequate terminals and cable termination space shall be provided for the main cabling indicated on the single line diagrams.

Individual terminals shall be provided for each external conductor for busbar wiring and outgoing control circuits.

Terminals shall be identified in accordance with the related wiring diagram.

e) Current transformers

Current transformers shall be in accordance with IEC 185.

Current transformers for measuring purposes shall be of accuracy class 3 with an instrument security factor such that the instruments are not endangered at maximum fault current. The secondary current rating is indicated on the SLD.

Secondary terminals of current transformers shall be wired up to a terminal block with short circuiting links, located at an accessible place. At this terminal block one side of each transformer shall be connected to earth.

f) Measuring instruments

All instruments shall have an enclosure with a degree of protection of at least IP 52.

All instruments shall be flush mounted in the associated functional units at a suitable height for easy reading from the front. Scales shall be graduated in actual values.

g) Circuit Breakers to match existing type and manufacturer.

h) It is the contractor's responsibility to ensure that all switchgear used is SANS certified.

i) Uncertified switchgear will not be acceptable.

j) All components within the MCC are to be clearly labelled with sandwich board labels (yellow-black-yellow gravoply, traffolite or similar). Minimum height of letters and numbers to be 5mm.

k) All door mounted components are to be labelled with sandwich board labels (yellow-black-yellow gravoply, traffolite or similar) as well.

l) Each cubicle must be clearly labelled on the outside with its own designation on sandwich board labels. Minimum height of letters and numbers to be 15mm.

m) All labels shall be securely attached with screws and not stuck on.

n) Terminal blocks or rail-mounted terminals shall be labelled to identify them when more than one block is used.

o) Cable glands must be Enviroglands or Corroguard.

p) Surge protection devices must be provided on the incoming mains supply. The surge protection must be visible through a clear Perspex window. SPDs to be equipped with thermal disconnecting mechanisms and visual indication that shows end of life. Surge Protection to comply to SANS 61643-1. The bonding bridge across SPDs shall be located as close to the SPDs as possible. A bridge that clamps direct into the SPD should be used in preference to hard wiring. A 16mm² copper conductor must be used for bonding to the earth terminal, unless otherwise specified by the manufacturer if the SPD. Surge protection to have protection fuses as specified by the manufacturer.

q) An earth bar at the bottom of the MCC must be provided.

r) The contractor is to submit drawings for approval prior to commencement of any work.

s) Contractors to specify manufacture/make of switchgear with quotation.

t) All indication lamps to be LED type.

u) The contractor is to arrange for Factory Acceptance Tests and inspections to be conducted by the Engineer prior to delivery of the MCC to site.

Type tests

- a) The switchboard must be manufactured in compliance with SANS 61439. The manufacturer must provide evidence of compliance with by design verification and a conformity report.
- b) Components installed within the assembly shall be type tested in accordance with the applicable IEC publications (e.g. IEC 947). Certificates obtained from the component Manufacturers shall be made available at the request of the Principal.

Routine Tests

- a) The Manufacturer shall perform routine tests in accordance with SANS61439 on the total assembly. The results shall be recorded in a test report.
- b) The Principal or his Nominee shall witness the final routine testing after all work and factory testing by the Contractor has been completed.
- c) Switchgear shall be visually inspected for conformity with the latest issue of the approved drawings and with the order. The following shall be verified:
 - the degree of protection of the enclosure;
 - degree of protection within the compartments;
 - effectiveness and reliability of safety shutters, partitions and shrouds;
 - effectiveness and reliability of operating mechanisms and locks;
 - insulation of the busbar system;
 - creepage distances and clearances;
 - proper mounting of components;
 - internal wiring and cabling system;
 - correct wiring of main and auxiliary circuits;
 - suitability of earthing and terminating arrangements;
 - correct labelling of functional units;
 - completeness of the data on the nameplate;
 - interchangeability of electrically identical components;
- c) Insulation resistance testing shall be carried out by applying a Megger between each phase and neutral to earth, with the two remaining phases and neutral connected to earth. This test shall be carried out with all manually operated and latched type switching devices closed in the closed position. The insulation resistance measured shall be at least 5MΩ. The voltage applied shall be at least 1.1 times Un DC.
- d) Dielectric tests shall be carried out in accordance IEC 60439-1 as follows:
 - Main circuits: 2500 V AC for 1 minute
 - Control and auxiliary circuits: 2 x Un + 1000 V AC for 1 minute, with a minimum of 1500V
 - Control and auxiliary circuits: 2 times rated insulation voltage plus 1000V with a minimum of 2000V, 50Hz for 1 minute
- e) Full function testing of the mechanical and electrical operation of all functional units shall be conducted. Electrical tests shall include the following:
 - primary injection testing to prove CT circuits
 - secondary injection testing to prove control circuits
- f) Busbar ductor testing shall be carried out on site once the busbars have been fully assembled and torqued.

Notes:

- a) Inspection and tests shall be carried out on the complete assembled switchgear. Transportable units can be wired together instead of completing busbar joints.

9.5.2 The LV switchboard shall include the supply and installation of all associated accessories required to secure the panels to the floor.

9.5.3 The Contractor shall be responsible for the organisation and coordination of all rigging and off-loading activities. **The dimensions of the switchboard is restricted to room size and co-ordination with reticulation services. The contractor shall confirm final allowable dimensions to the switchboard supplier before any manufacturing can commence.**

9.6 Schedule of Distribution Boards and Switchboards

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
Single Line Diagram Layout SWITCHBOARD (MHSA-SB- SLD-REV000)	Floor Standing	Orange	Refer to DB Schematic
Single Line Diagram Layout DB1-GF (DB1- MHSA-GF- REV000)	Flush Mounted	White	Refer to DB Schematic
Single Line Diagram Layout DB2-GF (DB2- MHSA-GF- REV000)	Flush Mounted	White	Refer to DB Schematic
Single Line Diagram Layout DB3-GF (DB3- MHSA-GF- REV000)	Flush Mounted	White	Refer to DB Schematic
Single Line Diagram Layout DB4-FF (DB4- MHSA-FF- REV000)	Flush Mounted	White	Refer to DB Schematic
Single Line Diagram Layout DB5-FF (DB5- MHSA-FF- REV000)	Flush Mounted	White	Refer to DB Schematic
Single Line Diagram Layout DB6-FF (DB6- MHSA-FF- REV000)	Flush Mounted	White	Refer to DB Schematic
Single Line Diagram Layout DB7-SF (DB7- MHSA-SF- REV000)	Flush Mounted	White	Refer to DB Schematic
Single Line Diagram Layout DB8-SF (DB8- MHSA-SF- REV000)	Flush Mounted	White	Refer to DB Schematic

Single Line Diagram Layout DB9-SF (DB9- MHSA-SF- REV000)	Flush Mounted	White	Refer to DB Schematic
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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 epoxy powder coated 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 1,5mm² conductors and a 1,5mm²-earth conductor. For socket outlet circuits the wiring shall comprise 4mm² conductors and a 2,5mm²-earth conductor. In certain instances, 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 Data Installation

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

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, and shall be epoxy powder coated. 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 colour 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 riveted, 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.

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.

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.

1	LUXON PRISM 50W LED - Aluminium Frame, Prismatic Diffuser, 2.3mm PMMA, Flicker Free, 55000h (L70) , CRI >80, 1.5kV Surge Protection, BAKELITE 600x600 3000K with Plug set or approved equivalent (Surface Mounted)
2	LUXON PRISM 50W LED - Aluminium Frame, Prismatic Diffuser, 2.3mm PMMA, Flicker Free, 55000h (L70) , CRI >80, 1.5kV Surge Protection, BAKELITE 600x600 3000K with Plug set WITH 2HOUR Battery BACKUP @ 40% Luminance, Maintenance Free, With LED indicator or approved equivalent (Surface Mounted)
3	LUGO 44W LED - Aluminium Frame, Diffuser, T6063 Anodised Finish, Flicker Free, 90000h (L70B10) , CRI >80, 1.5kV Surge Protection, 1200mm,4000K with Plug set, or approved equivalent (Surface Mounted) - IP65
4	LUGO 44W LED - Aluminium Frame, Diffuser, T6063 Anodised Finish, Flicker Free, 90000h (L70B10) , CRI >80, 1.5kV Surge Protection, 1200mm,4000K with Plug set, WITH 2HOUR Battery BACKUP @ 40% Luminance, Maintenance Free, With LED indicator or approved equivalent (Surface Mounted) -IP65
5	NASA 24W LED- Housing-PMMA, Flicker Free, 50000h (L90B10) , CRI >80, 1.5kV Surge Protection, 580mm,3000K with Plug set, or approved equivalent (Surface Mounted) -IP65
6	NASA 24W LED- Housing-PMMA, Flicker Free, 50000h (L90B10) , CRI >80, 1.5kV Surge Protection, 580mm,3000K with Plug set, WITH 2HOUR Battery BACKUP @ 40% Luminance, Maintenance Free, With LED indicator or approved or equivalent (Surface Mounted) -IP64
7	NASA 19W LED - Housing-PMMA, Flicker Free, 50000h (L90B10) , CRI >80, 1.5kV Surge Protection, 580mm,3000K with Plug set, or equivalent (Surface Mounted) -IP64
8	NASA 19W LED- Housing-PMMA, Flicker Free, 50000h (L90B10) , CRI >80, 1.5kV Surge Protection, 580mm,4000K with Plug set, WITH 2HOUR Battery BACKUP @ 40% Luminance, Maintenance Free, With LED indicator or approved equivalent (Surface Mounted) -IP64
9	ODIN 16W LED- Housing-reinforced polypropylene, Diffuser - UV Stabilized Flicker Free, 50000h (L90B10), 1.5kV Surge Protection, 4000K with Plug set, or approved equivalent (Surface Mounted) -IP65
10	ODIN 16W LED- Housing-reinforced polypropylene, Diffuser - UV Stabilized Flicker Free, 50000h (L90B10), 1.5kV Surge Protection, 4000K with Plug set, WITH 2HOUR Battery BACKUP @ 40% Luminance, Maintenance Free, With LED indicator or approved equivalent (Surface Mounted) -IP65
11	ARGO 54W LED- Including, Siggot, 5m Hot Dip Galvanised Pole, Powder coated with Access Hatch, Access Door and Termination block (3x10mm ² 3 core cable and 5x 2.5mm house wire, 5A circuit breaker) Housing-Hail resistant, Diffuser UV Stabilized Flicker Free, 50000h, 6kV Surge Protection, 4000K, Day/Night sensor or approved equivalent (Installed in ground- including bolt cage) -IP66
12	Flood Light 50W LED- Housing-Metal, 6000k, 50 000h, CRI>70 or approved equivalent (Surface Mounted) -IP65 or approved equivalent

13	Spazio LED - Metal body, acrylic diffuser, includes LED driver, 3 hour emergency backup. (Ceiling Mounted) -IP20 or approved equivalent
14	Lumina 58W LED- Including, Sigo, 36 Degree, 5m Hot Dip Galvanised Pole, Powder coated with Access Hatch, access door and Termination block (3x10mm ² 3 core cable and 5x 2.5mm house wire and 5A circuit breaker) Housing-Hail resistant, Diffuser UV Stabilized Flicker Free, 50000h,6kV Surge Protection,4000K,Day/Night sensor, or approved equivalent (Installed in ground- Including bolt cage) -IP66

16. POWER POINTS

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

16.1 Water Heaters

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

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 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.

16.3 Washing Machines and Dryers

The supply and installation of washing machine 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 being 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. ELECTRONIC EQUIPMENT

The electronic equipment is listed in the BOQ and relevant layout drawings. All products supplied must be SANS approved. The bidder may offer alternatives (SANS approved); however, this must be verified and approved by the engineer before procurement. All supporting documentation must be provided with the bid.

Should the Bidder be aware of additional equipment that may be required then this should be documented and submitted with the bid, otherwise it is deemed that the offer includes all items required for the system to be fully functional.

All prices must be fully inclusive of all cabling, software programs and software programming.

Bidders need to be aware that some of these systems need to be integrated into the existing Hospital infrastructure and linked to the main Hospital Control Room. These include the IT Network, telecommunication, BMS, CCTV, Alarm systems, Access Control, time keeping and fire detection.

Additional PC's and Screens Shall be added to the Existing building and Main Control Room for overview and operation of all the electronic systems.

18.1 CCTV System

Camera's shall be strategically placed along the exterior and interior of the building. The Bidder shall refer to MHSA-GF-ELCT-REV000 and MHSA-FF/SF-ELCT-REV000 to better understand the positions of the camera and routing thereof.

Two Dahua NVR 64 Channel 2U Ultra 4K (RCDA324) with 8TB SATA 3.5" HDD shall be supplied and installed together with IP 2MP Dome Camera IR30m WDR 2.7-13.5mm IP67 & IP 4MP WDR IR 60m 2.7-13.5mm Motorized Bullet type cameras. System to be fully inclusive of all cabling, software programs and software programming.

Refer to the Bill of quantity for system requirements.

18.2 Access Control System

The Access control system must be an integrated solution that consists of hardware and software designed to control entry into selected areas and manage movement of people within. The system shall be designed to increase security by defining access permissions based on area for each user and maintaining a log of all events.

Bidder shall refer to MHSA-GF-ELCT-REV000 and MHSA-FF/SF-ELCT-REV000 and the Bill of Quantity for components of the access control system.

Access control system to be integrated with the Some Detection System and include emergency operation.

Technical requirements

Software

There shall be no limitations on the number of PC workstations, readers and alarm inputs.

The number of cards/users shall be limited only by memory available in hardware.

At least 3 active cards per user shall be supported.

At least 8 access levels per user shall be supported.

Access levels should be assigned to a user, not to a card, in order to help issue a new card in a fast and easy manner, without reassigning access levels.

The software shall support at least 4000 holiday dates and have automatic holiday rescheduling feature.

The software shall have the ability to perform scheduled automatic database maintenance and backup tasks at user selected intervals and ability to configure the amount of history stored in the active database.

The software shall have the ability to produce the following report types: system and alarm event reports, user reports, hardware configuration settings, access level reports, employee time & attendance reports.

The reports shall be available in Adobe PDF and MS Excel formats.

Report filters must be convenient and user friendly: allow operator preview user photos, content of access levels, hardware settings and time zone configuration.

The software shall support an unlimited number of building floor plans.

Floor plan viewing interface shall have convenient zoom in/out controls by mouse wheel.

The software shall allow operator to conveniently edit floor plans by "dragging and dropping" hardware devices to selected plan areas.

The software shall allow assigning custom icons to each floor plan in order to help operators identify

floor plans quickly. The software shall have a wide selection of default icons as well.

The software shall support "full-screen" mode that would take up 100% of the monitor area and prevent operators from starting or accessing any other programs.

All configuration and user changes shall be sent to controller immediately. The software shall display the progress in percent as the changes are being downloaded. The downloading shall be done in background and not affect the normal use of the software in any way.

The floor plans shall display real-time status of system hardware and allow operators to immediately see the effects caused by configuration changes.

Dynamic search function shall be present in all windows of the program: search results shall be narrowed automatically as a key phrase is being entered. I.e. after entering characters "xy" the program shall locate and display all records containing these characters, and after typing in more characters shall refresh the results automatically.

The software shall use an industry standard database engine released not earlier than 2005 and currently supported by the manufacturer.

The software shall have the ability to automatically display photos and additional information about users as they enter/exit through doors.

The software shall be available in the official language(s) of the country where it is being installed. If such language is not included in the standard installation, the software shall support user friendly translation method: simply replacing program text directly in the software ("on the fly"), without the need of sending any files to the manufacturer for compiling.

The software shall have a modern interface, attractively designed and convenient to use.

The software shall be adapted for operators who have not received any special training related to management of integrated security systems. Graphical user interface shall be intuitive. Introducing the system to a new operator shall not take more than 1 hour.

In order to reduce the amount of work done by an operator, the software shall incorporate an option to copy objects: users, doors, floor plans, time schedules, access levels and holidays.

The software shall facilitate integration with other systems of the building.

The software shall have the ability to transfer entry and exit events to HR systems with the purpose of work time calculation.

The software shall store information and provide reports about visitors and appointments.

Hardware

The hardware shall support open architecture. Communication protocols shall be available to system integrators and software development companies in order to protect end-users from being constrained to a single brand of hardware or software.

The hardware shall support all industry standard readers that output information in Wiegand or Clock/Data formats (up to 128 bits).

There shall be at least 2 types of controllers: (a) for one door with an entry reader and an exit button and (b) for one door with two readers (entry and exit) or for two separate doors with entry readers and exit button.

There shall be an IP-reader available. The IP-reader shall integrate a contactless card reader and controller in a single body, designed for surface mounting on a wall or a door frame eliminating the need for enclosures.

Each controller and IP-reader shall have a standard RJ-45 network port for communication with software and other controllers.

Controller and IP-reader shall support standard Ethernet 10/100BaseT network and TCP/IP communication protocol.

Systems using Ethernet converters, adapters, or terminal servers that enable network connectivity for legacy controllers by tunneling RS-232/485 serial data over Ethernet shall not be acceptable.

Single-door controller and IP-reader shall have at least 32Mb SDRAM operating memory and 8 MB Flash memory for database and events. Two-door controller shall have an option for expanding Flash memory to 32MB.

All controllers and IP-readers shall use a 32Bit 100Mhz RISC processor (or better) in order to enable fast execution of advanced functions.

Controllers and IP-readers shall use Linux operating system and accept firmware upgrades via

network.

All system parameters including card numbers, PINs, access levels, time schedules, holidays and operations modes shall be stored in controller and IP-reader memory and not affected in case of a power loss.

Single-door controller and IP-reader shall have enough memory to store at least 40,000 users. Two-door controller shall have enough memory to store at least 250,000 users.

In case communication with the host PC is interrupted, the controller and IP-reader must have enough memory to store at least 5000 latest events (FIFO buffer).

Operation of controller and IP-reader shall be completely independent of the PC or "Master controller". Should the PC or the communication link fail, the users should not be affected in any way and all functions should continue working.

18.3 Alarm System

Supply and install an alarm system to meet the security demands of the nursing accommodation. This should include strategically positioned, panic buttons, siren, Beacon, keypad, control unit, wiring and accessories.

Bidder shall refer to MHSA-GF-ELCT-REV000 and MHSA-FF/SF-ELCT-REV000 and the Bill of Quantity for components of the Alarm System.

18.4 Intercom System

Supply and install all cabling and accessories for a 1 to 1 intercom system. The intercom shall provide a link between the entrance gate and the security office of the accommodation area.

18.5 Smoke Detection System

Supply and install all cabling, smoke/heat detectors, manual alarm contacts/Break glass units, siren and analogue addressable fire alarm control panel with LCD display and mimic panel.

Break glass units must sound warning devices and alert Fire department when activated.

In order to maintain the system under mains fail condition an integral standby power set consisting of power pack and constant potential charger must be provided.

All LV electrical wiring must be of the Fire retardant type- PH30 1.5mm 2 core.

Bidder shall refer to MHSA-GF-SD-REV000 and the Bill of Quantity for components of the Smoke Detection System.

19. 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.