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DEVELOPMENT BANK OF SOUTHERN AFRICA  
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# **ELECTRICAL GENERAL SPECIFICATION**

RFP 002/2023 – APPOINTMENT OF A CONTRACTOR FOR THE REPAIR  
OF STRUCTURAL DEFECTS AND REPLACEMENT OF BUILDINGS IN  
UNSATISFACTORY CONDITION AT WESTERN HOLDINGS PRIMARY SCHOOL  
ON BEHALF OF FREE STATE DEPARTMENT OF EDUCATION

*Prepared by:*



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## GENERAL ELECTRICAL 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 alias, 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, 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 $\Omega$  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 mm<sup>2</sup> 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 mm<sup>2</sup>.
- 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 angel 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.