TENDER NO: DCS05ECAN002/WP1/C3

PROCUREMENT OF CONSTRUCTION COMPANY FOR THE SECURITY INSTALLATIONS TO THE PERIMETER FENCE, SALLY PORTS AND CONTROL ROOM BUILDINGS AT ST ALBANS CORRECTIONAL FACILITY IN GQEBERHA – EASTERN CAPE

BID DOCUMENT

OCTOBER 2022

PREPARED FOR:	ISSUED BY:	PREPARED BY:
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PART C4 SITE INFORMATION

USER CLIENT | EMPLOYER | ENGINEER

PROCUREMENT OF CONSTRUCTION COMPANY FOR THE SECURITY INSTALLATIONS TO THE PERIMETER FENCE, SALLY PORTS AND CONTROL ROOM BUILDINGS AT ST ALBANS CORRECTIONAL FACILITY IN GQEBERHA – EASTERN CAPE

C4 Site Information

The site is located at the Department of Correctional Services, St Albans Correctional Facility located at St Albans Road, Uitenhage Farms, Gqebera, Eastern Cape. GPS Coordinates: 33.9055° S, 25.3476° E

PART 1

THE SUPPLY, INSTALLATION AND COMMISSIONING OF AN INTEGRATED SECURITY FENCE INSTALLATION

INCLUDING INNER TAUT-WIRE DETECTION FENCE SYSTEM, PLC CORRECTIONAL CENTRE CONTROL SYSTEM, ICT BACKBONE, ACCESS CONTROL SYSTEM (BIOMETRIC), C.C.T.V. SYSTEM, EVENT LOGGING SYSTEM, DIGITAL INTERCOM AND RECORDING SYSTEM, X-RAY MACHINES, METAL DETECTORS, OUTER PERIMETER FENCE KINEMATIC DETECTION SYSTEM, DIESEL BACK GENERATOR SYSTEM, UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	**Integrated Electronic Specification (This Document)**
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification
Part 12:	ICT Specification

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY: ELECTRONIC INSTALLATIONS

ELECTRONIC WORK

PART 1: ELECTRONIC SPECIFICATION

CONTENTS

GENERAL SPECIFICATION

1. COMPLIANCE WITH REGULATIONS

(a) The installation shall be erected and tested in accordance with the latest issues and amendments of the following Acts and regulations:

(i) SANS 10142: "Code of Practice for the Wiring of Premises",

(ii) the Occupational Health and Safety Act, 1993 (Act 85 of 1993),

(iii) the Local Government Act 1998 (Act 10 of 1998 (Gauteng), municipal by-laws and any special requirements of the local supply authority,

(iv) the Fire Brigade Services Act 2000 (Act 14 of 2000),

(v) the National Building Regulations and Building Standards Act 1996 (Act 29 of 1996),

(vi) the Post Office Act 1998 (Act 124 of 1998),

(vii) the Electricity Act 1996 (Act 88 of 1996) and

(viii) the Regulations of the local Gas Board where applicable.

(ix) SANS 2220 – 2 Section 1 – 7 of 2005

(x) SANS 10222: 2007

(xi) SANS 61131-1: 2017

2. PROJECT SPECIFICATION

2.1 INTENT OF DOCUMENT

The specification is intended to cover the complete installation of the Security Fence Installation for the correctional facility. The minimum equipment requirements are outlined, but do not cover all the details of design and construction. Such details are recognised as being the exclusive responsibility of the contractor.

In all cases where a device or part of the equipment is referred to in the singular, it is intended that such reference shall apply to as many devices as are required to complete the installation.

2.2 GENERAL

This specification covers the supply, installation, testing, commissioning and guarantee for a period of 15 months, with an additional 36 – month maintenance period for the Integrated Electronic Security Installation System at St Albans Correctional facility in Port Elizabeth, The contract also includes integration of existing electronic products and materials, as detailed in the attached Material On Site Schedule.

The drawings issued herewith and listed in the relevant section are to be read in conjunction with the specification and all items mentioned, together with all ancillary equipment necessary for the correct installation, operation and full compliance with the Standards and codes must be provided, notwithstanding the fact that they may not have been included in detail in these documents.

The Tenderer shall, at the time of tendering, draw the Engineer's attention to any omissions or discrepancy between the specification and the drawings and request from his clarification of details or responsibilities.

If a limited allowance or special conditions are made for the Tender Sum for the supply or erection of any item of the installation, the limit or special conditions shall be defined at the time of tendering.

It is the sole responsibility of the Contractor to ensure that all quotations obtained from manufactures and suppliers are complete in their entirety and must include all equipment and accessories necessary for compliance with current practice and the efficient and proper functioning of the installation.

If any such items of equipment, brackets and accessories, etc., have been omitted from a supplier's quotation, or incidental work is necessary, the Contractor must include for all such items and work in the tender.

Wireways including terminal boxes to all the various installations have been allowed for under the Electrical contractor. However, it remains the responsibility of the various installers (Cashless Society, Cell Phone Detection System, Inner Taut-wire Detection Fence System, PLC Correctional Centre Control System, ICT Backbone, Access Control System (Biometric), C.C.T.V. System, Event Logging System, Digital Intercom and Recording System, X-Ray and Metal Detectors, Outer Perimeter Fence Kinematic Detection System, Diesel Back Generator System, Uninterruptable Power Supply (UPS) System) to ensure that this work is thoroughly coordinated and the necessary wireways & boxes have been allowed for.

Location

This system set is to provide a complete Security Fence Installation for the Department of Correctional Services at St Albans Correctional Facility in Gqeberha.

Site Conditions

The following site conditions will be applicable and all equipment shall be capable of operation at these conditions.

a)	Height above sea level -	247m
b)	Ambient temperatures -	8^0C to 26^0C
c)	Relative Humidity at lowest temperature -	79 %

Site Co-ordinates: 33°54'19.05"S, 25°21'0.69"E

3. SECURITY MANAGEMENT SYSTEM (SMS)

The installation detailed in this specification adheres to the Standard specification as published by the Department of Public Works, namely, "*Department Of Public Works Security Standard Technical Specification*

For An Integrated Security System For A Correctional Facility", herein after termed the GENERAL SPECIFICATION.

4. GENERAL DESCRIPTION AND SYSTEM OVERVIEW

The contractor shall include in their tendered rate(s) compensation for the complete supply, installation, testing and commissioning of an integrated multi-workstation security management system to facilitate the control and monitoring of all security subsystems components by means of a mouse activated operated workstation. This will include all required and necessary licenses and software interfaces for sub-system integration to ensure optimal and correct operation of the Security Management System (SMS).

Operator Workstations shall be located within each local control room as well as the movement and Central control rooms within the facility.

The SMS system offered shall be capable of providing a multiple operator workstation environment, which may be configured for full or selective operational & functional monitoring and control of select areas and functions.

The Contractor shall provide all materials, labour and supervision required to install, commission and document the complete system as required by this specification, and as indicated on the accompanying drawings.

The SMS offered shall have demonstrated proven operation in a minimum of three (3) Correctional facilities, and a list of reference sites shall be provided as part of the tender response.

5. OPERATOR VISUAL DISPLAY UNITS

The SMS system offered shall be capable of providing a multiple operator workstation environment, which may be configured for full or selective operational & functional monitoring and control of select areas and functions. Operator workstations shall be located as indicated in the tender drawings issued.

The operator workstations shall operate in both text and graphics based display. Any operator workstation enabled via the Biometric logon system shall be capable of controlling any area within the facility providing the respective operator is authorized to do so.

The operator workstation shall also be capable of implementing changes to the system configuration and parameters, provided the operator has the necessary administration rights.

Entries, deletions or modifications to the configuration shall be possible via the operator workstation VDU/Keyboard without loss of, or degradation to, any other system functionality.

The following workstation functions shall be possible:

- Displaying point status information.
- Manually initiating control commands.
- Displaying system events and alarms.
- Displaying staff, visitor and inmate photographs for positive identification.
- Enrolling and verifying staff, visitor and inmate fingerprints. (Visitation Management module)
- Assigning operator access levels.
- Altering time schedules and creating new time schedules.
- Assigning or modifying time schedules for automatic operation of monitored doors/gates and redirection of duress alarms and indicators appropriate to the user's building/department/etc.
- Overriding time controlled functions, momentarily, to allow operator control of doors/gates/and the like.
- Altering existing or assigning new descriptions or actions.
- Displaying status of all alarm sectors within the user's areas.
- Remotely operate doors/gates within their restricted areas.
- Displaying all appropriate building activities.
- Performing on-line backup copies of complete system without any degradation in the overall system performance.
- Displaying building alarms including fire alarms, gas/vapour sensor alarms, duress push buttons, etc.
- Enable the viewing of Sub-system status icons to be enabled or disabled through a built in menu structure.

All of the above shall be restricted by user level based on the finger print access to the operator workstation.

6. SECURITY SUB-SYSTEM INTEGRATION

The Security Management System (SMS) shall provide the integration platform for all Security Sub-Systems. It is a specific requirement of this tender that the SMS shall interface directly with all sub-system hardware by means of existing drivers supplied as part of the SMS software. Hardwired interface of one sub-system to another to achieve integration with the SMS shall not be accepted.

The SMS software shall perform all interlocking functions between the various subsystems i.e. the automated switching of CCTV images upon intercom selection, door alarms, fire alarms etc. The SMS software shall be capable of configuring the necessary interlock functions either by providing a configuration table or an internal scripting facility or a combination of the two. The programming of interlock functions within sub-system hardware/software as a means of achieving the required functionality shall not be accepted. The tenderer shall provide a description of the interface protocol for each sub-system hardware platform offered as part of this tender, in the clause by clause compliance statement to be returned with their submission.

The SMS software shall provide the necessary soft control functions to eliminate the need for any additional control components such as keyboards, joysticks or proprietary operator panels.

System operators shall be capable of controlling all functions of the sub- system hardware components via a single mouse driven operator workstation running on a Windows 10 or later operating platform within a single Security Management Application.

The following sub-system hardware components shall be directly integrated with the Security Management System by means of a high level interface:

1) PLC based door locking system

2) Access Control based door locking system

3) Digital Intercom & Public Address system

4) IP based CCTV system

5) IP based Video Recording system

6) Perimeter Detection system

7) Fire Detection system

8) Uninterruptible Power Supplies

The following devices shall be interfaced to the Security Management System via the PLC based door locking system by providing remote multi-I/O modules where required:

1) Duress Buttons

2) Non-controlled door position switches (DPS)

3) Over voltage suppression devices

4) Standby Generator Sets

7. SMS SYSTEM LOGGING AND OPERATIONAL REQUIREMENTS

The server workstations shall be capable of logging the following data:

Event related data:

Item	Database Fields
1	Time and Date Stamp
2	Equipment Type
3	Control Area
4	Equipment Designation
5	Equipment Location
6	Alarm/Event Type
7	Alarm/Event Status
8	Responsible Operator
9	Operator Workstation Name
10	Control Area
11	Alarm/Event Priority

Logged Events/Alarms:

Item	Intercom Events/Alarms
1.1	Intercom Station Call in
1.2	Intercom Station Activated
1.3	Intercom Station I/O Failure
1.4	Intercom Station Tamper Alarm
1.5	Intercom Station Threshold Alarm
1.6	Intercom Station Fault
1.7	Intercom Call-in Transferred
1.8	Intercom Call-in Unanswered
1.9	Intercom Station Isolated
1.10	Intercom Station Isolated warning
1.11	Intercom System Hardware Failure
1.12	Intercom System Communication Failure

1.13	Intercom Alarm/Failure Acknowledged
1.14	Intercom System Call Central Command
1.15	Intercom System Call Movement Command
Item	CCTV Events/Alarms
2.1	CCTV Camera Activated
2.2	CCTV PTZ Preset Edited
2.3	CCTV Sequence Selected
2.4	CCTV Sequence Edited
2.5	CCTV System Hardware Failure
2.6	CCTV System Communication Failure
2.7	CCTV Alarm/Failure Acknowledged

Item	DVR Events/Alarms
3.1	DVR Channel Record Command
3.2	DVR Channel Halt Record Command
3.3	DVR System Hardware Failure
3.4	DVR System Communication Failure
3.5	DVR Alarm/Failure Acknowledged

Item	Door Events/Alarms
2.1	Door Open Command
2.2	Door Closed Command
2.3	Door Fault on Closing
2.4	Door Fault on Opening
2.5	Door Forced Open Manually
2.6	Door Open outside of limits
2.7	Door Open for extended period
2.8	Door Control module Communication Failure
2.9	Door DPS Opened
2.10	Door DPS Closed
2.11	Door Interlock Override Command

2.12	Door Group Activated
2.13	Door Group Edited
2.14	Door Emergency Release Activated
2.15	Door Control System Hardware Failure
2.16	Door Control System Communication Failure
2.17	Door Alarm/Failure Acknowledged

Item	Gate Events/Alarms
5.1	Gate Open Command
5.2	Gate Stop Command
5.3	Gate Close Command
5.4	Gate Fault on Closing
5.5	Gate Fault on Opening
5.6	Gate Forced Open Manually
5.7	Gate Open outside of limits
5.8	Gate Open for extended period
5.9	Gate Control module Communication Failure
5.10	Gate Alarm/Failure Acknowledged

Item	Lighting Events/Alarms
6.1	Lighting Zone Activated
6.2	Lighting Zone De-activated
6.3	Lighting Zone Scheduled Reset

Item	Public Address Events/Alarms
7.1	Public Address Zone Manual Activation
7.2	Public Address Zone Scheduled Activation

Item	Intrusion Events/Alarms
8.1	Intrusion Zone Activated
8.2	Intrusion Zone Alarm Acknowledged

Item	Panic Button Events/Alarms
9.1	Panic Button Activated
9.2	Panic Button Activation Acknowledged

Item	UPS Events/Alarms
10.1	UPS Mains Failure Alarm
10.2	UPS Load on Bypass
10.3	UPS Battery Low
10.4	UPS Battery Failure
10.5	UPS Load not protected
10.6	UPS Surge Arrestor Failure
10.7	UPS Communication Failure
10.8	UPS Alarm/Failure Acknowledged

Item	SMS Events/Alarms
11.1	New Operator Enrolment Successful
11.2	New Operator Enrolment Failed
11.3	Operator Details Edited
11.4	Operator Details Deleted
11.5	Workstation Logon Successful
11.6	Workstation Logon Failed
11.7	Workstation Unauthorized Access Attempted
11.8	Workstation Manual Logoff
11.9	Workstation Automatic Logoff
11.10	Workstation Inhibited
11.11	Workstation Re-instated
11.14	Workstation Online
11.15	Workstation Offline
11.16	Workstation Communication Failure
11.17	Workstation Alarm/Failure Acknowledge

7 MATERIAL ON SITE

The contractor shall be supplied with a Material On Site Schedule, detailing material that is available for installation purposes. This material schedule is divided into various categories, spanning the scope of works for this project.

It is required that as much of this equipment as is possible is used, and the tenderer is to familiarize themselves with the listing. If the contractor deems it impractical to use any of the equipment, they are to bring it to the attention of the Engineer with proof as to why it cannot be utilised.

8.1 Existing Material Testing

The contractor shall include compensation for the complete testing of each of the listed equipment in the MOS schedule. The contractor will thereafter take receipt of this equipment, and will be required to provide adequate storage for the equipment, taking full responsibility for the material issued.

If any equipment damaged after receipt by the contractor, and deemed to have been damaged in the care of the contractor shall be replaced at the sole cost of the contractor.

9. SMS SYSTEM TESTS AND COMMISSIONING

TEST AND INSPECTION ON COMPLETION OF REPAIR AND UPGRADE WORK

9.1 General

The tendered price shall allow for full compensation for the comprehensive inspection and testing of the performance of each sub-system hardware and software, as well as the sub-system integration to the Integrated Security Management System. An allowance of 4 working days shall be included in the tender sum during which time each aspect of the system operation shall be evaluated for compliance with the specification.

Should such testing by the Engineer indicate that aspects of the system are not performing to the required standard, modifications to and re-testing of the entire installation, in the presence of the Engineer shall be for the account of the contractor.

9.2 Prior Delivery Tests

Upon completion of the installation the contractor shall conduct the following tests and submit the results to the Engineer for evaluation before requesting the Engineer to take first delivery of the entire, or any part of the installation.

On the day of first delivery inspection, the contractor must be prepared and fully equipped to repeat any of the tests as required in the presence of the Engineer.

9.3 Test equipment

The contractor shall provide all of the necessary test equipment.

The equipment must be of a professional standard and recently calibrated and certified by the S.A.B.S. or other test authorities. All test equipment shall remain the property of the contractor.

9.4 Test Procedure

The following test procedures shall serve as a guide to the contractor regarding the extent of tests that will be conducted on site.

Should these test procedures prove inadequate, however, the test procedures detailed in the relevant standards and manufacture recommendations shall be adhered to where applicable.

Should these tests prove the system to be unsatisfactory, the Engineer reserves the right to have the installation or individual components tested by the SABS in whatever way may be necessary to determine the quality of the equipment and installation. The cost of such tests shall be for the contractors account.

The Integrated system shall comply with the minimum performance requirements irrespective of the minimum requirements set for individual sub-systems.

9.5 CCTV

The Contractor shall demonstrate the CCTV functionality in accordance with the above-mentioned specification including the following functions:

1. Select active camera to spot monitor from Local and Central Control.
2. Deselect camera.
3. Apply sequence number to monitor.
4. Black screen switching on Perimeter **Alarms**

9.5.1 DVR Recording and playback

The Contractor shall demonstrate the full Digital Video Recording functionality in accordance with the above-mentioned specification including the following functions:

1. Selective recording based upon events including door activate, Intercom selection and camera selection.
2. Selective recording based on motion.
3. Playback of Historical video from the SMS.
4. Selection of current DVR from SMS.
5. Search and Playback of video footage by selecting an event from the event recording system.
6. Control of DVR functions from SMS including Search, Jog, Forward, Reverse etc.

9.6 Intercom Selection

The Contractor shall demonstrate the Intercom functionality in accordance with the above-mentioned specification including the following functions:

1. Select Audio Channel from Icon.
2. De-select Audio Channel form Icon.
3. Select Audio Channel from “Select Button”
4. Select Audio Channel from FIFO queue.
5. Reset Audio Call In.
6. Audio Call In Annunciation.
7. Audio Call in Entry into FIFO queue.
8. Automatic SMS page selection upon Audio selection.
9. Automatic camera selection upon Audio selection.
10. Active channel indication, annunciation and reporting

9.7 Building Monitoring

The Contractor shall demonstrate the Building Monitoring functionality in accordance with the above-mentioned specification including the following functions:

1. Door Monitor switches
2. UPS status & Standby Generator Alarms

3. Panic Button Monitoring.
4. Surge Voltage Alarms.

9.8 Perimeter Detection

The Contractor shall demonstrate the Perimeter Detection system functionality and interface to the SMS in accordance with the above-mentioned specification including the following functions:

1. Individual Taut Wire alarm status
2. Individual Taut Wire maintenance status
3. Individual Taut Wire healthy status
4. Non-Lethal shock energiser loop open circuit status
5. Non-Lethal shock energiser loop short circuit status
6. Non-Lethal shock energiser loop normal status
7. Field Node communication status
8. Field cabinet tamper status
9. Field Node logic monitoring status (Light on status)
10. Sensor alarm Acknowledge
11. Loop alarm Acknowledge
12. Sensor alarm Reset
13. Loop alarm Reset
14. Inhibit Taut Wire Sensor alarm
15. Inhibit Taut Wire Loop alarm
16. Inhibit Field cabinet Tamper alarm
17. Individual Sensor sensitivity setting
18. Loop sensitivity setting

9.9 Smoke Detection System

The Contractor shall demonstrate the GST Smoke detection system functionality and interface to the SMS in accordance with the above-mentioned specification including the following functions:

1. Detector Healthy status
2. Detector Alarm status
3. Detector Fault/Maintenance status
4. Detector Inhibit status
5. Detector Inhibit Command
6. Detector Un-inhibit Command
7. Alarm Silence Command
8. Alarm Reset Command
9. Synchronize Clock Command
10. Communication Failure Alarm

9.10 SMS Interlock Functions

The Contractor shall demonstrate the Interlock Functions of the SMS in accordance with the above-mentioned specification including the following functions:

1. The selection of Cameras prior to Door opening
2. The selection of Intercom communications prior to Door opening
3. Sally port door interlocking
4. Monitored door interlocking
5. Automatic Video recording on camera image activity
6. Automatic event recording on individual operator activity
7. Automatic Control console “LOG-OFF” on control room door opening

8. Interlock capability according to operator log-in level

9.11 SMS General Functions

The Contractor shall demonstrate the General functions of the SMS in accordance with the above-mentioned specification including the following functions:

1. Operator Response instructions to alarms.
2. Allocation of alarm priorities.
3. Setting of Alarm response properties.
4. Current Alarm Window indicating alarm conditions in order of priority.
5. Enrolment of Operators via the Management Station.
6. Downloading of Operator details to Workstations.
7. Verification of On-Line workstations.
8. Remote Logon of Workstations from Central Control.
9. Remote Disabling of Workstations from Central Control.
10. Logon of Operators via the Biometric Finger print reader (one to many)
11. Logon of Operators via a User name and Password.
12. Logging of un-authorised logon attempts.
13. Automatic request for finger print confirmation every 30 Minutes.
14. Automatic log off of workstations upon failure to present finger print.
15. Lockdown capability

9.12 Central Operator Workstation Response

The Contractor shall confirm that the interaction delay between activating a control icon on any given operator workstation and the controlled point activation, (i.e., the lock), is less than one second (1 sec).

Similarly the interaction delay between controlled point activation and any given operator workstation response either by activation of an audible alarm and/or the associate icon changing state (colour) shall be confirmed as being no greater than one second (1 sec).

The interaction delay between recalling any floor plan at any given operator workstation shall be no greater than one quarter of one second (0.25) second.

9.13 Local Operator Workstation Response

The Contractor shall confirm that the interaction delay between activating a control icon on any given operator workstation and the controlled point activation, (i.e., the lock), is no greater than one half of one second (0.5 sec).

Similarly the interaction delay between controlled point activation and any given operator workstation response either by activation of an audible alarm and/or the associate icon changing state (colour) shall be confirmed as being no greater than one half of one second (0.5 sec).

9.14 Event Recording And Report Generation

The Contractor shall verify the functionality of the Event recording and reporting system in accordance with Section SI 10 of the Standard Specification for Security Management Systems including the following functions:

1. Logging of event related data.
2. Logging of Alarms.
3. Logging of Operator Activity.
4. Logging of Operator Logon and Log off events.
5. Logging of System Alarms.
6. Automatic Archiving of historical data.
7. Report design and creation.
8. Report printouts.

10. Logging and Recording Procedures

10.01 Recording System

The Contractor shall as part of this Contract institute a Recording system as part of his Maintenance Control Plan as defined in the Additional Specification SA - General Maintenance.

This shall consist of a Record book, which shall be utilised to log and record all faults, system checks, services, overhauls, breakdowns, maintenance visits, inspections, etc.

10.02 Logbook

The logbook shall be stored in a safe place inside the prison maintenance supervisor's office and shall only be utilised by the Contractor and Engineer.

The Contractor shall submit a copy of the entries and recordings into this logbook together with his report to the Engineer.

10.1 Maintenance Tools and Spares

10.1.01 Parts Cabinet

The contractor shall supply and install a double door floor-standing steel lockable spare parts cabinet in the maintenance office to store parts and a copy of the O&M manuals.

The cabinet shall consist of horizontal and vertical compartments. Each part type shall be stored in its own compartment, labelled with the shelf-number, part and quantity. A complete part schedule indicating the number, quantity and type of part shall be attached permanently to the inside of the door behind protective material.

A spares schedule shall be kept with the following columns:

Part description, quantity, date taken, by whom it was taken, date returned and signature of the responsible person.

10.1.02 Spare Parts

Spare parts shall be supplied as part of this contract, which shall serve for the day-to- day maintenance and shall be fully restocked at three-monthly intervals.

The spare schedule and equipment cabinet shall be inspected monthly. Failure to replenish the spares cabinet shall result in a penalty at the tendered rates, plus 20% for costs and disbursements for the Engineer

The equipment as listed in the schedules of quantities shall be supplied and maintained to the completion of the maintenance phase.

10.03 Quality Assurance System

10.03.01 Quality Assurance System Implementation

Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved Quality Assurance system.

10.03.02 Quality Assurance System records

Records of this Quality Assurance system shall be kept throughout the duration of the contract and shall be submitted to the Engineer as required by the Department.

10.04 Re-Commissioning Of Installation

10.04.01 Re-commissioning

On practical completion of the repair work, the contractor shall re-commission and put all systems into operation.

10.04.02 Re-commissioning acceptance

All commissioning shall be performed by the Contractor, to the satisfaction of the Engineer.

The Contractor shall confirm in writing that all systems have been repaired according to specification and are fully operational.

11 Server Hardware Requirements

The minimum hardware requirements for the different workstations are detailed below.

11.1 Operator Workstations

Operator Workstations shall comply with the following minimum specification:

- Chassis: Mini-Tower
- Processor: Dual Core Intel® Xeon® W3503 2.40GHz, 4M L3, 4.8GT
- OS: Windows 10 Pro (64 bit) or later
- Memory: 16GB, 2666MHz, DDR5 SDRAM, ECC (2 DIMMS)
- Hard Drive: 512GB SATA 3.0Gb/s, NCQ and 16MB Cache
- HD Controller: Integrated Intel chipset SATA 3.0Gb/s
- Optical Drive: 16X DVD-ROM with Cyberlink Power DVD
- HD Configuration: All SATA drives, No RAID
- Graphics Card: 2GB NVIDIA® dedicated graphics card ,DUAL MON, 2DP & 1DVI + HDMI
- Network Adapter: Intel, 1Gbps, PCI Express with SNTP and DMI2 support
- Monitor: 24”LCD HAS Wide Monitor, VGA/ DVI /HDMI Inputs, Res 1680 x 1050 pixels.

Logon Reader: Vandal resistant Finger Print verification reader for automatic operator identification and logon.

11.2 Management Workstation

A single Management Workstation shall be provided, and shall comply with the following minimum specification:

- Chassis: Mini-Tower
- Processor: Dual Core Intel® Xeon® W3503 2.40GHz, 4M L3, 4.8GT
- OS: Windows 10 Pro (64 bit) or later
- Memory: 16GB, 2666MHz, DDR5 SDRAM, ECC (2 DIMMS)
- Hard Drive: 750GB SATA 3.0Gb/s, NCQ and 16MB Cache
- HD Controller: Integrated Intel chipset SATA 3.0Gb/s
- Optical Drive: 16X DVD-ROM with Cyberlink Power Dvd
- HD Configuration: All SATA drives, No RAID
- Graphics Card: 2GB NVIDIA dedicated graphics card , DUAL MON, 2DP & 1DVI +HDMI
- Network Adapter: Intel, 1Gbps, PCI Express with SNTP and DMI2 support
- Monitor: 24”LCD HAS Wide Monitor, VGA/ DVI Inputs, Res 1680 x 1050 pixels.

11.3 Server Workstation

A redundant server configuration shall be provided, and shall and shallcomply with the following minimum specification:

- Intel Xeon E2314, 2.8GHz, 8M Cache, 4C/4T, Turbo (65W), 3200 MT/s, OnBoard,
- LOM, 1x 16GB UDIMM, 3200MT/s, ECC, 1x 2TB 7.2K RPM SATA 6Gbps 512n, 3.5in

- Hotplug Hard Drive, PCIe Riser, 1x FH x8 PCIe Gen3 slot, 1x LP x4 PCIe Gen3 slot,
- R240/R340, Standard Bezel, No Internal Optical Drive, Dual, HotPlug, Redundant
- Power Supply (1+1), 600W, 2x C13 to C14, PDU Style, 10 AMP, 6.5 Feet (2m) Power Cord, 3.5" Chassis with up to 4 Hot Plug Hard Drives, PERC H355 Adapter (RAID 0,1, 10), iDrac9 Basic 15G,
- No Rack Rails or Cable Management Arm, 3 Year Basic Warranty

- Licenses: Windows Server 2019, 5 CALs

11.4 Minimum Software Requirements:

1. The Security Management System (SMS) software shall be design specifically for Prison Security Management Applications, shall have a proven track record in the security industry, and shall be an Off-the- shelf package available through a distributor network. The off-the– shelf software shall be programmed and tailored to the specified functions and features described herein and as indicated on the accompanying drawings.
2. The software shall convey and accurate floor plan of all areas that require display on the VDU. The software shall utilize the maximum resolution and colours of the SVGA monitor to enhance and simplify the displayed control and status information. Fast orientation and ergonomics will be the goal of the graphic displays.

3. The software shall provide integrated Biometric (Fingerprint) log-on security functionality with security level protection for all Mouse driven operator workstations. The Biometric (Finger print) logon facility shall be capable of providing a one too many search algorithm to confirm operator credentials, without the need for entering user details or the swiping of a personal identification card.

4. There shall be a minimum of ninety nine (99) levels of access, and shall be expandable.

5. The software shall provide a user database within the Management workstation. The database shall support a minimum of two thousand (2000) users.

6. The software shall provide on-line utilities accessed through the Management workstation menu structure. These utilities shall provided the system supervisor with the ability to edit and update required data bases, system operating variable, report configuration and generation, alarm tags and point descriptions, etc. These utilities shall be protected by security levels and Biometric Access.

7. All software licenses shall be transferred to the Owner at completion of the project. This shall include but not be limited to all original installation disks, software manuals, equipment manuals, etc. All project specific applications software shall be transferred at the end ofwarranty period.

11.5 Spares Holding:

The tenderer should allow for the following minimum spares holding:

One (1) SVGA 24” LCD monitor as specified under hardware section of the specification. Packed in its original packaging. This shall include, power cords and interconnecting cables.

One (1) fully equipped server workstation shall be provided, which shall be capable of replacing any workstation in the facility with the exception of the servers. This shall include; power cords and all required interconnecting cables.

This also includes all the software packages required to operate the facility. When one of the workstations fails, an exchange of computers must ensure that the system is immediately on line and active.

The equipment supplied under this section shall be fully supported and maintained locally.

11.6 Rack Mounted 1U Server Workstations

The contractor shall allow for rack mounted server workstations to be installed in the equipment cabinets as depicted on drawings supplied.

Minimum Technical Specification:

Server Purpose	Specification
SMS Software Server	Intel Xeon E2314, 2.8GHz, 8M Cache, 4C/4T, Turbo (65W), 3200 MT/s, OnBoard, LOM, 1x 16GB UDIMM, 3200MT/s, ECC, 1x 2TB 7.2K RPM SATA 6Gbps 512n, 3.5in Hotplug Hard Drive, PCIe Riser, 1x FH x8 PCIe Gen3 slot, 1x LP x4 PCIe Gen3 slot, R240/R340, Standard Bezel, No Internal Optical Drive, Dual, HotPlug, Redundant Power Supply (1+1), 600W, 2x C13 to C14, PDU Style, 10 AMP, 6.5 Feet (2m) Power Cord, 3.5" Chassis with up to 4 Hot Plug Hard Drives, PERC H355 Adapter (RAID 0,1, 10), iDrac9 Basic 15G, No Rack Rails or Cable Management Arm, 3 Year Basic Warranty
SQL Server	Intel Xeon E2314, 2.8GHz, 8M Cache, 4C/4T, Turbo (65W), 3200 MT/s, OnBoard, LOM, 1x 16GB UDIMM, 3200MT/s, ECC, 1x 2TB 7.2K RPM SATA 6Gbps 512n, 3.5in Hotplug Hard Drive, PCIe Riser, 1x FH x8 PCIe Gen3 slot, 1x LP x4 PCIe Gen3 slot, R240/R340, Standard Bezel, No Internal Optical Drive, Dual, HotPlug, Redundant Power Supply (1+1), 600W, 2x C13 to C14, PDU Style, 10 AMP, 6.5 Feet (2m) Power Cord, 3.5" Chassis with up to 4 Hot Plug Hard Drives, PERC H355 Adapter (RAID 0,1, 10), iDrac9 Basic 15G, No Rack Rails or Cable Management Arm, 3 Year Basic Warranty

It is a specific requirement that a spare and hot swap rack mounted server workstation be made available for use in each equipment cabinet on site.

13 MAINTENANCE OF INSTALLATIONS

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

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

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

This specification covers the supply, installation and commissioning and guarantee for twelve months of the complete Security Installation

A further 36-month maintenance and repair contract shall be allowed for, as detailed under Clause 2 above.

14 OMMISIONS AND DISCREPANCIES

The Tenderer shall, at the time of tendering, draw the Engineer's attention to any omissions or discrepancy between the specification and the drawings and request from his clarification of details or responsibilities.

If a limited allowance or special conditions are made for the Tender Sum for the supply or erection of any item of the installation, the limit or special conditions shall be defined at the time of tendering.
It is the sole responsibility of the Contractor to ensure that all quotations obtained from manufactures and suppliers are complete in their entirety and must include all equipment and accessories necessary for compliance with current practice and the efficient and proper functioning of the installation.

If any such items of equipment, brackets and accessories, etc., have been omitted from a supplier's quotation, or incidental work is necessary, the Contractor must include for all such items and work in the tender.

Bidders are requested to adhere to the requirements of the specification as closely as possible. Should a bidder find that he cannot comply with certain requirements of the specification without deviating from his standard range of products, he may offer his standard product, providing all deviations from the specification are clearly documented in a covering letter accompanying his bid offer. All the relevant paragraphs and sub-paragraphs in the specification must be referred to in the covering letter.

15 REGULATIONS

The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in the scope of works. It is the contractor’s responsibility to ensure that the system installed adheres to the *Department Of Public Works Security Standard Technical Specification For An Integrated Security System For A Correctional Facility.*

16 NOTICES AND FEES

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

17 QUALITY OF MATERIALS

Only materials of first-class quality shall be used.

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

Materials wherever possible, must be of South African manufacture.

Note: Material On Site Schedule has been provided, and it is required that the contractor familiarise himself with the schedule.

18 DRAWINGS

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

The position of the Inner Taut Wire fence installations are marked on drawing number E21/2107/SA/100.

19 TIME SYNCHRONISATION

The successful bidder is expected to configure each subcomponent device of the taut wire and kinematic fence detection system installation to ensure compliance to this specification as well as the DPW Standard Security Installation Specification.

20 CABLING

All cables and ports should be properly labelled and documented.

Cable dressing should be as per the standard norms. All the cables must be neatly tied together at each and every location.

21 TRAINING DELIVERY

Refer to individual section specifications, i.e., Part 2 to Part 11 of this specification series. Training of equipment shall be required of the tenderer, ensuring that trained personnel are trained on the use of the entire electronic security installation. The trained personnel shall be able to operate the SMS system from a single GUI interface encompassing the full and complete SMS installation as is accessible on a control room.

The contractor is to provide a technical proposal for the training, which includes the following:

- Details of course content to be provided;
- Number of training sessions per type of users (for example more training sessions may be required for middle management);
- Duration of each training session; and
- Relative experience of trainer.

21 INTEGRATION

The Systems listed above shall be fully integrated with the Security Management System provided in accordance with the SMS specification as contained in the Electronic Specification.

The contractor shall include in their pricing full compensation for any licencing costs for any of the software applicable to the SMS sub-systems, for the duration and scope of this project.

22 RETURNABLE MATERIALS SCHEDULE

NB: **Only one manufacturer's name to be inserted for each item.**

Item	Material	Make or trade name	Country of origin
1.	SMS Software		
2.	Rack Mounted Server Workstation		
3.	Equipment Cabinets		
4.	Operator Workstation		
5			
6			
7			
8			
9			
10			
11			

ANNEXURE D - MATERIAL TESTING RESULTS

Item	Device/Product	Product Description	Total
1	Virdi AC-5000RF	Fingerprint scanner	50
2	U.ARE. U 4500 U.ARE. U 4500	Fingerprint Reader	18
3	Virdi Fingerprint and smart card reader	Fingerprint and smart card reader	5
4	Samsung Color Laser printer	Printer	3
5	Vista Optoelectronics 42"	Monitor	8
6	Alcatel-Lucent OS6450-P24	Switch 24 ports	3
7	Proxim ORiNOCO Access Point	Access Point	27
8	GST GST200-2/1	Fire Alarm control panel	3
9	GST GST P-9930	Communication card	4
10	GST Fire Derection Manual Call Point	Manual Call Point	8
11	GST GST I-9103	Smoke detector	40
12	SDC SDC-520	Ethernet controller	11
13	Bosch DIP 7080 00N IP7000 Server	Server	3
14	Bosch DIP 6080 00N IP6000 Server	Server	1
15	Mercer VoiP Server	VoiP Server	3
16	SECURI-Pro MC26	Roller Shutter Mags	32
17	10kVA online UPS 10kVA online UPS	UPS	6
18	Equipped Kiosks Equipped Kiosks	Equipped Kiosks	6
19	Stentofon Intercom	Intercom	2
20	Stentofon Call station	Call station with outside cases	19
21	Stentofon Call station	Call station with indoor cases	55

Item	Device/Product	Product Description	Functional
1	Bosch-5005c-S0940 1/2.5",CS,9-40mm,SR-IRIS	IP Camera	91
2	Bosch 1/2" C-Mount 3.8-13mm 3MP Sr-Iris LVF-5003N-S3813	IP Camera	10
3	Bosch Dinion IP Camera Dinion IP 5000 HD	IP Camera	122
4	BOSCH FLEXIDOME OUTDOOR 5000 IP dome NDN 50022-V3	IP Camera	38
5	Auto Dome IP Starlight 7000 PTZ Camera	IP Camera	4
6	VG4-SBOX 24VAC SUPPLY BOX FOR AUTODOME	Supply Box	4
7	Phoenix Contact PSU 24VDC 5A	Power Supply Unit	12
8	Logitech c170 5MP webcam	Logitech Camera	3
9	BOSCH KBD KEYBOARD	Bosch Keyboard	4
10	Microsoft LifeCam HD-3000	HD Camera	4

Item	Device/Product	Product Description	Functional
1	1000BASE-SX MULTI MODE SFP TRANSCEIVER	Gigabit Transceiver	46
2	Moxa PSU 48VDC	Power Supply	5
3	Alcatel-Lucent SFP-GIG-SX 1Gb SFP TRANSCEIVER	Gigabit Transceiver	10
4	Moxa SFP1-port Gigabit Ethernet SFT modules SFP-1GLSXLC V1.1	Gigabit module	9

Item	Device/Product	Product Description	Functional
1	64GB SDXC Card	Memory Card	11
2	Alcatel-Lucent OS6250-P24	Managed Switch	8
3	Genius Slimstar C130 Stylish Slim Desktop Kit (mouse and keyboard wired)	Keyboard	16
4	19" Dell Monitor E1916HV	Monitor	18
5	Dell Towers (PC Box Complete) Full Test Pictures in Folder	Workstation	10
6	Dell PowerEdge R330	Server	3

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic Specification
Part 2:	**Access Control and Intercom Specification (This Document)**
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification
Part 12:	ICT Specification

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:
ELECTRONIC INSTALLATIONS

ELECTRONIC WORK

PART 2: Intercom and Access Control Specification

FUNCTIONAL SPECIFICATION

1 TESTS

The contractor shall inspect, complete and present a certificate, certifying that:

- The installation meets the Client approved requirements in terms of design and installed location and standard.
- Cabinets are earthed and correctly in accordance with the requirements of Earthing, Bonding, Surge and Lightning protection specifications.
- Source of electrical supply has been identified and clearly marked.
- All data and electrical infrastructure installed has been tested and meets the standards.
- The installation documentation has been compiled and is available for inspection.

2 MAINTENANCE OF INSTALLATIONS

Refer to Part 1 – Integrated Electronic Specification – Section 13

3 OMMISIONS AND DISCREPANCIES

Refer to Part 1 – Integrated Electronic Specification – Section 14
.

4 REGULATIONS

The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in the scope of works. It is the contractor's responsibility to ensure that the system installed adheres to the *Department Of Public Works Security Standard Technical Specification For An Integrated Security System For A Correctional Facility.*

5 NOTICES AND FEES

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

6 SCOPE OF WORK

In terms of this contract bidders must include the following in their bid offers:

1. De-installation and Re-installation of the parts and/or portions of the existing distributed control system installation in order to bring the intercom and access control system to correct working order, as guided by this specification and other regulations as stated in Section 3 of this specification.

2. The complete supply, delivery, installation, testing and commissioning of the Intercom and Access Control system, including use of the existing hardware, as detailed in Annexure A - MOS schedule.

3. The supply, installation and connection of equipment shall be done by an accredited supplier and installer who is to be subcontracted by the electrical contractor. They should be aware and adhere to all requirements, including site safety, to that of the electrical contractor.

4. Supply and installation of conduit and ducting access shall be done by the Electrical Contractor.

7 QUALITY OF MATERIALS

Only materials of first-class quality shall be used.

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

Materials wherever possible, must be of South African manufacture.

Note: Material On Site Schedule has been provided, and it is required that the contractor familiarise himself with the schedule.

7.1 MOS Sub-System Equipment

The table below shows s summary of the MOS equipment, relevant to this sub-system of the security installation. This listing shall not be considered as final or exhaustive.

Refer to Annexure A1 – MOS Schedule, as attached to Part 1 of this specification, ***Part 1 - Integrated Electronic Specification****.*

8 DRAWINGS

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

The final position for the intercom devices, access control devices, cabling etc may be influenced by built-in furniture, thus must be established on site, prior to these items being installed.

9 TIME SYNCHRONISATION

The successful bidder is expected to configure each device to be connected to the main control room site server, and all networks need to be synchronized with the primary NTP server.

10 CABLING

All cables and ports should be properly labelled and documented.

Cable dressing should be as per the standard norms. All the cables must be neatly tied together at each and every location.

11 TRAINING DELIVERY

Refer to Part 1 – Integrated Electronic Specification – Section 24

12 INTERCOM EQUIPMENT RACK CABINET

The general principles for the placement of the rack cabinets are flexible to allow for the various Sally Port layouts. This said, the general requirements of the Department in this regard are as follows:

a. The rack cabinet must be placed in the equipment room, as detailed on the drawings series E21/2107/SA/200-209.

b. The positioning of the equipment rack, in sally ports without the equipment room must not obstruct the guard/user from free movement at his/her workspace.

c. Allow the officer easy access to the front of the equipment rack cabinet from his/her workplace (the front door of the cabinet should ideally face the officer).

d. The placement of the equipment rack cabinet should allow the front and rear doors of the cabinet to open at least 90 degrees for easy access.

13 HARDWARE REQUIREMENTS

NB: Compliance with the DPW *Security Standard Technical Specification For An Integrated Security System For A Correctional Facility* is a requirement.

13.1 Intercom Master Station

The intercom master station shall be equipped with the following minimum specifications

Technical Specifications:

Protection	Vandal resistant design 1 mm stainless steel front plate Tamper proof buttons and loudspeaker grills
User Interface	Backlit graphical display, 35 mm x 68 mm 4 function keys for LCD menu navigation Full keypad Volume Adjust Keys Backlight Brightness Adjust keys Call indication LED 8 programmable direct access keys (option)
Power	Power over Ethernet, IEEE 802.3 a-f Local power (19-27 VDC) Idle 4W, max. 8W
Connectors	2 x RJ45 (Ethernet) 10/100 Mbit/sec. 2 x 3.5mm stereo jacks for headset 1 x RJ11 for handset 1 x Power Connector
IP Protocols	IP v4 - TCP - UDP - HTTP - RTP - RTCP - DHCP - DiffServ - TOS - STENTOFON CCoIP
Audio Technology	Telephony 3.4kHz (G.711) Acoustic echo cancellation Open duplex Adaptive jitter filter 1.5 Watt audio output
Installation	Remote automatic software upgrade Centralized provisioning DHCP and static IP Integrated web server
Operation	Network supervision VoIP statistics Centralized monitoring Tone test

13.2 Intercom IP Station

The master station shall be a durable vandal resistant, and suitable for use in harsh environments. Features include, designed for CCoIP® the station offers a set of critical communication features such as integrated firewall, group call, call priority and over-rid. Device to be capable of delivering instant, efficient and secure voice and data services in an IP environment.

Technical Specification:

Protection	Vandal resistant design 2 mm stainless steel front plate Tamper proof fastening screws, buttons and loudspeaker grills
Call Button	16 mmØ stainless steel
Mounting	Surface mount in 60 mm deep back box
Power	Power over Ethernet, IEEE 802.3 a-f Local power (19-27 VDC) Idle 4W, max. 8W
Connectors	2xRJ45 (Ethernet) 10/100 Mbit/sec. Pluggable screw terminals.
IP Protocols	IP v4 - TCP - UDP - HTTP - RTP - RTCP - DHCP - DiffServ - TOS - STENTOFON CCoIP
Audio Technology	Wideband 200 Hz - 7 kHz (G.722) Telephony 3.4kHz (G.711) Acoustic echo cancellation Open duplex Adaptive jitter filter 1.5 Watt audio output External audio output (0 dB, 600 ohm)
Installation	Remote automatic software upgrade Centralized provisioning DHCP and static IP Integrated web server
Operation	Network supervision VoIP statistics Centralized monitoring Tone test
Advanced features	Dual port Ethernet switch for connecting CCTV cameras and other IP stations.

	Programmable inputs, (closing contact) or monitoring door status and alarms if not used for call buttons. Programmable relay output for door control, switch on beacon, etc. (1A at 24V DC)

13.3 Type 1 Biometric Reader

Technical specification:

IP65 rated fingerprint reader, PoE enabled, RISC 400MHz, 32bit CPU, 2. 8 inch color LCD, TCP/IP, Wiegand In/Out, RS485, RS232, 32MB RAM + 32MB SD Memory, max users : 20000, log capacity 61,000, Certificates: KC,CE,FCC, RoHS, Dimensions: 88 X 175 X 43.5 mm

13.4 Type 2 Biometric reader

- Pixel resolution: 512 dpi (average x,y over the scan area)
- Scan capture area: 14.6 mm (nom. width at center) 18.1 mm (nom. length)
- 8-bit grayscale (256 levels of gray)
- Reader size (approximate): 65 mm x 36 mm x 15.56 mm
- Compatible with USB 1.0, 1.1 and 2.0 (Full Speed) specifications
- Indoor, home and office use

14. DOOR CONTROLLER HARDWARE

14.1 Type 1 Door Controller:

Technical specification

- Offline operation; intelligence at the door controller.
- On-board TCP/IP and RS-232 communications.
- Network capable programming for easy product updates.
- Secure enclosure designed for easy installation.
- 15Vdc 5A power supply + 7AHr battery backup included.
- Mains monitoring with a battery charging circuit and a low voltage cutoff.
- Robust isolated RS-485 controller network topology.
- Robust isolated RS-485 communications for up to 16 terminals.**
- 2 Wiegand interface connections.
- 4 digital / analog inputs.
- 2 internally powered or potential free individually fused relay outputs.
- 6.5 Million offline transactions which are only stored for 180 days.
- 3.25 Million offline system events which are only stored for 90 days.
- 250,000 tag holders, with a maximum of 4 cards/tags per card holder. (1 000 000 tags/cards)
- On-Board OLED programmer and diagnostic display.
- Expansion module header.
- Dedicated / Automatic fire input.
- Dedicated tamper input.
- 256 powerful offline event / action combinations.
- Diagnostic LEDs for easy testing.

15 SCHEDULE OF MATERIALS

The schedules will be scrutinised by the Representative/Agent and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NB: **Only one manufacturer's name to be inserted for each item.**

Item	Material	Make or trade name	Country of origin
1.	IP Master Station		
2.	Intercom IP Station		
3.	Type 1 Biometric Reader		
4.	Type 2 Biometric Reader		
5	Type 3 Biometric Reader		
6	Type 1 Door Controller		
7	Door Controller IO Board		
8	Cat 6 Cable		

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic and ICT Specification
Part 2:	Access Control and Intercom Specification
Part 3:	**Distributed Control System Specification (This Document)**
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:
ELECTRONIC INSTALLATIONS

ELECTRONIC WORK

PART 3: DISTRIBUTED CONTROL SYSTEM

FUNCTIONAL SPECIFICATION

1 TESTS

The contractor shall inspect, complete and present a certificate, certifying that:

- The installation meets the Client approved requirements in terms of design and installed location and standard.
- Cabinets are earthed and correctly in accordance with the requirements of Earthing, Bonding, Surge and Lightning protection specifications.
- Source of electrical supply has been identified and clearly marked.
- All data and electrical infrastructure installed has been tested and meets the standards.
- The installation documentation has been compiled and is available for inspection.

2 MAINTENANCE OF INSTALLATIONS

Refer to Part 1 – Integrated Electronic Specification – Section 2.2[G1]

3 OMMISIONS AND DISCREPANCIES

Refer to Part 1 – Integrated Electronic Specification – Section 2.2[G2]
.

4 REGULATIONS

The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in the scope of works. It is the contractor's responsibility to ensure that the system installed adheres to the *Department Of Public Works Security Standard Technical Specification For An Integrated Security System For A Correctional Facility.*

5 NOTICES AND FEES

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

6 SCOPE OF WORK

In terms of this contract bidders must include the following in their bid offers:

1. De-installation and Re-installation of the parts and/or portions of the existing distributed control system installation in order to bring the control system to correct working order, as guided by this specification and other regulations as stated in Section 3 of this specification.

2. The complete supply, delivery, installation, testing and commissioning of the Distributed Control System, including use of the existing hardware, as detailed in Annexure A - MOS schedule.

3. The supply, installation and connection of equipment shall be done by an accredited supplier and installer who is to be subcontracted by the electrical contractor. They should be aware and adhere to all requirements, including site safety, to that of the electrical contractor.

4. Supply and installation of conduit and ducting access shall be done by the Electrical Contractor.

7 QUALITY OF MATERIALS

Only materials of first-class quality shall be used.

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

Materials wherever possible, must be of South African manufacture.

Note: Material On Site Schedule has been provided, and it is required that the contractor familiarise himself with the schedule.

7.1 MOS Sub-System Equipment

The table below shows s summary of the MOS equipment, relevant to this sub-system of the security installation. This listing shall not be considered as final or exhaustive.

Refer to Annexure A1 – MOS Schedule, as attached to Part 1 of this specification, ***Part 1 - Integrated Electronic Specification****.*

[G3]

8 DRAWINGS

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

The final position for the control system devices, cabling etc may be influenced by built-in furniture, thus must be established on site, prior to these items being installed.

9 TIME SYNCHRONISATION

The successful bidder is expected to configure each device to be connected to the main control room site server, and all networks need to be synchronized with the primary NTP server.

10 CABLING

All cables and ports should be properly labelled and documented.

Cable dressing should be as per the standard norms. All the cables must be neatly tied together at each and every location.

11 TRAINING DELIVERY

The successful bidder is expected to conduct staff trainings on the usage of the new Distributed Control System, in accord with Part 2

The following information is to be provided in the technical proposal:

- Details of course content to be provided;
- Number of training sessions per type of users (for example more training sessions may be required for middle management);
- Duration of each training session; and
- Relative experience of trainer.

12 DCS PLC RACK CABINET

The general principles for the placement of the rack cabinets are flexible to allow for the various Sally Port layouts. This said, the general requirements of the Department in this regard are as follows:

a. The rack cabinet must be placed in the equipment room, as detailed on the drawings series E21/2107/SA/200-209.

b. The positioning of the equipment rack, in sally ports without the equipment room must not obstruct the guard/user from free movement at his/her workspace.

c. Allow the officer easy access to the front of the equipment rack cabinet from his/her workplace (the front door of the cabinet should ideally face the officer).

d. The placement of the equipment rack cabinet should allow the front and rear doors of the cabinet to open at least 90 degrees for easy access.

13 PLC DOOR LOCKING SYSTEM

The security installation shall include a door locking system which shall be integrated with the SMS system.

The installation shall provide for the following minimum features:

1 Door Lock
2 Door Unlock
3 Door Inhibit
4 Door lockdown
5 Door lockdown time preset
6 Door Status monitoring
7 Door Alarm annunciation

8 Door auto-close
9 Hardware fault diagnostics.

The locking sub-system shall control and monitor all electrically controlled doors and gates within the security fence installations of the facility.

14 PLC CONTROL DEVICES

The table below details the minimum ratings for the PLCs used for the door control distributed system:

14.1 TYPE A PLC DEVICE

PLC Programming Features:

Type A Device - Terminal Bus Controller

Description	**Value**
Data memory	32 kbyte
Program memory	48 kbyte minus task-configuration minus POUs during online change
Source code memory	128 kbyte
RETAIN	2 kbyte
Persistent data	1000 bytes
INPUT	2 kbyte
OUTPUT	2 kbyte
FLAG	4 kbyte
Max. variable	16 kbyte
Max. POUs	Limited by memory

14.2 TYPE B DEVICE – Bus Terminal

Technical data

Connection technology	1-wire
Specification	EN 61131-2, type 1/3
Number of inputs	8
Nominal voltage	24 V DC (-15 %/+20 %)
“0” signal voltage	-3…+5 V (EN 61131-2, type 1/3)
“1” signal voltage	11…30 V (EN 61131-2, type 3)
“0” signal current	0…1.5 mA
“1” signal current	2.0…2.5 mA
Input filter	typ. 3.0 ms
Current consumption K-bus	typ. 5 mA

Current consumption power contacts	typ. 2 mA + load
Electrical isolation	500 V (K-bus/field potential)
Bit width in the process image	8 inputs
Configuration	no address or configuration setting
Weight	approx. 55 g
Operating/storage temperature	-25…+60 °C/-40…+85 °C
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protect. rating/installation pos.	IP20/variable
Pluggable wiring	for all KSxxxx Bus Terminals
Approvals/markings	CE, UL, ATEX, DNV GL
Ex marking	II 3 G Ex nA IIC T4 Gc

14.3 TYPE C DEVICE – Bus Terminal

Technical Data

Connection technology	1-wire
Number of outputs	8
Nominal voltage	24 V DC (-15 %/+20 %)
Load type	ohmic, inductive, lamp load
Max. output current	0.5 A (short-circuit proof) per channel
Short-circuit current	< 2 A
Breaking energy	< 150 mJ/channel
Reverse voltage protection	yes
Electrical isolation	500 V (K-bus/field potential)
Current consumption power contacts	typ. 60 mA + load
Current consumption K-bus	typ. 18 mA
Bit width in the process image	8 outputs
Configuration	no address or configuration setting
Weight	approx. 70 g
Operating/storage temperature	-25…+60 °C/-40…+85 °C
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protect. rating/installation pos.	IP20/variable
Pluggable wiring	for all KSxxxx Bus Terminals
Approvals/markings	CE, UL, ATEX, DNV GL, IECEx, cFMus
Ex marking	ATEX:
	II 3 G Ex nA IIC T4 Gc
	IECEx:

	Ex nA IIC T4 Gc
	Ex tc IIIC T135 °C Dc
	cFMus:
	Class I, Division 2, Groups A, B, C, D
	Class I, Zone 2, AEx ec IIC T4 Gc

14.4 TYPE D DEVICE – Bus End Terminal

Technical data:

Nominal voltage	–
Current load	–
Integrated fine-wire fuse	–
Diagnostics	–
Power LED	–
Defect LED	–
Reported to K-bus	–
PE contact	–
Shield connection	–
Renewed infeed	–
Connection facility to additional power contact	–
K-bus, looped through	–/yes
Bit width in the process image	0
Electrical connection to DIN rail	–
Current consumption K-bus	–
Starting current	–
Electrical isolation	–
Housing width	12 mm
Special features	end terminal for bus communication
Weight	approx. 50 g
Side by side mounting on Bus Terminals with power contact	yes
Side by side mounting on Bus Terminals without power contact	yes
Operating/storage temperature	-25…+60 °C/-40…+85 °C
Approvals/markings	CE, UL, ATEX, DNV GL, IECEx, cFMus
Ex marking	ATEX:
	II 3 G Ex nA IIC T4 Gc
	IECEx:
	Ex nA IIC T4 Gc
	Ex tc IIIC T135 °C Dc
	cFMus:
	Class I, Division 2, Groups A, B, C, D
	Class I, Zone 2, AEx ec IIC T4 Gc

14.5 TYPE E DEVICE – Programmable Logic Controller

Technical data:

Processor	ARM9, 400 MHz
Number of cores	1
Flash memory	512 MB microSD (optionally expandable)
Main memory	64 MB DDR2 RAM (not expandable)
Persistent memory	1-second UPS (for 1 MB persistent data)
Programming languages	IEC 61131-3
Web visualization	yes
Online change	yes
Up/down load code	yes/yes
Interfaces	1 x RJ45 10/100 Mbit/s, 1 x USB device (behind the front flap), 1 x bus interface
Bus interface	2 x RJ45 (switched)
Diagnostics LED	1 x TC status, 1 x WD, 1 x error
Clock	internal battery-backed clock for time and date (battery behind the front flap, exchangeable)
Operating system	Windows Embedded CE 6
Control software	TwinCAT 2 PLC
I/O connection	E-bus or K-bus, automatic recognition
Web-based management	yes
Current supply E-bus/K-bus	2:00 AM
Max. power consumption	3 W
Dimensions (W x H x D)	64 mm x 100 mm x 73 mm
Weight	approx. 180 g
Operating/storage temperature	0…+55 °C/-25…+85 °C
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protection rating	IP20
Approvals/markings	CE, UL, ATEX, IECEx, cFMus
Ex marking	ATEX:
	II 3 G Ex nA IIC T4 Gc
	II 3 D Ex tc IIIC T135 °C Dc
	IECEx:
	Ex nA IIC T4 Gc
	Ex tc IIIC T135 °C Dc
	cFMus:
	Class I, Division 2, Groups A, B, C, D
	Class I, Zone 2, AEx ec IIC T4 Gc

14.6 TYPE F DEVICE – EtherCAT Coupler

Technical Data

Task within EtherCAT system	coupling of EtherCAT Terminals (ELxxxx) to 100BASE-TX EtherCAT networks
Data transfer medium	Ethernet/EtherCAT cable (min. Cat.5), shielded
Distance between stations	max. 100 m (100BASE-TX)
Number of EtherCAT Terminals	up to 65,534
Protocol	EtherCAT
Delay	approx. 1 µs
Data transfer rates	100 Mbit/s
Bus interface	2 x RJ45
Nominal voltage	24 V DC (-15 %/+20 %)
Current supply E-bus	1000 mA
Current consumption from UP	40 mA + load
Current consumption from US	100 mA + (∑ E-bus current/4)
Number of inputs	8
Specification	EN 61131-2, type 1/3
“0” signal voltage	-3…+5 V (EN 61131-2, type 1/3)
“1” signal voltage	11…30 V (EN 61131-2, type 3)
Input filter	3.0 ms
Input current	typ. 3 mA (EN 61131-2, type 3)
Number of outputs	4
Load type	ohmic, inductive, lamp load
Max. output current	0.5 A (short-circuit proof) per channel
Short-circuit current	typ. < 2 A
Reverse voltage protection	yes
Breaking energy	< 150 mJ/channel
Switching times	typ. TON: 60 µs, typ. TOFF: 300 µs
Electrical isolation	500 V (power contact/supply voltage/Ethernet),
	500 V (E-bus/field potential)
Operating/storage temperature	-25…+60 °C/-40…+85 °C
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protect. rating/installation pos.	IP20/variable
Approvals/markings	CE, UL

14.7 TYPE G DEVICE – EtherCAT Extension

Technical Data

Task within EtherCAT system	conversion of the E-bus signals to 100BASE-TX Ethernet for extension of the EtherCAT network
Data transfer medium	Ethernet/EtherCAT cable (min. Cat.5), shielded
Distance between stations	100 m (100BASE-TX)
Protocol	any EtherCAT protocol
Delay	approx. 1 µs
Data transfer rates	100 Mbit/s
Configuration	not required
Bus interface	1 x RJ45
Power supply	from E-bus
Current consumption E-bus	typ. 130 mA
Electrical isolation	500 V (supply voltage/Ethernet)
Weight	approx. 50 g
Operating/storage temperature	-25…+60 °C/-40…+85 °C
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
Protect. rating/installation pos.	IP20/variable
Approvals/markings	CE, UL, ATEX
Ex marking	II 3 G Ex nA IIC T4 Gc

15 RETURNABLE EQUIPMENT SCHEDULE

PART 5: ELECTRICAL WORK MATERIAL SCHEDULE

The Contractor shall complete the following schedules and submit them to the Representative/Agent within 21 days of the date of the acceptance of the tender.

The schedules will be scrutinised by the Representative/Agent and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NB: **Only one manufacturer's name to be inserted for each item.**

Item	**Material**	**Make or trade name**	**Country of origin**
1.	24" Display Monitor		
2.	42" LCD Display Monitor		
3.	PC Based Professional Server License		
4.	PLC Devices		
4.1	Type A		
4.2	Type B		
4.3	Type C		
4.4	Type D		
4.5	Type E		
4.6	Type F		
4.7	Type G		

16. SCHEDULE OF IMPORTED MATERIALS AND EQUIPMENT TO BE COMPLETED BY TENDERER

Item	**Material/Equipment**	**Rand (R) (Excluding VAT)**
1		
2		
3		
4		
5		
6		

THE SUPPLY, INSTALLATION AND COMMISSIONING OF AN IP BASED CLOSED CIRCUIT TELEVISION SURVEILLANCE SYSTEM

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic and ICT Specification
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	**CCTV Surveillance Specification (This Document)**
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification

Table of Contents

COMPLIANCE WITH REGULATIONS

(a) The installation shall be erected and tested in accordance with the latest issues and amendments of the following Acts and regulations:

(i) SANS 10142: "Code of Practice for the Wiring of Premises",

(ii) SANS 2220 – 2 Section 1 – 7 of 2014,

(iii) The latest issue of SANS 60794: “Optic fibre”,

(iv) Security Industry Regulation Act, 2001,

(v) the Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,

(vi) the Local Government Act 1998 (Act 10 of 1998 (Gauteng), municipal by-laws and any special requirements of the local supply authority,

(vii) the National Building Regulations and Building Standards Act 1996 (Act 29 of 1996),

(viii) The Post Office Act 1958 (Act 44 of 1958) as amended,

(ix) the Electricity Act 1996 (Act 88 of 1996) and

(x) the Regulations of the local Gas Board where applicable.

1. PROJECT SPECIFICATION

1.1 INTENT OF DOCUMENT

The specification is intended to cover the complete installation of the CCTV Video Surveillance System to be installed at the St Albans Correctional Facility, as part of the Integrated Security Installation. The minimum equipment requirements are outlined, but do not cover all the details of design and construction. Such details are recognised as being the exclusive responsibility of the contractor.

In all cases where a device or part of the equipment is referred to in the singular, it is intended that such reference shall apply to as many devices as are required to complete the installation.

1.2 GENERAL

This specification covers the supply, installation, commissioning and guarantee for twelve months of the CCTV system capable of stand-alone operation including monitoring, video surveillance, remote access and sufficient footage archiving.

The drawings issued herewith and listed in the relevant section are to be read in conjunction with the specification and all items mentioned, together with all ancillary equipment necessary for the correct installation, operation and full compliance with the Standards and codes must be provided, notwithstanding the fact that they may not have been included in detail in these documents.

The Tenderer shall, at the time of tendering, draw the Engineer's attention to any omissions or discrepancy between the specification and the drawings and request from him clarification of details or responsibilities.

If a limited allowance or special conditions are made for the Tender Sum for the supply or erection of any item of the installation, the limit or special conditions shall be defined at the time of tendering.

It is the sole responsibility of the Contractor to ensure that all quotations obtained from manufactures and suppliers are complete in their entirety and must include all equipment and accessories necessary for compliance with current practice and the efficient and proper functioning of the installation.

If any such items of equipment, brackets and accessories, etc., have been omitted from a supplier's quotation, or incidental work is necessary, the Contractor must include for all such items and work in the tender.

Wire ways including terminal boxes to all the various installations have been allowed for under the Electrical contractor. However, it remains the responsibility of the CCTV Surveillance installers to ensure that this work is thoroughly coordinated and the necessary wireways & boxes have been allowed for.

1.2.1 Location

This system set is to provide CCTV IP based Video surveillance system for the St Albans Correctional Facility in Gqeberha, co-ordinates 33°54'19.05"S, 25°21'0.69"E

1.2.2 Site Conditions

The following site conditions will be applicable and all equipment shall be capable of operation at these conditions.

a)	Height above sea level -	246m
b)	Ambient temperatures -	8^0C to 31^0C
c)	Relative Humidity at lowest temperature -	82 %

2. DETAILED SPECIFICATION

2.1 SCOPE OF WORKS

The Contractor's work shall consist of, but shall not necessarily be limited to the supply, interim storage, testing, installation and commissioning of the following:

- IP based CCTV Surveillance system to provide surveillance of the site as shown on drawing series No. E21/2107/SA/200 to E21/2107/SA/209 and E21/2107/SA/100, and all the applicable details which are attached herein.
- Wiring and termination of control cables.
- System interfaces.
- Production of as-built drawings.
- Production of maintenance and operating manuals.
- Testing, commissioning and handover.
- 12 months defects liability period including service & maintenance of all the Electronic equipment.
- Integration with the SMS system to ensure complete interoperability, as required in this specification and Part 1 of this specification.

2.1.1 CCTV System

The CCTV system shall be of the highest quality, employing the latest applicable standards. The specifications of the various components of the CCTV system are to be outlined in this document. All components and sub-components of the CCTV system shall comply with the Rotakin Test where applicable, and shall offer performance capable of complying with the Rotakin test or higher .The system shall allow monitoring and live viewing via web browser, with varying access levels granted for unique users.

The CCTV system shall comprise and be capable of, but not limited to the following:

- Full on-line operation, but also allow off-line operation with no loss of functionality or security during a host or network failure.
- Allow LAN/WAN connection using TCP/IP connectivity.
- Easy to use Graphic User Interface.
- Graphic display of CCTV camera alarms and events triggered or malfunctions.
- CCTV Digital Video Recorder software integration
- Building Graphics Module
- Web Reporting
- TCP/IP Controllers
- On-line downloading of updated firmware while hardware remains in-situ.

2.1.2 Host PC

This PC shall be capable of use as a dedicated host PC for communications from individual IP cameras, and switches and allowing for logging of data, live viewing and playback.

PC minimum requirements

CPU	: A high performance model released in the last 3 months, (Intel Core i7 or equivalent)
Operating System	: Windows 10 64bit, Quad 256 bit display
Memory	: 16GB
Hard Disk Space	: 1 TB

Camera	
Image Sensor	1/2.5" Progressive Scan CMOS
Min. Illumination	Color: 0.009 lux @(F1.2, AGC ON), 0.016 lux @(F1.6, AGC ON), 0 lux with IR
Shutter Speed	1/3 s to 1/100,000 s
Slow Shutter	Yes
Auto-Iris	No
Day & Night	IR Cut Filter
Digital Noise Reduction	3D DNR
WDR	120dB
3-Axis Adjustment	Pan: 0° to 360°, tilt: 0° to 90°, rotate: 0° to 360°
Lens	
Focal Length	2.8, 4, 6, 8, 12 mm
Aperture	F1.6
Focus	No
FOV	2.8 mm, horizontal FOV: 109°, vertical FOV: 60°, diagonal FOV: 131° 4 mm, horizontal FOV: 88°, vertical FOV: 46°, diagonal FOV: 105° 6 mm, horizontal FOV: 53°, vertical FOV: 30°, diagonal FOV: 61° 8 mm, horizontal FOV: 41°, vertical FOV: 23°, diagonal FOV: 48° 12 mm, horizontal FOV: 25°, vertical FOV: 14°, diagonal FOV: 29°
Lens Mount	M12
IR	
IR Range	Up to 30 m
Wavelength	850nm
Compression Standard	
Video Compression	Main stream: H.265/H.264 Sub-stream: H.265/H.264/MJPEG Third stream: H.265/H.264
H.264 Type	Main Profile/High Profile
H.264+	Yes
H.265 Type	Main Profile
H.265+	Yes
Video Bit Rate	32 Kbps to 16 Mbps
Smart Feature-set	
Behaviour Analysis	Line crossing detection, intrusion detection, object removal detection, unattended baggage detection
Exception Detection	Scene change detection
Face Detection	Yes
Region of Interest	Support 1 fixed region for main stream and sub-stream
Image	
Max. Resolution	2560 x 1440
Main Stream	50Hz: 25 fps (2560 x 1440, 2304 x 1296, 1920 x 1080) 60Hz: 30 fps (2560 x 1440, 2304 x 1296, 1920 x 1080)
Sub-Stream	50Hz: 25 fps (640 x 480, 640 x 360, 320 x 240) 60Hz: 30 fps (640 x 480, 640 x 360, 320 x 240)
Third Stream	50Hz: 25 fps (1280 x 720, 640 x 360, 352 x 288) 60Hz: 30 fps (1280 x 720, 640 x 360, 352 x 240)
Image Enhancement	BLC/3D DNR
Image Settings	Rotate mode, saturation, brightness, contrast, sharpness, and white balance adjustable by client software or web browser
Target Cropping	No
SVC	H.264 and H.265 encoding support
Day/Night Switch	Day/Night/Auto/Schedule
Network	
Network Storage	Support microSD/SDHC/SDXC card (128G), local storage and NAS (NFS, SMB/CIFS), ANR

Alarm Trigger	Motion detection, video tampering, network disconnected, IP address conflict, illegal login, HDD full, HDD error
Protocols	TCP/IP, ICMP, HTTP, HTTPS, FTP, DHCP, DNS, DDNS, RTP, RTSP, RTCP, PPPoE, NTP, UPnP, SMTP, SNMP, IGMP, 802.1X, QoS, IPv6, Bonjour
General Function	One-key reset, anti-flicker, three streams, heartbeat, mirror, password protection, privacy mask, watermark, IP address filter
API	ONVIF (PROFILE S, PROFILE G), ISAPI
Simultaneous Live View	Up to 6 channels
User/Host	Up to 32 users 3 levels: Administrator, Operator and User
Client	iVMS-4200, Hik-Connect, iVMS-5200, iVMS-4500
Web Browser	IE8+, Chrome 31.0-44, Firefox 30.0-51, Safari 8.0+
Interface	
Video Output	No
Communication Interface	1 RJ45 10M/100M self-adaptive Ethernet port
On-board storage	Built-in microSD/SDHC/SDXC slot, up to 128 GB
Reset Button	Yes
General	
Operating Conditions	-30 °C to +60 °C (-22 °F to +140 °F), humidity 95% or less (non-condensing)
Power Supply	12 VDC ± 25%, Φ 5.5 mm coaxial plug power PoE(802.3af, class 3)
Power Consumption and Current	12 VDC, 0.5 A, max. 5.5 W PoE (802.3af, 36V to 57V), 0.2 A to 0.1 A, max. 7 W
Protection Level	IP67
Material	Metal
Dimensions	Camera: Φ70 x 155 mm (Φ2.8" x 6.1") Package: 216 x 121 x 118 mm (8.5" x 4.8" x 4.7")
Weight	Camera: 410 g (0.9 lb.)

Peripherals : DVD Multi Writer
Monitor : 2 x 32” TFT LED (Depending on specific Sally port configuration. Refer to relevant drawing and Part 1 of this Specification Series.)
Monitor type : Commercial Quality UHD (1080p)

The PC shall include all other ancillary equipment, namely, all the necessary operating software DVD’s, Windows Operating System DVD’s, Optical Wheel Mouse USB, Keyboard USB mouse, keypad et cetera.

Please Note: The PC shall come complete with the database management system software to manage the database so as allows users and other software to store and retrieve data in a structured way. A local UPS that is fed from the facility’s standby generator set shall form part of this installation.

2.1.3 Power supplies

The Security system shall be fed from 230 V mains power supply from the closest distribution board. The conductors shall be 2.5mm PVC insulated conductors and earth fed from a 20 amp single pole 5kA circuit breaker directly to the CCTV system. At the DB the circuit breaker shall be marked “CCTV System – Do not switch off”. The labels shall be engraved 8mm high lettering, colour red on white background and shall be screwed on. This installation shall be done by the Electrical Contractor including the supply and installation of the circuit breaker.

The standby batteries for the system shall be capable of supporting the system as specified.

2.1.4 Cabling

All the cabling necessary for the CCTV system forms an integral part of this contract. Good quality CAT6 cable shall be used and must be earthed as per manufacturers' specification.

Power and control cables shall conform to all the applicable SABS standards.

2.2 Surveillance cameras

The surveillance cameras (c/w mounting brackets et cetera) are to be supplied and installed by the Security Contractor in the position shown on Drawing Number E21/2107/SA/100as well as drawing series E21/2107/SA/200-209, at various heights and in the positions shown (final mounting height and position to be agreed upon on site with Engineer before installation).

The tenderer shall provide a suitable free standing rack (c/w glass front, air-conditioning, fan, power, casters etc.) for housing the Network Video Recorder, Switches, Patch & Brush Panels, and all other ancillary equipment, allowing inlets for bringing in all the cabling from cameras and equipment.

The cameras used shall ensure complete functional, technical and software interoperability with the current existing cameras, as listed in the MOS schedule, including associated software license integrations.

The cameras shall additionally be fully compatible with various ONVIF profiles such as Profile S, Profile G, and as indicated for each camera.

The minimum requirements for the various components are as follows:

<u>IP camera(s) specification:</u>

2.2.1 Camera Type 1 (Direct IP Enabled Vandal Proof Fixed Dome Camera)

2.2.2.1 Technical Specification

- Supply voltage: 12 – 28 VAC
- Signal-to-noise ratio: >50dB
- Backlight compensation: Automatic and manual
- White Balance: Automatic tracking (2500 to 10000 K), AWB hold
- Stream resolution: 4CIF/D1 @ 25 IPS
- Compression: H264 & JPEG
- TV System: PAL
- Output 1: Ethernet 10/100 Base T, Auto Sensing, RJ45, 2x DVD quality H264 streams and 1 JPEG stream, configurable from 10 Kbps to 6 Mbps per channel

- Output 2: BNC – Composite Video at 1.0 VP-P 750
- Optical Resolution: 540 TV Lines

- Colour Sensitivity: 50IRE with frame integration off and shall not be more than 1lx unless otherwise noted.

- Min Illumination: Colour,1.3Lux (0.12fc), Night Mode, 0.5
- Lux(0.048fc)

- Image Sensor: 1/3" Day/Night CCD
- Lens options: 2.6 – 6mm, 3.7 – 12mm
- Power over Ethernet: IEEE 802.3af Compliant
- Housing: Cast aluminum housing, Vandal Proof clear polycarbonate dome with UV blocking properties.

- IP Rating: IP 54
- ISCSI support
- Automatic Lens detection
- On screen display (OSD)

2.2.1.2 Minimum Camera Features

1. The camera specified shall be a true hybrid, 1/3-inch format, Day/Night camera that provides an Ethernet connection for direct connection to a network and a composite video BNC connection to enable the pre-commissioning of camera positions prior to network availability.

2. The camera shall incorporate a network video server capable of encoding two individual H264 quality video streams and one JPEG stream simultaneously, to allow the configuration of bandwidth and image quality for live video and recorded video individually.

3. The camera shall produce 30 images per second (NTSC) or 25 images per second (PAL) of DVD-quality, 4CIF H264 video over IP. The camera shall also support 2CIF, ½ D1, CIF and QCIF resolution.

4. The camera shall support power over the Ethernet (PoE) using UTP Category 5 cable with RJ45 connectors when an IEEE802.3af compliant switch is utilized. The camera shall also be capable of accepting an individual 24 VAC or 12 VDC Class 2 power source.

5. The camera shall support both unicast and multicast modes.

6. Access to the camera configuration via the network shall be restricted by a minimum of three user levels of protection where each level has its own password and authorizations.

7. The camera shall have video authentication capability whereby all images transmitted are marked with a visual indication of whether the image is the original or has been manipulated.

8. The camera shall support a snapshot mode that saves individual images from the video sequence, currently being displayed on the live view page, as JPEG format, 4CIF resolution images to the Operator Workstation hard drive.

9. The camera shall provide a standalone recording function to save video sequences to the computer's hard drive. These saved images may then be viewed from the computer hard drive using an H264 viewer provided by the manufacturer.

10. The camera shall provide a web browser interface to enable remote individual camera configuration by authorised users. Settings shall be stored in the camera memory and preserved during power interruption.

11. The camera shall provide a system status log and an event log which shall display detail such as alarm trigger events and time and date stamp detail. It shall be possible to automatically store such system and event messages to file on the Operator Workstation if required.

12. The camera shall provide an automatic Time/Date synchronisation function whereby all cameras are synchronised with the Security Management System time server.

13. The camera shall provide automatic IR filter switching to enhanced night viewing. The camera shall also allow the IR filter to be switched manually via the alarm input, by pre-programming the feature in the camera mode profile, or remotely via the web browser.

14. The camera design shall provide 15-bit DSP image processing technology for enhanced sensitivity.

15. The camera shall provide an on-screen display to simplify the camera/lens back focus and network configuration settings.

16. The camera shall provide video motion detection with four programmable areas with individual thresholds. The motion detector function shall incorporate a global scene change detector to minimize false alarms caused by sudden changes in lighting conditions.

2.2.2 Camera Type 2

2.2.2.1 Technical Specification

1. As per Camera Type 1
2. Dynamic Range: 15-bit digital XF Dynamic range

2.2.3 Camera Type 3 (Direct IP Enabled Camera with Dynamic Range)

2.2.3.1 Technical Specification

Property	Description
PoE	IEEE 802.3af (802.3at Type 1) Power level: Class 1
Power Consumption	3.6 W
Current Consumption	300 mA (12 VDC) 75 mA (PoE 48 VDC)
Power Supply	12 VDC Power-over-Ethernet 48 VDC nominal
Type	1/3-inch CMOS
Total sensor pixels	2592 x 1944
Dynamic range	81 dB Wide Dynamic Range (WDR)
Sensitivity –• Color	0.35 lx
Sensitivity –• Mono	0.05 lx
Video compression	H.264 (MP); M- JPEG
Streaming	Multiple configurable streams in H.264 and MJPEG, configurable frame rate and bandwidth.
Overall IP Delay	Min. 300 ms, Max. 850 ms
GOP structure	IP
Encoding interval	1 to 12 fps
Video Resolution	
5MP (4:3)	2592 x 1944
Optical	
Input/output	
Analog Video out	
Audio	Built-in microphone, 1 x mono line in, 1 x mono line out
• connectors	3.5 mm mono jack
• signal line in	0.707 Vrms , 20 kOhm typical
• signal line out	0.707 Vrms , 20 kOhm typical
Alarm input	1 input
• activation	Short to activate
Alarm output	1 output
• voltage	24 VAC or +30 VDC max. Load current 1 A max.
Network	
Protocols	IPv4, IPv6, UDP, TCP, HTTP, HTTPS, RTP/ RTCP, IGMP V2/V3, ICMP, ICMPv6, RTSP, FTP, ARP, DHCP, APIPA (Auto-IP, link local address), NTP (SNTP), SNMP (V1, V3, MIB-II), 802.1x,

	DNS, DNSv6, DDNS (DynDNS.org, selfHOST.de, no-ip.com), SMTP, iSCSI, UPnP (SSDP), DiffServ (QoS), LLDP, SOAP, Dropbox™, CHAP, digest authentication
Ethernet	10/100 Base-T, auto-sensing, half/full duplex
Connectivity	Auto-MDIX
Interoperability	ONVIF Profile S; GB/T 28181
Software	
Unit Configuration	Via web browser or Configuration Manager
Firmware update	Remotely programmable
Software viewer	Web browser, Bosch Video Client, or third party software

- Intelligent Dynamic Noise Reduction reduces bandwidth and storage requirements by up to 50%
- ONVIF conformance : EN 50132-5-2; IEC 62676-2-3

2.2.4 Camera Type A

Technical Specifications:

- 1/ 1 .8 Progressive Scan CMOS
- 1920 × 1080 @ 60 fps
- Ultra l ow light
- 120dB WDR
- IP67
- Support target cropping, details can be seen with low bandwidth
- Support H.264 H.264/ MPEG4/ MJPEG video compression, multi level video quality configuration;
- Support ONVIF (profile S/profile G), ISAPI protocol
- Support standard 128 G m icro SD/SDHC/SDXC card storage
- Support 10M/100M Ethernet p ort
- Support Audio I/O S)
- Support Alarm I/O S)
- Support CVBS analog output (4CIF resolution)
- Support security certificate as HTTPS

2.2.4 Camera Housings

Cameras that are externally mounted shall use camera housings, which should include all the necessary pole/wall mount brackets, heater elements and any additional hardware required to make the installations complete

2.2.4.1 Technical Specification

Internal Cabling: Cable Managed
Sunshield: Stand-off sunshield to reduce solar loading
Tamper: Tamper resistant
Access: Flip top access
IP Rating: IP66
Construction: Die-Cast Aluminum

Finish: Pre-treated, Polyester coated
Window: 6mm strengthened glass
Fastenings and Hinges: Stainless Steel
Usable Internal Dimensions: 220mm (L) x 130mm (W) x 95mm (H)
Colour: White or Grey

2.2.5 Camera Interoperability

The cameras used shall ensure complete functional, technical and software interoperability with the current existing cameras, as listed in the MOS schedule, including associated software license integrations.

The cameras shall additionally be fully compatible with various ONVIF profiles such as Profile S, Profile G, and as indicated for each camera.

The dome camera s offered shall be

Specifications as below:

Network Video Recorder / DVR specification

The NVR shall come complete with the required licences and any other items necessary for full functionality

- RAID-5 protected (standard configuration), allin-one video management solution for up to 256 channels
- Out-of-the-box IP video management solution with up to 96 TB storage capacity
- Advanced user and alarm management
- 3 years hardware warranty, including next business day services
- Rack unit (U) size 2 U

Electrical:

Operating voltage (VAC)	:100 - 240 VAC
Maximum output power (W)	:800 W
Power frequency	: 50 Hz; 60 Hz
Rated input current (A)	:1.0 A
Actual output wattage from power supply (W)	:228.8 W
Power consumption* (W)	:238.3 W

Operation:

Processor	: Intel® Xeon® E-2226GE
Processor base frequency	: 3.40 GHz
Cache	: 12 MB Intel® Smart Cache
Installed memory	: 16GB DDR4-2666 2Rx8 ECC UDIMM
Memory protection	: ECC unbuffered
Operating System	: Microsoft Windows Server IoT 2019 for Storage Standard

Connectivity

Number of USB ports	6

	Front: 2 USB 2.0 ports Rear: 3 USB 3.1 ports and 1 USB-C port
Number of Ethernet ports	2 RJ45 Gigabit Ethernet LAN ports (teamed)
Network port	1 IPMI BMC port

Transmission medium specification:

- CAT6

HDD specification:

The hard drives to be used are to be of surveillance grade quality and performance, supporting SATA interface and 6GB/s.

Formatted capacity	4TB
Form factor	3.5-inch
Advanced Format (AF)	Yes
RoHS compliant	Yes
Product Features	
Cameras supported	Up to 64
Drive Bays Supported	8+
Firmware Feature Name	AllFrame 4K
Tarnish resistant components	Yes
Performance	
Interface transfer rate (max)5	
Buffer to host	6 Gb/s
Host to/from drive (sustained)	150 MB/s
Cache (MB)	64
Performance Class	5400 RPM Class
Reliability/Data Integrity	
Load/unload cycles	300,000
Annualized workload rating	180TB/yr
Non-recoverable read errors per bits read	<1 in 10^{14}
MTBF	1,000,000
Limited warranty (years)	3
Power Management	
Average power requirements (W)	
Read/Write	5.1
Idle	4.5
Standby and Sleep	0.4

Environmental Specifications	
Temperature (°C, on the base casting)	
Operating	0 to 65
Non-operating	-40 to 70
Shock (Gs)	
Operating (2 ms, read/write)	30
Operating (2 ms, read)	65
Non-operating (2 ms)	250
Acoustics (dBA)	
Idle	25
Seek (average)	28
Physical Dimensions	
Height (in./mm, max)	
Length (in./mm, max)	1.028/26.1
Width (in./mm, ± .01 in.)	5.787/147
Non-operating (2 ms)	4/101.6
Weight (lbs/kg, ±10%)	1.65/0.75

Network IP Switch

The network switch shall be capable of the following:

Model	
Port	
10/100M RJ45	24
10/100/1000M RJ45	2
1000M SFP	2 (multiplex)
Port of high priority	Port 1 to 8
Performance	
Store-and -forward	Support
MAC Address table	4K
MAC address learning	Automatic learning/Aging
Backplane bandwidth	8.8Gbps
PoE	
PoE standard	IEEE 802.3af, IEEE802.3at
PoE cable core	Supports 8-core power supply and simultaneous power supply via the 1236 and 4578 line order.
PoE port	Port 1 to 24
Port max. power	30W
Switch max. power	370W
Power Supply	100to 240VAC, 50/60Hz
Data Transfer rate	Ethernet: 10 Mbps (half-duplex)/20 Mbps (full-duplex) Fast Ethernet: 100 Mbps (half-duplex)/200 Mbps (full-duplex) Gigabit Ethernet: 2000 Mbps (full-duplex)
Network Media	
Ethernet	UTP/STP of CAT3 or above
Fast Ethernet	UTP/STP of CAT5 or above
Gigabit Ethernet	Recommended UTP/STP of CAT5e or CAT6
1000 Base-SX:	MMF (Multi-Mode Fiber)
1000 Base-LX:	MMF (Multi-Mode Fiber) or SMF (Single Mode Fiber)

Gigabit Ethernet Unmanaged Switch

The Gigabit switch shall have the following specification

Product Specifications	
Gigabit ports	8
Max MAC entries	4K
Buffer size	192KB
Energy Efficient Enthernet (IEEE 802.3az compliant)	Yes
Performance	
Store-and -forward	Yes
Bandwidth	16Gbps
Jumbo Frame Support(packet size)	Up to 9,720 bytes
Acoustic noise (ANSI-S10.12)	0 dBA (fanless)
Mean Time Between Failures (MTBF)	9,727,733 hrs (158 yrs)
Quality of Service	
DSCP	Yes
IEEE 802.1p COS	Yes
Queue WRR Ratio	1:2:4:8
IEEE NETWORK PROTOCOLS	
IEEE 802.3 Ethernet	IEEE 802.1p Class of Service
IEEE 802.3ab 1000BASE-T	IEEE 802.3x full-duplex flow control
LEDs	
Per port	Speed, Link, Activity
Per device	Power Status
Power Specifications	
Power Consumption (when all ports used, line-rate traffic)	4.9W

2.3 Video Wall Servers

The contractor shall allow for two video wall server types, to be installed as depicted on the drawing series E21/2107/SA/200 to E21/2107/SA/209.

2.3.1 Small Video Wall (Local and Movement Control Rooms)

Each local control room shall contain a small video wall, complete with associated ancillary connectors, mountings and fasteners for a video wall comprising four (4) 42” LED monitors.

The video wall shall be capable of displaying a Graphical User Interface, Live, Sequenced and recorded video images.

2.3.2 Large Video Wall Server (Central Control Room – Sally Port 6)

The central equipment room as located in Sally port 6 shall contain a large video wall server. This office shall be equipped with 2 x operator workstations with a default 3 x 24 inch LED monitor small video server equipment as described in part 2.3.1, and an additional 3 x3 x 42 inch monitor video wall (9 x monitors), to be wall mounted, as indicated on drawings.

Dedicated servers shall drive the 9 monitors, and the contractor shall thus include full compensation for the supply, install, testing and commissioning of these servers as described in this specification.

2.3.3 Server Specifications

The video wall servers shall have the following typical specification:

1. Small Video Server:

- Processor: Intel® Xeon® W-2225 (8.25 MB cache, 4 cores, 8 threads, 4.10 GHz to 4.60 GHz Turbo, 105 W)
- Memory: 2 x 4096MB, 2666MHz DDR4, Non ECC
- Hard Drive: 1TB, 7200 Rpm, Serial ATA II (Excl recording)
- Optical Drive: 16X DVD+/-RW Drive
- Graphics Adapter: NVIDIA Quadro RTX 4000 Display Card
- Max Monitors/Server: Two (2)
- Max Images/Server: Twenty Five (25)
- Max CPU Usage: 50% with 25 simultaneous Images

2. Large Video Server:

- Processor: Intel® Xeon® Silver 4208 (11 MB cache, 8 cores, 16 threads, 2.10 GHz to 3.20 GHz Turbo, 85 W)
- Memory: 2 x 8192MB, 2666MHz DDR4 Quad Channel FBD
- Hard Drive: 1TB, 7200 Rpm, Serial ATA II (Excl recording)
- Optical Drive: 16X DVD+/-RW Drive
- Graphics Adapter: Dual Port NVIDIA Quadro RTX 4000 Display Card
- Max Monitors/Server: Two (2)
- Max Images/Server: Fifty (50)
- Max CPU Usage: 50% with 50 simultaneous Images

2.4 CCTV Monitors

The Contractor shall provide two monitor types within the scope of the Security Contract as follows:

2.4.1 High Resolution 24” LED Monitor

Each Operator shall be equipped with 2x 24”LED Monitors in compliance with 2.4.3 below. The monitors shall be driven by the Small Video Wall Server detailed in part 2.3.3.1 above.

2.4.2 High Resolution 42” LED Monitor

The Central Control Room shall be equipped with 9x 42” LED Monitors in compliance with 2.4.4 below. The nine monitors shall be driven by the Large Video Wall Server detailed in 2.3.3.2 above.

2.4.3 24” LED Monitor Technical Specification

- Viewing Image Size: 24” LCD HAS Wide Screen
- Input: Analogue (Composite) + Digital (SVGA) + HDMI
- Contrast Ratio: 800:1
- Minimum Resolution: 1920 x 1080
- Pixel pitch: 0.255mm
- Minimum Viewing Angle: 160º/160º
- Scanning Frequency: 30-81kHz
- Brightness: 300 cd/m2
- Response Time: 5ms

2.4.4 42” LED Monitor Technical Specification

- Viewing Image Size: 42” LED (Active Matrix)
- Input: Analogue (Composite) + Digital (SVGA)+HDMI
- Contrast Ratio: 800:1
- Minimum Resolution: 1920 x 1080
- Pixel pitch: 0.650mm

- Minimum Viewing Angle: 170º/170º
- Scanning Frequency: 30-70kHz Horizontal, 50-85 Vertical
- Brightness: 500 cd/m2
- Response Time: 8ms

2.5 Video Management Module – Features and Functions

The contractor shall allow for full compensation for a Video management module that caters for the full recording requirements of the SMS system, as detailed in this specification and the GENERAL SPECIFICATION.

The module functionality shall include the following:

1. Full integration with the security management software system

2. The VMM will offer a complete video surveillance solution that will be scalable from one to hundreds of cameras, with the ability to add more cameras.
3. The VMM Shall allow:
    - Live display of camera images
    - Live display of camera sequences
    - Control of PTZ cameras
    - Playback of archived video
    - Instant Replay of live video
    - Selection of Camera Icons via area maps

- The VMM shall support any form of IP network connectivity, including: LAN, WAN, VPN, and Internet technologies

- The VMM shall be able to use multiple CCTV keyboards to operate any camera within the system, regardless of brand, make or model, including their PTZ functionalities (i.e. Pelco keyboard controls Panasonic dome or vice-versa)

- The VMM shall allow for a CCTV keyboard to be attachable directly to a encoder/decoder via its serial port or directly to the PC

Furthermore, the Security Management System (SMS) shall be capable of issuing control commands directly to the IP Cameras, Video Encoders, Video Decoders and the NVR's (Virtual Matrix), to select live or recorded video images onto any external Video Monitor as required.

2.6 GENERAL DESCRIPTION – CCTV SYSTEM

The CCTV system shall be of first class quality, comprised of various components to provide surveillance capabilities to the central control room, including full integration with the SMS system and entire security installation. The system offered shall integrate all the different components and shall work as one package controlled from a single point, but also capable of being controlled individually.

2.6.1 Display System

Refer to section 2.3 of this specification

2.6.2 PC input points and switching

The system offered shall be simple, flexible to configure and an elegant solution. The system shall have a VGA & audio point mounted in the power skirting below the screen and it shall come c/w all the necessary control cables and connectors.

2.6.3 UPS System

The system shall have a dedicated rack mounted Online UPS system capable of allowing uninterruptible supply to sensitive equipment for a period not less than 30mins after power disconnection. The UPS system shall be used for all sensitive equipment, including monitoring equipment, Host PC, NVR and other network switching equipment. This section is to be read in conjunction with *Part 8 - Uninterruptible Power Supply Specification.*

3. TESTS AND COMMISSIONING

3.1 GENERAL

The Contractor shall draw up procedures for and execute the following tests and inspections:

- Site tests.
- Acceptance tests.

The Employer and Engineer will have the right to attend any or all tests and inspections.

The Contractor must supply all the necessary test equipment to execute the tests.

All completed test and inspection reports must be submitted to the Engineer before acceptance of the system.

The Contractor must execute all tests and submit completed test reports to the Engineer. The Engineer shall have the right to request the Contractor to perform all or some tests in the presence of the Engineer and the Employer.

In the event of failure of the system to pass any of the tests, a re-test will be required within 14 days of the original test. The cost associated with all re-tests will be for the account of the Contractor.

3.2 SITE TESTS

Site tests must be executed on all systems/modules before integration of the system takes place.

The site tests must ensure that all sub-systems function according to the specifications and comply with the specification.

The site test procedures must contain at least the following:

(i) Sub-system/module description and identification number.

(ii) Test equipment needed/used.

(iii) Logical explanation of actions and/or measurements to be taken in order to determine the compliance with the specifications.

(iv) Test reports containing the following:

- Specified values/requirements.
- Measures/observed values/requirements.
- Remarks.
- Name and capacity of person that performed the tests.
- Date of tests.
- Space for acceptance of the test report by the Engineer.

The test procedures must be submitted to the Engineer for approval at least two weeks before the scheduled tests.

3.3 ACCEPTANCE TESTS AND COMMISIONING

Acceptance tests shall be executed on the integrated system as a whole before the first delivery can take place.

Successful completion of the acceptance tests will serve as proof that the system is functioning as required. No handing over of the system or execution of Tests on Completion in terms of the Contract shall take place before the Engineer is satisfied that the system conforms to specification.

3.4 TRAINING OF OPERATING STAFF

The Contractor shall undertake to train the Employer's operating staff to be fully competent in the operation of the equipment.

Before or on completion of the installation, when the system is in running order, the Contractor shall instruct operators in the operation of the system until they are fully conversant with the equipment and the handling thereof.

The Contractor shall take full responsibility for the safety of personnel during training and for the quality of work produced by such personnel under his supervision.

Training of staff and personnel shall be equivalent to eight full hours of training, done over two to three days.

3.5 WARRANTY PERIOD

It shall be possible to do maintenance in one equipment section, without interfering with the other parts of the CCTV system.

The contractor shall include in the tender price a "free" warranty period of 12 months. This shall include all repairs/replacement of defective equipment.

When any equipment becomes defective during the warranty period the Contractor will be contacted by the Employer to repair or replace the defective equipment.

3.6 SCHEDULES OF PARTICULARS AND INFORMATION

All schedules which accompany this tender notice, form an integral part of it and shall be duly completed in every detail; **FAILING** which, the tender in question may be rendered ineligible for consideration.

Under no circumstances will statements such as: -

- See attached pamphlets
- Refer to catalogue
- Data to follow
- As given by supplier, etc. be acceptable to the OTP.

Equipment offered and listed on the schedules shall be capable of performing the specified duties and complying with the Specification requirements in all respects; Should it transpire that such equipment, even when offered by make, model and/or type, is unsuitable of meeting, or performing in accordance with, the Specification requirements in any respect, the Contractor shall nevertheless be responsible for any additional costs incurred in providing the required or suitable equipment.

The schedules on the following page/s must be completed in full and returned with the tender. Blank statements of compliance will not be considered.

NOTE:

Tenderers are to note that under no circumstances may materials be installed other than that offered in the following material schedule.

3.7 OPERATING AND MAINTENANCE MANUALS

OPERATING MANUALS

The Sub-Contractor shall supply as part of the contract three (3) copies of the Operation Manual and "As Built" drawings of the complete system.

(a) The Manuals shall contain the name, address and all telephone numbers of the Company supplying and installing the specific system.

(b) The location of the main switch that isolates all power to the system.

(c) Details of maintenance service agreement as specified in this section.

The Manuals must be compiled in layman's language.

At least one month before commissioning, one draft copy shall be submitted to the Engineer for comments and approval. Operating manuals shall give a clear description of and the purpose of the installation.

(a) Paper copies of all approved drawings and diagrams.

(b) Detailed description of the different components used in the installation.

(c) On- and off switching procedures.

(d) Guidelines for routine-test to be carried out by the End User inclusive of the periods during which tests are to be undertaken.

(e) Detailed instructions for procedures to be followed during a fault or alarm.

The Sub-Contractor shall in addition to documentation specified above and/or in the Standard Specifications furnish the Engineer with two sets of documents and drawings related to the concept, design, installation, commissioning, operation and maintenance of the entire system and its components, on or before the First Delivery date.

The following drawings are required:

- Layout drawings
- Schematic drawings
- Internal circuit drawings and schematic circuit drawings of all panels, etc.

The following documents are required:

- Full description of the system.
- Operating instructions**.**
- Installation instructions.
- Commissioning instructions.
- Maintenance instructions, maintenance schedule and troubleshooting guide.
- Parts Books, Spares Books and Log Book
- Inspection Certificates and Reports

3.8 MAINTENANCE MANUALS

Three complete sets of maintenance manuals (Technical) prepared in English shall be supplied by the Contractor.

At least one month before commissioning a draft copy shall be submitted to the Engineer for comments and approval.

Maintenance manuals shall consist of the following:

(a) A general description of the system.
(b) A general description of the controls.
(d) Detailed monthly, quarterly, semi-annually and annual preventative maintenance procedures (if necessary).
(e) Manufacturer's catalogues clearly indicating type, and model of equipment supplied.
(h) List of spare parts for all equipment.
(i) Fault tracing/finding procedures.

Manuals shall be bound in a firm hard cover.

The information shall be clear and readable and supplied with an index.

The above mentioned manuals shall be available at first delivery. Delivery of the installation will not be accepted without the manuals.

3.9 AS-BUILT DRAWINGS

The as-built drawings shall contain the following (where installed):

- position and types of all field devices
- conduit and trunking routes and sizes

4. DEVIATIONS FROM THE SPECIFICATION

Explanatory remarks with regard to special technical characteristics of the Tender, or with regard to variations to the design of the building structure to house the installation or remarks regarding the contents of the Specification, shall be comprehensively described in the blank space provided on this page (or in an accompanying letter). Should no remarks be made or special requirements stated, it shall be interpreted that the installation offered in the Tender duly complies with the requirements of the Specification. Should remarks of requirements be included in an accompanying letter, the Tenderer shall so state in the space provided on this page.

…….

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SIGNATURE OF TENDERER: ……..

5. SCHEDULES OF INFORMATION

NOTE:

THE FOLLOWING SCHEDULES SHALL BE COMPLETED IN FULL. FAILURE TO DO SO WILL RESULT IN THE TENDER BEING DECLARED NULL AND VOID

5.1 SCHEDULE OF TECHNICAL INFORMATION

1.		**MONITORS**	
	(i) (II)	Make Model	…… ……
2.		**PC INPUT POINTS & SWITCHING**	
	(i) (II)	Make Model	…… ……
3.		**VARI FOCAL IP CAMERAS**	
	(i) (II)	Make Model	
4.		**FIXED IP CAMERAS**	
	(i) (II)	Make Model	…… ……
5.		**DOME IP CAMERAS**	
	(i) (II)	Make Model	…… ……
6.		**VIDEO RECORDER/ DVR**	
	(i) (II)	Make Model	…… ……
7.		**NETWORK SWITCH**	
	(i) (II)	Make Model	
8.		**RACKMOUNTED UPS (2kVA)**	
	(i) (II)	Make Model	
10.		**GIG SWITCH**	
	(i) (II)	Make Model	

11.		**SURVEILLANCE HARD DRIVE**	
	(i) (II)	Make Model	

5.2 Previous Experience

CCTV System

Previous Contracts	Value	Reference: Name & Number

ICT

Previous Contracts	Value	Reference: Name & Number

Surveillance

Previous Contracts	Value	Reference: Name & Number

6. SCHEDULE OF RATES FOR VARIATIONS TO THE CONTRACT

6.1 SCHEDULE OF RATES

THE SCHEDULES OF RATES SHALL BE COMPLETED IN FULL. FAILURE TO DO SO WILL RESULT IN THE TENDER BEING NULLIFIED

The rates entered in this schedule shall serve unaltered to calculate the value of variation orders (additions or omissions) issued in terms of the Contract.

All rates in this bill shall be given to ensure that these rates are available for variation orders covering work not envisaged at the tender stage.

These rates shall include the following items necessary for the supply, delivery, handling, installation and guarantee of all applicable equipment:

- Nett cost of material.
- Profit, storing cost, handling charges, etc. for material.
- Nett cost of labour.
- Labour overheads and profit on labour.
- Duties payable.
- Attributable overhead costs.

These rates shall exclude VAT.

6.2 PROFIT ON MATERIAL FOR OMISSIONS AND ADDITIONS:

The following percentage profit will be required on the proven cost of materials for additions or omissions not covered by any other section of this schedule. This percentage shall include all direct overheads, profit handling charges, etc.

Nett percentage: .....%

6.3 RATES FOR ADDITIONAL LABOUR

The rate per man-hour shall be applied to determine labour costs not covered by any of the other section of this schedule.

PERSONNEL	RATE, R PER MAN-HOUR
NORMAL HOURS	
Supervisor	……
Qualified artisan	……
Skilled Labourer	……
Semi-skilled Labourer	……
19H00 - 07H00 OVERTIME WEEKLY	
Supervisor	……
Qualified artisan	……
Skilled Labourer	……
Semi-skilled Labourer	……
OVERTIME WEEKENDS AND PUBLIC HOLIDAYS	
Supervisor	……
Qualified artisan	……
Skilled Labourer	……
Semi-skilled Labourer	……

7. SCHEDULE OF IMPORTED MATERIALS AND EQUIPMENT

TO BE COMPLETED BY TENDERER

Item	Material/Equipment	Rand (R) (Excluding VAT)
1		
2		
3		
4		
5		
6		

The Contractor shall list imported items, materials and/or equipment, which shall be excluded from the Contract Price Adjustment Provisions and shall be adjusted in terms of currency fluctuations only. Copies of the supplier's quotations for the items, materials or equipment (provided that such costs shall not be higher than the relevant contract rate as listed above) should be lodged with the Representative of the Client within 60 (sixty) days from the date of acceptance of the tenders. No adjustment of the local VAT amount, nor the contractor's profit, discount, markup, handling costs, etc shall be allowed.

These net amounts will be adjusted as follows

FORMULA:

The net amount to be added to or deducted from the contract sum:

$$A = V \left(\frac{Z}{Y} - 1 \right)$$

A = the amount (R) of adjustment

V = the net amount (supplier's quotation) (R) of the imported item

Y = exchange rate at the closing date of tender submission

Z = exchange rate on the date of payment.

CONTRACTOR: _____

SIGNED: _____

DATE: _____

SPECIFICATION FOR THE

ELECTRICAL INSTALLATION

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic and ICT Specification
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	**Electrical Works Specification (This Document)**
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification

SPECIFICATION FOR ELECTRICAL WORK

PART 1 - GENERAL

CONTENTS

PART 1 - GENERAL

1 TESTS

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

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

2 MAINTENANCE OF INSTALLATIONS

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

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

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

3 REGULATIONS

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

4 NOTICES AND FEES

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

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

5 SCHEDULE OF FITTINGS

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

6 QUALITY OF MATERIALS

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

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

Materials wherever possible, must be of South African manufacture.

7 CONDUIT AND ACCESSORIES

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories

shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in Part 2 of this specification.

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

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

a) Screwed metallic conduit and accessories: SABS 1065, parts 1 and 2.

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

c) Non-metallic conduit and accessories: SABS 950

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

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

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

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

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

Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

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

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

Bending and setting of 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.

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

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

8 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.

9 SURFACE MOUNTED CONDUIT

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

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

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

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

10 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 preferable be installed in passages or male toilets.

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

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

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

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

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

Aluminium and zinc alloy connectors will not be acceptable.

12 WIRING:

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

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

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

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

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

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

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

13 SWITCHES AND SOCKET OUTLETS

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

No other than 16 A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

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

14 SWITCHGEAR

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

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

15 SWITCHBOARDS

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

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

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

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

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

16 WORKMANSHIP AND STAFF

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

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

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

17 CERTIFICATE OF COMPLIANCE

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

18 EARTHING OF INSTALLATION

Main earthing

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

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

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

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

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

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

Roofs, gutters and down pipes

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

Sub-distribution boards

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

Sub-circuits

The earth conductors of fall sub-circuits shall be connected to the earth busbar in the supply board in accordance with SABS 0142.

Ring Mains

Common earth conductors may be used where various circuits are installed in the same wire way in accordance with SABS 0142. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Engineer. Earth conductors for individual circuits branching from the ring main shall by connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

Non-metallic Conduit

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

Standard copper earth conductors shall be installed in the conduits and fixed securely to all metal

appliances and equipment, including metal switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

Flexible Conduit

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

Connection

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

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

19 MOUNTING AND POSITIONING OF LUMINAIRES

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

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

Fluorescent luminaires installed against concrete ceilings shall be screwed to the outlet boxes and in addition 2 x 6mm expansion or other approved type fixing bolts are to be provided. The bolts are to be ¾ of the length of the luminaires apart.

Fluorescent luminaires to be mounted on board ceilings shall be secured by means of two 40mm x No. 10 round head screws and washers. The luminaires shall also be bonded to the circuit conduit by means of locknuts and brass bushes. The fixing screws are to be placed ¾ of the length of the fitting apart.

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

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

PART 2: INSTALLATION DETAILS

CONTENTS

PART 2: INSTALLATION DETAILS

1 CABLE SLEEVE PIPES

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

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

2 NOTICES

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

3 ELECTRICAL EQUIPMENT

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

4 DRAWINGS

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

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

5 BALANCING OF LOAD

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

6 SERVICE CONDITIONS

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

7 SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to clause 13 of Part 1 of this specification.

8 LIGHT FITTINGS AND LAMPS

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

All fittings to be supplied by the Contractor shall have the approval of the Department. Incandescent lamps shall bear the approved mark of the S.A.B.S. and shall have the British light centre length.

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

9 EARTHING AND BONDING

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

10 MAINTENANCE OF ELECTRICAL SUPPLY

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

11 EXTENT OF WORK

The work covered by this contract consists of the following:

- Upgrading of the four (4) LV supply take-off point circuit breakers and confirmation that these supplies are taken from the non-essential part of the LV distribution boards.
- Supply and installation of four (4) Mains Fail change-over panels (labelled MDB-SXX on drawings) including relocation/rerouting of existing LV cables from the supply point through the aforementioned panel and new LV cabling from the generator sets to be supplied and installed by others.
- Supply and installation of LV cabling between existing DB-UPS and the new UPS units to be supplied and installed by others.
- Supply and installation in existing PVC sleeves approximately 4800 metres of LV supply cabling for existing Outdoor Electronic Equipment Enclosures.
- Supply and installation directly in trench of approximately 140 metres of LV supply cabling to existing Tower Post.
- Supply and installation in existing sleeves approximately 5500 metres of perimeter/security lighting cabling.
- Repair and maintenance of approximately 251 perimeter lights.

12 SUPPLY AND CONNECTION

The supply to the Sally Ports will be at 400/230 Volt 50Hz.

The Contractor shall be responsible for liaising with the local Authority/Maintenance Personnel and must arrange in good time with them for switching off of the installation where necessary for the purposes of maintenance of the installation.

13 CONDUIT AND WIRING

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

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

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

<u>Lugs held by switch fixing screws or self tapping screws will not be acceptable.</u>

14 CABLES

The Contractor shall supply and completely install all distribution cables as indicated on the drawings.

Low Voltage (LV) 400/230Vac cables for the main LV supplies, supplies to kiosks and for perimeter lighting shall be PVC insulated stranded copper cores with galvanized steel wire armouring and PVC sheath. The sizes and number of the cores of the conductor are provided on drawings and Bills of Quantities.

LV cabling for kiosks and perimeter lighting shall be provided with tinned copper earth continuity

conductor (ECC) which will form part of the armouring.

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 0,8m 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.

Cables for supplies to kiosk and perimeter lighting will be installed through existing 50mm diameter sleeves.

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 that 500 V for low tension cables.

Earth continuity conductors are to be run with all underground cables constituting part of a low tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable, but shall not be less than $4mm^2$ or more than $70mm^2$. 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.

14.1 LAYING, JOINTING AND MAKING OFF OF ELECTRICAL CABLES

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

1. The use of the term “Inspector”, includes the engineer or inspector of the Department or an empowered person of the concerned supervising consulting engineer’s firm.

2. No cable is to be laid before the cable trench is approved and the soil qualification of the excavation is agreed upon by the Contractor and inspector.

3. After the cable has been laid and before the cable trench is back-filled the inspector must ensure that the cable is properly bedded and that there is no undesirable material included in the bedding layer.

4. All cable jointing and the making off of the cables must only be carried out by qualified experienced cable jointers. Helpers of the jointers may not saw, strip, cut, solder, etc. The cable and other work undertaken by them must be carried out under the strict and constant supervision of the jointer.

5. Before the Contractor allows the jointer to commence with the jointing work or making off of the cable (making off is recognized as half a joint) he must take care and ensure:

5.1 that he has adequate and suitable material available to complete the joint properly and efficiently. Special attention must be given to ensure the cable ferrules and cable lugs are of tinned copper and of sufficient size. The length of the jointing lugs must be at least six times the diameter of the conductor,

5.2 that the joint pit is dry and that all loose stones and material are removed,

5.3 that the walls and banks of the joint pit are reasonable firm and free from loose material which can fall into the pit,

5.4 that the necessary coffer-dams or retaining walls are made to stop the flow of water into the joint pit,

5.5 that the joint pit is provided with suitable groundsheets so that the jointing work is carried out in clean conditions,

5.6 that the necessary tents or sails are installed over the joint pit to effectively avert unexpected rainfall and that sufficient light or lighting is provided,

5.7 that the necessary means are available to efficiently seal the jointing or cable end when an unexpected storm or cloudburst occurs, regardless of how far the work has progressed,

5.8 that the cables and other materials are dry, undamaged and in all respects are suitable for the joint work or making off,

5.9 that the heating of cable oil, cable compound, plumbers metal and solder is arranged that they are at the correct temperature when required so that the cable is not unnecessary exposed to the atmosphere and consequently the ingress of moisture (care must be taken of overheating)

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

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

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

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

7**.** If the cable contains moisture or is found to be otherwise unsuitable for jointing or making of the inspector is to be notified immediately and he will issue the necessary instruction to cope with the situation.

8. The joint or making off of paper insulated cables must not be commenced during rainy weather.

9. Once a joint is in progress the jointer must proceed with the joint until it is complete and before he leaves the site.

10. The jointer must ensure that the material and his tools are dry at all times, reasonably clean and absolutely free from soil.

11. Relating to the jointing of the cable the following requirements apply:

11.1 All jointing must be carried out in accordance with recognized and tried techniques and comply strictly with the instructions given by the supplier of the jointing kit.

11.2 The cables must be twisted by hand so that the cores can be joined according to the core numbers. If necessary the cable is to be exposed for a short distance to accomplish this. Under no circumstances may the cores in a joint be crossed so as to enable cores to be joined according to the core numbers. If it is not possible to twist the cables so that the preceding requirements can be met, then cores are to be joined in the normal way without any consideration of the core numbers.

11.3 Normally the cables will have profile conductors. The conductors shall be pinched with gas pliers to form a circular section, bound with binding wire so that they do not spread, and then tinned before jointing.

11.4 Jointing ferrules, the length of which are at least 6 times the diameter of the conductors, must be slid over the conductor ends to be joined and pinched tightly. Then they are soldered by means of the ladle process whilst being pinched further closed.

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

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

NB: The spaces between the conductor strands must be completely filled by soldering process and must be carried out quick enough to prevent the paper insulation from burning or drying out unnecessarily.

11.5 After the ferrules have been rubbed smooth and clean, they and the exposed cores must be treated with hot cable oil (110°C) to remove all dust and moisture. These parts are to be thoroughly basted with the oil.

11.6 The jointer must take care that his hands are dry and clean before the joint is insulated. Also the insulating tape which is to be used must first be immersed in warm cable oil (110°C) for a sufficient period to ensure that no moisture is present.

11.7 After the individual cores have been installed they must be well basted with hot cable oil and again after the applicable separator and/or belt insulation tape is applied before the lead joint sleeve is placed in position.

11.8 The lead joint sleeve must be thoroughly cleaned and prepared before it is placed on the cable and must be kept clean during the whole jointing process. Seal the filling apertures of the sleeve with tape until the sleeve is ready for compound filling.

11.9 The plumbing joints employed to solder the joint sleeve to the cable sheath, must be cooled off with tallow and the joint sleeve is to be filled with compound while it is still warm. Top up continuously until the joint is completely filled to compensate for the compound shrinkage.

11.10 The outer joint box must be clean and free from corrosion. After it has been placed in position it must be slightly heated before being filled with compound. Top up until completely full.

12. As far as cable end boxes are concerned the requirements as set out above are valid where applicable.

15. DISTRIBUTION BOARDS

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

The distribution boards required under this project are shown on drawings.

The boards shall be constructed using minimum 2mm thick 3CR12 enclosure which shall be adequately sized to house all the equipment shown of single line diagrams including spare capacity future installations. The boards shall be painted and the finishing coat of the enclosure shall be epoxy coated light orange.

The boards shall be surface mounted against plastered brickwall.

The boards shall be dust and vermin proof.

The boards shall be provided with stainless steel glands plates which shall be pre-drilled for cabling shown in diagrams.

All distribution boards shall further comply with the quality specification in Part 3 of this specification, and be approved by the Department's representative.

16. CABLE TRAYS

Cable trays shall be provided for main LV cabling to surface mounted distribution board inside the generator rooms.

The cable tray shall be minimum 300mm wide perforated light duty galvanised and fixed against plastered birckwall at 500mm intervals using hot dipped galvanised P1000T channels, bolts and nuts.

All cut ends of the galvanised metal work shall be treated for corrosion.

17. SECURITY LIGHTING

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

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

Note: All luminaires to be energy efficient and shall employ the latest energy efficiency technology available.

The existing security lighting installation consists of approximately 370 security lights which are installed along the perimeter of the correctional facility.

Each security light consists of a 4m mounting height galvanised steel pole and a streetlight that is similar to Genlux type Apollo and is fitted with 2 x 26W compact fluorescent lamps. It is estimated

that this lighting installation has been completed at least 5 years ago but was never used. Therefore, the operational condition of the luminaires is not known.

It has been assumed for tendering purposes that there is no cabling supplying the security lights and inside the security light pole, and thus allowance has been made for new cabling.

Allowance has been in the Bills of Quantities for Contractor to clean, repair or replace any component of the luminaire or even replace the entire luminaire.

STANDARD ELECTRICAL SPECIFICATIONS

SECTION A: PREAMBLE TO STANDARD SPECIFICATIONS
SECTION B: INSTALLATION SPECIFICATIONS

AUGUST 2004

SECTION A

A.1 PRE-AMBLE TO STANDARD SPECIFICATION FOR ELECTRICAL INSTALLATIONS

GENERAL

1. INTRODUCTION

(a) These Standard Specifications cover the general technical requirements for the equipment, materials, installation, testing, commissioning and maintenance of electrical installations for the Department. These requirements shall be read in conjunction with the Documents as specified below.

(b) "Document" shall mean the complete set of contract documents, including the Department's Tender Conditions, Tender Qualifications, the Standard Specification and the Detail Technical Specification including all drawings and variation orders issued in terms of the contract.

(c) "Contractor" shall mean the person, partnership, company or firm appointed for the supply, installation, testing, commissioning and maintenance of the Electrical Installation. In the case of the Electrical Installation being a sub-contract, nominated in terms of the Main Contract or otherwise, the word "Contractor" shall also mean "Sub-Contractor" in terms of the Sub-Contract Conditions for the specific installation. Where applicable the Builder or Principal Contractor shall be referred to as "Main Contractor".

2. INSTALLATION WORK

(a) The complete installation shall comply with the requirements of this Specification. Should any discrepancies or contradictions exist between this specification and the Detail Technical Specification for the specific installation, then the latter shall take precedence.

In the event of discrepancies between the drawings, specifications and bill of quantities the Department shall decide whether the work as executed shall be remeasured on site or whether remeasurement shall be effected from the working drawings only.

(b) The Department's authorised representative will inspect the installation from time to time during the progress of the work. Discrepancies will be pointed out to the Contractor and these shall be remedied at the Contractor's expense. Under no circumstances shall these inspections relieve the Contractor of his obligations in terms of the Documents.

(c) The Contractor shall notify the Department timeously when the installation reaches important stages of completion (e.g. before closing cable trenches, before casting concrete, etc.) so that the Department's authorised representative may schedule his inspections in the best interest of all parties concerned.

3. REGULATIONS

(a) The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in PW 379 or PW 379 (Civil) – “Standard Conditions in respect of the Supply-, Delivery and Installation of Electrical-, Mechanical-, Pneumatic- and Vacuum Operated Equipment, Control Systems, Plant and Materials”.

(b) The Contractor shall issue all notices and pay all of the required fees in respect of the installation to the authorities, and shall exempt the Department from all losses, claims, costs or expenditures which may arise as a result of the Contractor's negligence in complying with the requirements of the regulations.

(c) It shall be assumed that the Contractor is conversant with the above-mentioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this Document, apply or

become applicable during erection of the Installation, such requirement, by-law or regulation shall overrule this Document and the Contractor shall immediately inform the Department 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 Department.

4. SITE CONDITIONS

Tenderers are advised to visit the site and acquaint themselves with all local conditions pertaining to the execution of the installation before tender closing date. No claims from the Contractor which may arise from insufficient knowledge of site access, type of site, labour conditions, establishment space, transport and loading/unloading facilities, power and water supply, etc. will be considered after submission of tenders.

For services where prior permission is required before contractors can visit the site, a visit will be arranged for all interested parties.

5. ARRANGEMENTS WITH THE SUPPLY AUTHORITY

(a) The contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority unless specified to the contrary.

(b) It shall be the responsibility of the Contractor to make the necessary arrangements with the local Supply Authority at his own cost and to supply the labour, equipment and means to inspect, test and commission the installation to the satisfaction of the Local and Supply Authorities.

(c) The Contractor shall supply and install all notices and warning signs that are required by the relevant laws, regulations and/or the Documents.

6. MATERIAL AND EQUIPMENT

(a) All material and equipment shall conform in respect of quality, manufacture, tests and performance, with the requirements of the South African Bureau of Standards or where no such standards exist, with the relevant current Specification of the British Standards Institution.

(b) All material and equipment shall be of high quality and suitable for the conditions on site. These conditions shall include weather conditions as well as conditions under which materials are installed, stored and used. Should the materials not be suitable for use under temporary site conditions then the Contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

(c) The Contractor shall, where requested to do so, submit samples of equipment and material to the Department for approval prior to installation. Samples may be retained in the Department's possession until the contract is completed after which they will be returned.

7. CONNECTIONS INVOLVING ALUMINIUM (CABLES AND TRANSFORMERS)

As a result of the fact that aluminium flows when subjected to pressure and electrical connections based on this principle thus loses proper contact during the course of time, it should be noted that bolted connections between aluminium and copper or any other metal is not acceptable to this Department.

8. CODES OF PRACTICE OR STANDARD SPECIFICATION

Where reference is made to any Code of Practice or Standard Specification in this document the latest edition or amendment shall be applicable, except where specified to the contrary.

SECTION B.1

B.1 INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES

1. GENERAL

1.1 Scope

1.1.1 This section covers the installation of conduits and conduit accessories in buildings and other structures under normal environmental conditions and for system voltages up to 600 V.

1.1.2 The following types of conduit installations are included:

(a) Screwed metallic conduit - black enamelled and galvanised.

(b) Plain-end metallic conduit - black enamelled and galvanised.

(c) Non-metallic conduit.

(d) Flexible conduit.

1.1.3 Conduits may be installed as follows:

(a) In open roof spaces.

(b) Cast in concrete.

(c) Surface mounted against walls, concrete slabs, etc.

(d) In wall chases.

1.1.4 Where conduits are to be installed in concrete, this shall be undertaken while the building work is still in progress. Conduits may only be surface mounted where specified or where the Department has given its written consent.

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

1.1.6 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.

1.1.7 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.

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

1.2 Other Services

Conduits may not be installed closer than 150 mm to pipes containing gas, steam, hot water or other materials, which may damage the conduits or conductors. Conduits may not touch pipes of other service installations in order to prevent electrolytic corrosion. Where this is unavoidable, cathodic protection shall be provided.

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

2. SCREWED METALLIC CONDUIT

2.1 General

2.1.1 In general, screwed steel conduit shall be used in the wiring of buildings.

2.1.2 The installation shall comply with SANS 10142.

2.2 Galvanised Conduit

Galvanised conduit and accessories shall be used in the following:

(a) In damp areas.
(b) In areas exposed to the weather.
(c) For all installations within 50 km of the coast.
(d) In plenum chambers containing humidifying equipment.
(e) For surface mounted conduit installations in kitchens and boiler rooms.
(f) In screeds resting directly on soil.
(g) For connection points to future installations.
(h) For underground conduit containing earthing conductors.
(I) In buildings where animals are housed such as cattle, sheep, dogs, etc.

2.3 Terminations

2.3.1 Spouted Connections.

Conduits shall be connected directly to draw-boxes with spouted connections. Conduits shall be screwed tightly home and no threads shall be visible.

2.3.2 Switchboards, Power skirting, etc.

Conduits shall be terminated by means of a brass female bush and two locknuts in pressed steel switchboards and distribution boxes, cable ducts, power skirting, etc. The conduit end shall only project far enough through the entry hole to accommodate the bush and locknut. Alternatively the method detailed in 2.3.3 may be used.

2.3.3 Draw-boxes.

A female bush and two locknuts shall be used to terminate conduits at draw-boxes and outlet boxes without spouts, should there be sufficient room in the box. Where there is insufficient room, a coupling, brass male bush and locknut may be used with sufficient allowance for the reduction of the internal diameter by the male bush.

2.3.4 Holes.

Holes to accommodate brass bushes shall be large enough to accommodate the bush with a minimum of clearance.

2.3.5 Bush-nuts.

Bush-nuts for the connection of earth conductors to conduits are not acceptable.

2.4 Screws, Bolts and Nuts

Steel locknuts of thick gauge steel with milled sides shall be used in all cases. Cadmium-plated bolts and nuts shall be used except where the installation is exposed to the weather in which case brass bolts and nuts shall be used. Screws shall be installed in all tapped holes in fittings and accessories to prevent damage to the screw thread by concrete or plaster. The screws shall be screwed completely down to prevent damage to the thread on the screw.

2.5 Conduit Ends

Conduit ends shall be cut at right angles to ensure that ends butt squarely at joints. Threads shall not be visible at joints and connections except at running joints. The total length of the thread on the two conduit ends shall not exceed the length of the coupling.

2.6 Joints

All conduit ends shall be reamed and all joints tightly screwed. Only approved couplings shall be used. Running joints with long threads shall be kept to a minimum and locknuts shall be provided to ensure a strong mechanical and a continuous electrical joint. 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.

2.7 Finish

All joints shall be painted with red lead to prevent them from rusting in damp areas, areas within 50 km of the coast and in cases where the installation is exposed to the weather for any length of time. Where the galvanising or black paint has been damaged, the area shall first be cleaned and a coat of zinc base paint applied subsequently. Additional coats of paint shall only be applied after the undercoat has completely dried. All surface mounted non-galvanised metallic conduit must be painted. (Refer to par. 8.8 of Section B1).

2.8 Continuity

Mechanical and electrical continuity shall be maintained throughout the conduit installation.

3. PLAIN-END METALLIC CONDUIT

As an alternative to the screwed conduit, plain-end conduit complying with the Department's standard specification for "CONDUITS AND CONDUIT ACCESSORIES", par. 7 of Section CI, may be installed subject to the following additional conditions:

3.1 Bending and setting of plain-end conduit must be done with special benders and apparatus manufactured for this purpose and which are obtainable from the suppliers of the system. Damaged conduit resulting from the use of incorrect bending apparatus shall be completely removed and any wiring already drawn into such damaged conduits shall be completely renewed at the Contractor's expense.

3.2 Screwed conduit must be used in the following instances:

(a) In flameproof installations.
(b) Load bearing conduit.
(c) For the suspension of luminaries.
(d) Surface mounted conduit.

3.3 Plain-end conduit and associated accessories shall be manufactured of mild steel having a minimum thickness of 1,2 mm and shall comply with SANS 1065. Conduit manufactured of lighter gauge material, i.e. 0,97 mm, will not be permitted.

3.4 All conduit and accessories used in areas within 50 km of the coast shall be hot-dip galvanised to SANS 32 & 121. In inland areas Electro-galvanised or cadmium-plated accessories will be accepted.

4. NON-METALLIC CONDUIT

4.1 Installation Conditions

Where specified for a particular service, non-metallic conduit may be installed under the following conditions:

4.1.1 All non-metallic conduit shall comply fully with SANS 950 and shall be installed in accordance with Appendix C of the same specification as well as SANS 10142.

4.1.2 Insulated heat-resistant boxes shall be used for outlets of totally enclosed luminaries and other fittings where excessive temperatures are likely to occur.

4.1.3 Luminaries and other fittings shall not be supported by non-metallic conduit or conduit boxes. These fittings shall be secured to the surrounding structure in a way that is acceptable to the Department. Refer to the Department's standard specification for "INSTALLATION OF LUMINAIRES", Section B9.

4.1.4 The conduit shall be supported and fixed with saddles with a maximum spacing of 1 m, even in roof spaces. (Refer to SANS 10142.) The Contractor shall supply and install all additional supporting timbers required.

4.1.5 It shall be possible to rewire the completed installation in the future without undue difficulty.

4.1.6 Non-metallic conduit and fittings shall not be used under the following conditions:

(a) Outside a building (unless protected, or sheltered under eaves).

(b) For mechanical load bearing.

(c) Where they may be subjected to temperatures below -10°C or above 70°C for prolonged periods.

(d) As primary electrical insulation.

(e) In areas where they may be subject to mechanical damage.

(f) For applications other than those for which they are designed.

(g) In concrete slab unless specified to the contrary.

4.2 Painting of Conduits

Exposed conduit may be painted with normal oil or PVA paints, but care must be taken to ensure that the paint used does not contain any component that will soften or have any other detrimental effect on the materials from which the conduit and fittings are manufactured.

4.3 Connecting of Conduit to Metal Equipment/Components

When any part of a non-metallic conduit system has to be connected to metal equipment or components (e.g. switchboard, surface socket-outlet or switch box, existing metallic conduit system, etc.) fittings and joints manufactured specifically for this purpose must be used. Non-metallic conduit must not be threaded to fit metallic connectors.

4.4 Bends

In conduit of nominal size not exceeding 25 mm, bends may be made in accordance with par. 4.5. In all other cases bends must be achieved by the use of accessories that are introduced into the conduit run. Bends shall comply with SANS 10142.

4.5 Bending

Conduit of nominal size up to and including 25mm may be cold bent by hand provided that the radius of the bend is greater than six times the nominal size of the conduit, and that the external angle of the bend does not exceed 90°. The procedure (which involves the use of a bending spring) should be as follows:

(a) Determine the angle through which the conduit is to be bent.

(b) Warm the cold conduit over the length to be bent by rubbing with hands.

(c) Select a bending spring which matches the conduit size and insert in to the conduit at the point where the bend is required.

(d) Bend the conduit slowly with one motion (either with the hands alone approximately 1 m apart, or across the knee) to double the required angle, release the conduit and, when its position is stable, withdraw the bending spring (turning it in an anti-clockwise direction to reduce its diameter) and gently correct the angle.

(e) Install and secure the conduit immediately following bending.

4.6 Adhesive Joints

All adhesive joints must be made in a clean dry area. The surfaces of all components to be bonded must be dry and clean.

The insertion depth should be marked on the conduit end and the adhesive applied (by means of a soft clean brush) as quickly as possible to the surfaces to be bonded by brushing lengthwise along the conduit, ensuring that a thin coating of uniform thickness is formed. The joint must be made immediately after the application of the adhesive by pushing the prepared parts squarely together with a twisting motion to the full insertion depth. Care must be taken to avoid squeezing adhesive into the cableway and all excess adhesive must be wiped off.

NOTE: Solvent adhesives contain highly volatile liquids and their containers should not be left open.

4.7 <u>Cutting</u>

A fine-tooth hacksaw should be used to cut conduit to the required length. Each cut end should be square and free from swarf, burrs and loose material. When determining the length of conduit to be cut, allowance must be made for the length of couplings or accessories attached to the conduit. Incorrect determination will cause bulging of the conduit or insufficient joint length.

5. FLEXIBLE CONDUIT

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

5.2 The installation shall comply with SANS 10142.

5.3 Flexible conduit shall preferably be connected to the remainder of the installation by means of a draw-box. The flexible conduit may be connected directly to the end of a conduit if an existing draw-box is available within 2 m of the junction and if the flexible conduit can easily be rewired.

5.4 Flexible conduit shall consist of metal-reinforced plastic conduit or PVC-covered metal conduit with an internal diameter of at least 15mm, unless approved to the contrary. In false ceiling voids, flexible conduit of galvanised steel construction may be used. connectors for coupling to the flexible conduit shall be of the gland or screw-in type, manufactured of either brass or mild steel plated with either zinc or cadmium.

6. INSTALLATION REQUIREMENTS

6.1 Positions of Outlets

All accessories such as boxes for socket-outlets, switches, lights, etc. shall be accurately positioned. It is the responsibility of the Contractor to ensure that all outlets are installed level and square, at the correct height from the floor, ceiling or roof level and in the correct position relative to building lines and equipment positions as specified. It shall be the responsibility of the Contractor to determine the correct final floor, ceiling and roof levels in conjunction with the Main Contractor. Draw-boxes shall not be installed in positions where they will be inaccessible after completion of the installation. Draw-boxes shall be installed in inconspicuous positions to the approval of the Department's representative and shall be indicated on the "as built" drawings.

6.2 Cover plates

All draw-boxes and outlets shall be fitted with cover plates, either as part of the switch or socket assembly or with blank cover plates if unused. Blank cover plates shall match other cover plates in the same area. Flush mounted cover plates in both ceilings and walls shall overlap the draw-box and edges of the recess. If the fixing lugs are substantially deeper than the finished wall surfaces, suitable coiled steel wire or tubes shall be used as spacers.

6.3 Draw-wires

Galvanised steel draw-wires shall be installed in all unwired conduits e.g. conduits for future extensions, telephone installations and other services.

6.4 Bends

A maximum of two 90 bends or the equivalent displacement will be allowed between outlets and/or boxes.

Draw-boxes shall be installed at maximum intervals of 15 m in straight runs. All bends shall be made without heating the conduit or without reducing the diameter of the conduit. The inside radius of a bend shall not be less than five times the outside diameter of the conduit. (Refer to SANS 10142,

6.5 Wall Socket-outlets

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

6.6 Luminaires

Where the conduit end is used to support luminaries, a ball-and socket type lid shall be fitted to the pendant box in all cases where the conduit is longer than 500 mm. In all other cases a dome lid may be used. Where luminaries are specified which are fixed directly to the pendant box, the pendant box shall be fixed independently of the conduit installation except where the pendant box is cast into concrete.

6.7 Flush Mounted Outlet Boxes

The edges of flush mounted outlet boxes shall not be deeper than 10 mm from the final surface. Spacer springs shall be used under screws where necessary.

6.8 Excess Holes

All excess holes in draw-boxes or other conduit accessories shall be securely blanked off by means of brass plugs to render the installation vermin proof.

6.9 Debris

Care shall be taken to prevent debris or moisture from entering conduits during and after installation. Conduit ends shall be sealed by means of a solid plug which shall be screwed to the conduit end. Conduits shall be cleaned and swabbed to remove oil, moisture or other debris that may be present before conductors are installed. Swabs shall not be attached to the conductors.

6.10 Defects

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

6.11 Withdrawal of Conductors

To ensure that all electrical conductors are easily withdrawable from conduits and to ensure that there are no joints in the conductors, the Department's representative will have the right to have the conductors of any circuit removed at his discretion. If the conductors are found to be in a satisfactory condition after having been withdrawn, the Department shall bear the cost of withdrawing and re-installing such conductors. If the conductors are found to have been damaged during installation or removal or if joints are found, they shall be replaced and the cost shall be borne by the Contractor.

7. INSTALLATION IN CONCRETE

7.1 Timeous Installation

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

7.2 Draw-boxes

Draw-boxes, expansion joints and round ceiling boxes shall be installed where required and shall be neatly finished to match the finished slab and wall surfaces. Ceiling draw-boxes shall be of the deep type. In hollow block slabs, rear-entry draw-boxes shall be used. In columns where flush mounted draw-boxes are installed, the conduits shall be offset from the surface of the column immediately after leaving the draw-box.

7.3 Elbows

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

7.4 Cover Plates

Draw-boxes and/or inspection boxes shall, where possible, be grouped together under a common approved cover plate, and must preferably installed in passages or male toilets. The cover plate shall be secured by means of screws.

7.5 Neutral Axis

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

7.6 Fixing to the Shuttering

All conduits, draw-boxes etc. shall be securely fixed to the shuttering to prevent displacement when concrete is cast. Draw-boxes and outlet boxes shall preferably be secured by means of a bolt and nut installed from the back of the box through the shuttering. Fixing lugs may also be used to screw the boxes to the shuttering. Wire will not be accepted for securing boxes to the shuttering where off-shutter finishes are required. Where fibreglass shuttering is used by the Builder, the equipment shall be fixed to the steel only and no holes shall be drilled or made in shuttering. All draw-boxes and outlet boxes shall be plugged with wet paper before they are secured to the shuttering.

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

7.7 Concrete Floor Slabs

Conduits will not be allowed in concrete floor slabs of boiler rooms (or boiler houses), laundries or other damp areas. All socket outlets and three phase outlets in damp areas shall be supplied from above with galvanised conduit and accessories.

7.8 Expansion Joints

As far as possible, conduits shall not be installed across expansion joints. Where this is unavoidable a conduit expansion joint shall be provided. (Refer to par. 10)

7.9 Screeds

The installation of conduits in floor screeds shall be kept to a minimum. Where conduits are installed in screeds, the top of the conduit shall be at least 20 mm below the surface of the screed. Where the screed is laid directly on the ground, galvanised conduits shall be used. This ruling will always be applicable to the lowest floor of a building. A minimum distance of twice the outside diameter of the conduit shall be left free between adjoining conduits. Conduits shall be secured to the concrete slab at intervals not exceeding 2 m. The Contractor shall ensure that conduits are not visible above the screed where the conduits leave the screed.

7.10 Inspection

All draw-boxes, conduits, etc. which are installed in concrete shall be cleaned with compressed air and provided with draw-wires two days after removal of the shuttering. Errors that occurred during the installation of the conduits, or any lost draw-boxes, or blocked conduits shall be immediately reported to the Department by telephone and confirmed in writing in order that an alternative route can be planned and approved by the Department before the additional concrete is cast. Any additional cost shall be for the Contractor's account.

8. SURFACE INSTALLATIONS AND INSTALLATIONS IN ROOF SPACES

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

8.1 Appearance

(a) All conduits shall be installed horizontally or vertically as determined by the route and the Contractor shall take all measures to ensure a neat installation.

(b) Where conduits are to be installed directly alongside door frames, beams, etc. that are not true, conduits shall be installed parallel to the frames, beams, etc.

(c) All labels shall be removed from surface mounted conduit.

8.2 Saddles

Conduits shall be firmly secured by means of saddles and screws and in accordance with SANS 10142. Where saddles are used to secure vertical lengths of conduit connected to surface mounted switch boxes or socket outlet boxes, the saddles shall be spaced so that the intervals between the box and the first saddle, between any two successive saddles and between the last saddle and the ceiling or roof are equidistant. Conduits shall be secured within 150 mm before and after each 90° bend and within 100mm of each outlet box.

8.3 Joints

Joints will only be allowed in surface conduit lengths exceeding 3,5 m. Threads shall not be visible at joints of completed installations, except where running joints are used. Running joints will be allowed only when

absolutely necessary. All running joints shall be provided with locknuts and shall be painted with red lead immediately after installation.

8.4 Accessories

Inspection bends or tee pieces shall not be used. Non-inspection type bends may be used in the case of 32mm or 50 mm diameter conduits. All draw-boxes supporting luminaries or other equipment shall be fixed independently of the conduit installation.

8.5 Offsets

Where an offset is required at conduit terminations or crossovers, the conduit shall be saddled at the offset.

8.6 Cross-over

Conduit routes shall be carefully planned to avoid crossovers. Where a crossover is inevitable, one conduit only shall be offset to cross the other. Crossovers shall be as short as possible and shall be uniform. Alternatively, crossovers shall be installed in purpose-made boxes. This method shall be employed on face brick walls and in other circumstances where required by the Department.

8.7 Parallel Conduit

Parallel conduit runs shall be equidistant and saddles shall be installed in line. Alternatively, a special clamp may be used to secure all conduits in unison. In the case of conduits of different diameters, the latter method shall only be used if a purpose-made clamp designed to accommodate the various conduit sizes, is provided.

8.8 Painting of Conduit

All surface mounted conduits and accessories shall be painted with two coats of a high quality enamel paint or as otherwise specified. The colour shall comply with the colour code specified for the installation or where no code has been specified, shall match the colour of the surrounding finishes.

8.9 Conduit in Roof Spaces

8.9.1 In open roof spaces (no ceiling) conduits shall run along the wall plates and the rafters. The installation of conduits suspended between the rafters is not acceptable.

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

8.9.3 Nails or crampets will not be allowed.

8.9.4 Under flat roofs in false ceilings or where there is less than 900 mm clearance, or in instances where the ceilings are insulated with glass-wool or other insulating material impeding access, the conduit shall be installed in a manner which allows for wiring from below the ceilings.

8.9.5 Conduit runs from switchboards shall terminate in fabricated sheet steel draw-boxes installed directly above or in close proximity to the boards. Refer to the Department's standard specification for "CONNECTIONS TO SWITCHBOARDS", par. 2 of Section B10.

8.9.6 Spare conduits covering the total number of spare ways on switchboards, shall be provided between the boards and the roof draw-box.

8.9.7 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 450mm throughout the installation. The contractor shall supply and install all additional supporting timbers in the roof space as required.

8.10 Fixing to Walls

Only approved plugging materials such as aluminium inserts, fibre plugs or plastic plugs, etc., and round-head screws shall be used when fixing saddles, switches, plugs etc. to walls. Wood plugs are not acceptable nor should plugs be installed in joints in brick walls.

9. FUTURE EXTENSIONS

9.1 Open Roof Spaces

Conduits intended for future switches and socket outlets, shall terminate 40 mm above the tie beams in roof spaces with more than 900 mm free space. The conduit ends shall be threaded and fitted with a coupling and brass plug.

9.2 Concrete Slabs

Conduit ends shall protrude 150 mm from the concrete to facilitate the installation of future extensions above, below or to the side of the concrete slabs. All these conduits shall be connected to a draw-box, which is cast into the concrete within 2 m of the end of the concrete. Conduit ends shall be threaded and fitted with a coupling and brass plug. In cases where holes cannot be drilled through the shuttering to accommodate the conduit end, a deep draw-box with rear entry may be placed over the conduit end.

9.3 Cover Plates

Unused boxes for switches and socket-outlets shall be covered with metal cover plates. Unused boxes for luminaries shall be covered with round galvanised metal cover plates, which fit tightly against the finished surface. The cover plate shall overlap the outlet box and recess.

9.4 Galvanised Conduit

Galvanised conduit shall be installed at all free ends intended for future extensions. The conduit shall be treated with a paint, which will prevent corrosion and white rust.

10. EXPANSION JOINTS

10.1 Where conduits cross expansion joints in the structure, approved draw-boxes which provide a flexible connection in the conduit installation shall be installed. Refer to the Department's standard drawing No EE3/136/139.

10.2 The draw-box shall be installed adjacent to the expansion joint of the structure and a conduit sleeve, one size larger than that specified for the circuit, shall be provided on the side of the draw-box nearest the joint. The one end of the sleeve shall terminate at the edge of the joint and the other shall be secured to the draw-box by means of locknuts.

10.3 The circuit conduit passing through the sleeve shall be terminated 40 mm inside the draw-box and in the case of metallic conduit, the conduit end shall be fitted with a brass bush. The gap between the sleeve and the conduit at the joint shall be sealed with 'Pratley Tic-Tac' or equal sealing compound, to prevent the ingress of wet cement. In the case of metallic conduit, an earth clip shall be fitted to the conduit projection inside the draw-box and the conduit bonded to the box by means of 2,5mm2 bare copper earth wire and a brass bolt and nut.

10.4 The end of the other circuit conduit shall be secured to the draw-box by means of locknuts and a brass bush in the case of screwed metallic conduit or a standard bushed adaptor for other conduit types.

10.5 In the case of metallic conduit, a 2,5mm^2 bare copper wire shall be installed between the first conduit boxes on either side of the joint, in addition to an earth wire, which may be specified for the circuit. The conduit boxes shall be drilled and tapped and the earth wire shall be bonded to the boxes by means of lugs and brass screws.

10.6 Suitable steel cover plates shall be screwed to draw-boxes installed along the expansion joint. The cover plates shall be installed before the ceilings are painted.

10.7 Where a number of conduits are installed in parallel they shall cross the expansion joint of the structure via a single draw-box. A number of draw-boxes adjacent to each other will not be allowed.

11. CHASES AND BUILDER'S WORK

11.1 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.

11.2 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.

11.3 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.

11.4 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.

11.5 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.

SECTION B2

B2. INSTALLATION OF WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING

1. RESPONSIBILITY OF THE CONTRACTOR

The Contractor shall supply and install all wiring channels, underfloor ducting and power skirting as specified or as required for the cable, socket outlet and wiring installation including the necessary supports, hangers, fixing materials, bends, angles, junctions, T-pieces, etc. He shall further liaise with the Main contractor to verify the position of holes and access routes through the structure and finishes.

(Refer to the Department's quality specification for "WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING", Section C2 to determine which types are acceptable).

2. WIRING CHANNELS

2.1 Fixing

The Contractor shall supply and install all hangers, supports or fixings for the channels. Channels up to and including 76 x 76 mm shall be supported at maximum intervals of 600 mm and larger channels at maximum intervals of 1 m. Channel runs shall be carefully planned to avoid clashes with other services and to ensure that all covers can be removed after completion of the entire installation. Purpose made clamps, hangers, etc. shall be used as required. Where it is not possible to support the channels at the specified intervals, they shall be supported in a sound manner to the satisfaction of the Department.

2.2 Installation in Concrete

Where channels are cast into concrete, the insert type shall be used. Additional spacer blocks shall be used where necessary to prevent ducts from being deformed while the concrete is cast. Channels shall be filled with polystyrene or other suitable fillers to prevent the ingress of concrete and shall be securely fixed in position to the shuttering.

2.3 Cover Plates

All channels up to and including 127mm width shall have snap-in cover plates of metal or PVC. Cover plates for wider channels shall be of metal and shall be fixed by means of screws at suitable intervals to prevent warping. Cover plates shall be installed over the full length of the channels. Flush mounted wiring channels shall be fitted with overlapping metal cover plates with plastic edge trim to cover irregularities in the wall recess.

2.4 Joints

Adjoining lengths shall be aligned and securely joined by means of fishplates fixed by mushroom bolts, washers and nuts or connection pieces that are pop-riveted to both adjoining sections. All adjoining sections shall be rectangular and shall butt tightly. Covers shall fit tightly across the joints.

Where channels cross expansion joints in the structure, suitable expansion joints shall be provided in the channels by means of fishplates pop-riveted or screwed to the channel on one side of the expansion joint and floating freely in the channel on the other side of the expansion joint.

2.5 Support for Conductors

All conductors in inverted cable channels shall be retained by means of metal clips or metal spacer bars at not more than 1m centres. Where vertical duct lengths exceed 5m, conductors installed in the channels shall be secured at intervals not exceeding 5m to support the weight of the conductors. Clamps shall be provided in suitable draw-boxes for this purpose.

2.6 Conduit Connections

Conduit connections shall be terminated by means of two locknuts and a brass female bush. Where the channel is wide enough, conduit connections may be made by means of a conduit box and hole through the back or side of the channel. All holes through which conductors pass shall be fitted with bushes or grommets or shall be sleeved.

2.7 Internal Finishes

Bends and T-joints shall be constructed to ensure compliance with the allowable bending radii specified in SANS 10142, Appendix D in the case of PVC-insulated cables and conductors and shall comply with the relevant specification in the case of other cables. Burrs and sharp edges shall be removed and the inside edges of the joints shall be lined with rubber cement or other suitable rubberised or plastic compound to prevent laceration of the conductor insulation.

2.8 Vermin proofing

All cable channels shall be vermin proofed after installation. Holes shall be covered by means of screwed metal plugs or by means of metal strips, which are bolted, or pop-riveted to the channel. Wooden or other plugs which are driven into holes or other temporary plugs or covers are not acceptable.

2.9 Services

Multiple duct runs or internal metal partitions shall be used where conductors for power, control, communication and other services are present.

3. UNDERFLOOR DUCTING

3.1 General

3.1.1 Two or three compartment underfloor ducting as specified shall be supplied and installed in the positions and according to the layouts indicated on the drawings.

3.1.2 Three compartment ducting shall have a cross-section of approximately 200 x 32mm, subdivided into three approximately equal compartments, of which the centre compartment shall be used for electrical power distribution with the two outer compartments for telephone and other light current services respectively.

3.1.3 Unless specified to the contrary in the Detail Technical Specification or on the drawings, each compartment shall be provided with openings (occurring in line) at 1,5 m centres to permit installation of pedestals or recessed outlets in accordance with the design of the system. The openings shall have removable, flush, cover plates and shall have prepared fixing holes for future installation of pedestals or recessed outlets. The centre of the openings shall be offset a distance of 200 mm from the building nodule lines.

3.2 Junctions

The underfloor ducting installation shall be provided with flush cross-over, T-junction and right angle bend draw-boxes installed in the runs of ducting, generally as indicated on the drawings. The junction boxes shall be complete with cross-over of services. The junction boxes shall have nominal 300 x 300mm removable cover plates secured by means of four countersunk screws.

3.3 Pedestal Units

Where the system accommodates floor pedestal units, these shall consist of pressed steel or die cast aluminium units, suitable for either two or three services, as specified in the Detail Technical Specification. Where the pedestals are installed on vinyl tiled or similar floors which will be subject to washing, a matching waterproofing gasket shall be supplied below each pedestal to render the junction waterproof.

3.4 Installation

The underfloor ducting, junction boxes, pedestals, outlets and other accessories shall be installed strictly in accordance with the manufacturer's instructions and according to the following procedure:

a) The underfloor ducting shall be installed on a mortar bed, provided by the Plasterer for purposes of levelling the channel to the final floor screed level. The Contractor shall assist the Plasterer in marking out the layout of the ducting to enable the mortar bed to be laid. Final height of the underfloor ducting shall be determined in close liaison with the Builder.

b) After installation of the mortar bed, the components of the underfloor ducting shall be assembled and installed by the Contractor, following which the screeding will be completed.

3.5 Terminations

Up bends manufactured by the supplier of the underfloor ducting shall be supplied and installed wherever the ducting is terminated at a switchboard, telephone duct or telephone distribution box or where the ducting terminates behind power skirting.

3.6 Wiring

3.6.1 Power circuit wiring shall be installed in the centre compartment of the underfloor ducting. Sufficient slack shall be provided to allow for the installation of a floor pedestal outlet at each opening in the ducting, whether an outlet is specified at that position or not. This provision shall take the form of loops in the wiring, including the earth wire, wherever the openings occur. The loops shall be pushed back into the channel and the cover plates replaced. In the instances where pedestals/outlets are not installed, these provisions shall of necessity only be made for the area covered by the circuit and not for the run from the switchboard.

3.6.2 The entire underfloor ducting installation shall be effectively earthed and bonded together.

3.6.3 Galvanised draw-wires shall be supplied and installed along the entire length of the telephone and light current service compartments of the underfloor ducting. The draw-wires shall be interrupted at the junction boxes, with enough slack left coiled up to facilitate the drawing in of cables by others.

3.7 Expansion Joints

Where expansion joints in the buildings are crossed by underfloor ducting, expansion joints shall be provided as detailed in par. 2.4 of this section.

4. POWER SKIRTING

4.1 General

4.1.1 Two or three compartment power skirting as specified shall be supplied and installed in the positions and according to the layouts indicated on the drawings.

4.1.2 The top compartment shall be used for power wiring and switched socket outlets, whilst the bottom compartments shall be for telephone and other light current services.

4.2 Module

4.2.1 The power skirting shall be manufactured from 1mm (minimum) thick sheet steel or aluminium (as specified) in approximately 2,5m lengths.

4.2.2 The covers shall be manufactured in modular lengths, as specified in the Detail Technical Specification or otherwise in 1 m lengths and shall be secured to the wall channel by means of toggle or swivel nuts. Snap-in covers are also acceptable.

4.2.3 At the building module lines, covers of specified length or otherwise in 250 mm lengths shall be installed, against which partition walls may be installed, thereby trapping these covers. The removable modular covers shall be installed between these "fixed" covers.

4.2.4 Each modular cover associated with the power compartment shall be punched and prepared for the installation of either a 13A or a 16A, 3-pin standard flush switched socket outlet, whether any is

specified or indicated for that module or not. Where socket outlets are not installed, the punched holes shall be blanked off with a metal blanking plate, painted the same colour as the power skirting and installed at the back of the covers. These blanking plates shall be easily removable to permit future installation of socket outlets.

4.2.5 Unless otherwise specified, no provision shall be made on the covers of the telephone or light current services compartments for the installation of sockets.

4.2.6 Factory-made end covers shall be installed at the ends of all runs of power skirting. All internal and external bends or offsets shall be factory-made and shall be installed to provide a neat and workmanlike appearance.

4.3 Painting

The power skirting shall be painted in a colour as specified in the Detail Technical Specification. The painting of steel power skirting shall comply with the Department's "STANDARD PAINT SPECIFICATION", Section C39. Aluminium power skirting shall be anodised. The power skirting channels and covers shall be individually wrapped or packed to protect them against damage in transit and before installation.

4.4 Socket-outlets

4.4.1 Standard 13 A or 16 A, 3-pin flush switched socket outlets (100 x 50 mm nominal size) shall be supplied and installed in the positions indicated on the drawings and as specified in the Detail Technical Specification.

4.4.2 The switched socket outlets shall be secured to the channel by means of suitable brackets.

4.4.3 After installation of the modular front covers, they shall be screwed to the socket outlets to ensure proper alignment between the two components. Separate standard covers need not be provided for the socket outlets.

4.5 Conduit Feeders

4.5.1 Conduits for the circuit wiring to the power skirting shall be installed in the floor slab and shall terminate in flush conduit or boxes, behind the power skirting and installed to match the height of the power, telephone and light current services compartments of the skirting.

4.5.2 The wiring/cables shall pass through large diameter holes cut in the rear of the power skirting. The holes shall be suitably bushed or trimmed to prevent damage to the wiring or cables.

4.5.3 Alternatively conduits feeding to the telephone compartment may be terminated in boxes facing upwards in the floor slab immediately below the power skirting, with suitable bushed or trimmed openings being provided through the bottom of the power skirting duct for the cables to pass through. (Applicable only where the power skirting occurs at floor level).

4.6 Power skirting at Doorways

Where a section of power skirting is interrupted by a doorway, bridging conduits shall be installed to interconnect the power skirting sections. Where conduits are not specifically indicated, a minimum of 1 x 32mm bridging conduit shall be installed for each of the power, light current and telephone compartments.

4.7 Cleaning

Prior to fitting front covers, the power skirting shall be thoroughly cleaned to remove all dust and rubble and damage to paintwork where this has occurred, shall be repaired.

SECTION B3

B.3 INSTALLATION OF CABLE TRAYS AND LADDERS

1. GENERAL

Cable trays and cable ladders complying with the Department's standard specification for "CABLE TRAYS AND LADDERS", Section C3 shall be supplied and installed where specified and/or where generally suitable for cable distribution.

2. RESPONSIBILITY OF THE CONTRACTOR

The Contractor shall supply and install all cable trays and/or ladders as specified or as required by the cable routes including the necessary supports, clamps, hangers, fixing materials, bends, angles, junctions, reducers, T-pieces etc. He shall further liaise with the Main Contractor for the provision of holes and access through the structure and finishes.

3. SUPPORTS

Cable tray supports shall consist of two steel hangar rods, at least 8mm in diameter, on both sides of the tray with a substantial steel cross-member on the underside of the tray and bolted to the rods. Alternatively, cable trays may be cantilevered from walls on suitable brackets.

4. SPACING OF HORIZONTAL SUPPORTS

4.1 Horizontal trays shall be supported at the following maximum intervals:

(a) 1,2 mm to 1,6 mm thick metal with 12mm to 19 mm return trays. 1m maximum spacing

(b) 2,5 mm thick metal trays with 76 mm return 1,5m spacing.

(c) Cable ladders with 76mm side rail of 2mm thickness and with crossrungs. 1,5m spacing

(d) Metal cable ladders other than c) above, including site manufactured angle iron types 1m spacing

(e) 3 mm thick PVC trays with 40mm return. 1m maximum spacing

(f) 4 mm thick PVC trays with 60mm return 1,5m maximum spacing

4.2 In addition to the above spacing on the longitudinal run, trays and ladders shall be supported at each bend, offset and T-junction.

5. JOINTS

5.1 Joints shall be smooth and without projections or rough edges that may damage the cables. The Contractor will be required to cover joints with rubber cement or other non-hardening rubberised or plastic compounds if in the opinion of the Department joints may damage cables.

5.2 Joints shall as far as possible be arranged to fall on supports. Where joints do not coincide with supports, joints shall be made by means of wrap-around splices of the same material as the tray and at least 450mm long. The two cable tray ends shall butt tightly at the centre of the splice and the splice shall be bolted to each cable tray be means of at least 8 round head bolts, nuts and washers. Splices shall have the same finish as the rest of the tray.

5.3 Splices as described above shall be provided at joints, which do coincide with supports if the loaded tray sags adjacent to the joint due to the interruption of the bending moment in the tray.

6. FIXING TO SUPPORTS

Trays shall be bolted to supports by at least two round head bolts per support. Bolts shall be securely tightened against the tray surface to avoid projections which might damage cables during installation.

7. FIXING TO THE STRUCTURE

7.1 Where installed on concrete or brick, the supports for cable trays and ladders shall be securely fixed by means of at least 2 heavy duty, expansion type anchor bolts. Cantilevered trays shall be supported by a minimum of two 6mm diameter expansion bolts per support.

7.2 It is the responsibility of the Contractor to ensure that adequate fixing is provided since cable trays and ladders that work loose shall be rectified at his expense. The fixing shall take into account site conditions that prevail during installation.

7.3 Where installed on vertical steelwork, cable trays and ladders shall be fixed by means of 6mm diameter bolts and nuts.

7.4 On horizontal steelwork, use may alternatively be made of "CADDY" type fasteners.

7.5 Horizontal trays and ladders shall in general be installed 450 mm below slabs, ceilings, etc. to facilitate access during installation of cables.

7.6 Multiple runs shall be spaced at least 300 mm apart unless a different spacing is specified in the Detail Technical Specification.

8. INSTALLATION OF CABLES

Cables shall be installed adjacent and parallel to each other on the trays with spacings as specified in the Department's standard specification for "INSTALLATION OF CABLES", Section B6, and snaked slightly to allow for expansion. Cables shall present a neat appearance and shall under no circumstances be bunched. Cables shall be clamped at maximum intervals of 3 m when installed on horizontal trays and at maximum intervals of 600 mm when installed on vertical trays.

9. EARTHING

Metal trays and ladders shall be bonded to the earth bar of the switchboard to which the cables are connected. Additional bare copper stranded conductors or copper tape shall be bolted to the tray or ladder where the electrical continuity cannot be guaranteed. These additional conductors or tapes shall always be installed in outdoor applications and in coastal regions.

10. CORROSION

PVC trays shall be used in corrosive atmospheres. All supports shall be adequately protected against corrosion, preferably with a powder coated paint finish in accordance with the Department's "STANDARD PAINT SPECIFICATION", Section C39.

SECTION B4

B.4 FIXING MATERIALS

1. RESPONSIBILITY

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

2. FINISHING

All unpainted supporting steelwork installed by the Contractor shall be wire brushed and given one coat of rust-resisting primer, followed by one coat of high quality enamel paint before any other equipment is fixed.

3. STRUCTURAL STEEL

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

4. SCREWS AND BOLTS

Where holes exist in equipment to be fixed, bolts and fixing screws as specified shall be used. Where sizes are not specified, the largest bolt or screw that will fit into the hole shall be used.

5. WALL PLUGS

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

6. ANCHOR BOLTS

Where the fixing holes are 10mm and larger or where the mass of the equipment is 10kg, equipment shall be fixed by means of expanding anchor bolts or by means of bolts cast into the concrete or built into walls.

7. GALVANISED EQUIPMENT

Brass screws bolts and nuts shall be used to fix galvanised equipment.

8. SHOT-FIRED FIXING

8.1 Materials such as metal cable ducts or channels may be fixed against walls and concrete slabs by means of the shot-fired fixings.

8.2 The Contractor shall ascertain whether this method of fixing will carry the weight of the material including conductors, cables and other items of equipment to be installed later. Should it be found that the method of fixing is inadequate and supports tend to loosen, the Contractor will be required to fix the material by an alternative method to the satisfaction of the Department.

8.3 Where the shot-fired method is used, warning signs shall be placed at all entrances leading to the area where this work is in progress. The Contractor shall take all reasonable precautions to prevent accidents. Refer also to The Occupational Health and Safety Act.

8.4 Nails and explosive charges recommended by the manufacturer shall be used throughout.

9. CLAMPS AND BRACKETS

Clamps and brackets used to fix or support equipment such as cable trays, ducts, etc. shall be of a purpose-made type suitable for the specific application. Refer also to the Department's standard specification for "CABLE TRAYS AND LADDERS", Section B3 and "INSTALLATION OF WIRING CHANNELS", Section B2.

SECTION B5

B.5 WIRING

This section covers wiring in approved wire-ways for electrical installations in buildings or other structures under normal environmental conditions for 50 Hz systems not exceeding 600 V.

1. TYPE OF CONDUCTORS

PVC-insulated or equivalent, stranded copper conductors and bare stranded or green PVC-insulated copper earth conductors complying with the Department's quality specification for "PVC-INSULATED CABLES", Section C4, shall be used exclusively. Only where cables are specified or in instances where the exceptions stipulated in SANS 10142 are applicable, may the Contractor deviate from this requirement.

2. WIRE-WAYS

2.1 All unarmoured conductors shall be installed in conduits, cable channels (trunking) or power skirting and shall under no circumstances be exposed. Cable channels and power skirting shall be of metal construction unless specifically approved to the contrary.

2.2 Tenderers must note that common wire-ways will only be permitted for relatively light current-carrying conductors such as lighting and socket-outlet circuits. Refer also to par. 4 below. Heavy current-carrying conductors such as feeders to distribution boards and large power points, must be installed in separate conduits or wire-ways.

3. ORDER OF WORK

Wiring shall only be carried out after the wire-way installation has been completed, but before painting has commenced. Debris and moisture shall be removed from the wireways prior to the installation of the conductors.

4. CIRCUITS

Conductors that are connected to different switchboards, shall not be installed in the same wireway. The wiring of one circuit only will be allowed in a 20 mm dia. conduit with the exception of the wiring from switchboards to fabricated sheet metal boxes close to switchboards in which case more than one circuit will be allowed. For larger conduit sizes the requirements of SANS 10142, shall be met.

5. LOOPING AND JOINTS

A loop-in wiring system where conductors are looped from outlet to outlet, shall be employed. Joints in conductors shall be avoided as far as possible but where it becomes unavoidable, joints will be accepted in cable channels only and not in conduits. Joints shall be soldered or shall alternatively consist of approved ferruling, properly covered with heat-shrink sleeves. The use of PVC insulation tape is not acceptable.

6. GROUPING OF CONDUCTORS

In cases where the conductors of more than one circuit are installed in the same wireway, the conductors of each separate circuit (including earth conductor) shall be taped at intervals of 1m with PVC insulation tape. The conductors of different circuits shall however remain separate in order that any given circuit can be withdrawn. Conductors entering switchboards or control boards shall be grouped and bound by means of plastic or metal bands (not tape).

7. CABLE TRAYS

Conductors may only be installed directly on cable trays if specifically approved by the Department. In these cases cable trays shall be at least 2m above walkways or working areas. Conductors of the same circuit shall be grouped in the same manner as described in the previous paragraph. All the conductors on the

cable tray shall then be tied down securely to the cable tray at intervals of 2m or less by means of plastic or metal bands (not tape).

8. DRAWING-IN OF CONDUCTORS

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

9. THREE-PHASE OUTLETS

9.1 With the exception of three-phase outlets, circuits connected to different phases shall not normally be present at lighting, switch or socket outlet boxes. Where this is unavoidable, barriers shall be provided between terminals or connections of the various phases and the box shall be suitably labelled internally to indicate the presence of three phase voltages.

9.2 A neutral conductor shall be installed to all three phase outlets intended for equipment connection, whether sockets or isolators, irrespective of whether the particular equipment normally requires a neutral or not.

10. VERTICAL CONDUIT INSTALLATION

Conductors installed in vertical wire-ways shall be secured at intervals not exceeding 5m to support the weight of the conductors. Clamps shall be provided in suitable drawboxes for this purpose.

11. CONNECTIONS

The insulation of conductors shall only be removed over the portion of the conductors that enter the terminals of switches, socket outlets or other equipment. When more than one conductor enters a terminal, the strands shall be securely twisted together. Under no circumstances shall strands be cut off.

12. EARTHING CONDUCTORS

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

12.2 The installation shall be earthed to comply with SANS 10142.

12.3 The installation shall be bonded to comply with SANS 10142.

13. COLOURS

The colours of conductor insulation shall comply with SANS 10142. The colours of conductors for sub-circuits shall as far as possible correspond with the colour of the supply phase. The colours of conductors for wiring to two-way and intermediate switches shall preferably differ from the colour of phase conductors.

14. SINGLE-POLE SWITCHES

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

15. SIZE OF CONDUCTORS

Where conductor sizes are not specified, the following <u>minimum</u> conductor sizes shall be used:

Lighting circuits:	1,5mm² and 2.5mm² copper earth conductor
Socket-outlet circuits:	2,5mm² and 2,5mm² copper earth conductor.
Bell circuits:	1,5mm²

Stove circuits: 10mm² and 6mm² copper earth conductor

Clock circuits: 1,5mm²

16. PARTITIONS

16.1 When wiring is installed in removable partitions, the vertical and/or horizontal metal supports of the walls may be utilised for wiring on condition that:

(a) the conductors are not exposed,

(b) the metal supports are properly earthed,

(c) a separate bare earth continuity conductor is drawn in together with the current carrying conductors and is earthed to the metal parts of the switches and/or the socket-outlets, and

(d) conductors are installed in the metal and non-inflammable sections of the partitions.

16.2 Conductors enclosed in a copper braiding (harness wiring) may be installed in removable partitions. The braiding can be used as earth continuity conductor. The wiring shall be joined to the conduit (or cable) installation by interconnecting the conductor and the earth conductors in a draw-box using suitable ferrules and heat-shrink sleeves or screwed terminals.

SECTION B6

B.6 INSTALLATION OF CABLES

This section covers the installation of cables for the distribution of power in buildings, other structures and in ground for system voltages up to 11 kV, 50 Hz.

1. GENERAL

1.1 Cable Types

(a) All cables and jointing and termination accessories used for power distribution shall comply with the Department's Quality Specifications, Section C.

(b) Cables with copper conductors shall be used throughout unless otherwise specified or approved.

(c) All unarmoured cables shall be installed in metal trunking, sleeves or conduit unless clearly specified to the contrary.

(d) XLPE Cables shall only be used in exceptional circumstances with the written permission of the Department.

1.2. Competence of Personnel

It is a definite requirement that the Contractor shall only employ personnel fully conversant with cable manufacturer's recommendations for joining and terminating cables.

2. IDENTIFICATION OF CABLES

2.1 Cables shall be identified at all terminations by means of punched metallic bands or marked with labels or tags. (Refer also to SANS 10142).

2.2 The use of PVC tape with punched characters is not acceptable.

2.3 The identification numbers of cables shall be shown on "as built" drawings of the Installation.

3. TRENCHING

3.1 General

3.1.1 The Contractor shall be responsible for all trenching excavations unless specified to the contrary.

3.1.2 The Contractor shall, before trenching commences, familiarise himself with the routes and site conditions and the procedure and order of doing the work shall be planned in conjunction with the general construction programme for other services and building requirements.

3.1.3 The Contractor shall acquaint himself with the position of all the existing services such as stormwater pipes, water mains, sewer mains, gas pipes, telephone cables, etc. before any excavations are commenced. For this purpose he shall approach this Department's representative, the local municipal authority and any other authority which may be involved, in writing.

3.1.4 The Contractor will be held responsible for damage to any existing services brought to his attention by the relevant authorities and shall be responsible for the cost of repairs.

3.1.5 The Contractor shall take all the necessary precautions and provide the necessary warning signs and/or lights to ensure that the public and/or employees on site are not endangered.

3.1.6 The Contractor shall ensure that the excavations will not endanger existing structures, roads, railways, other site constructions or other property.

3.2 Mechanical Excavators

3.2.1 Power driven mechanical excavators may be used for trenching operations provided that they are not used in close proximity to other plant, services or other installations likely to be damaged by the use of such machinery.

3.2.2

3.2.2 The use of power driven mechanical excavators shall be subject to the approval of the Department. Should the excavator produce trenches that exceed the required dimensions, payment based on volumetric excavation rates will be calculated on the required dimensions only.

3.3 Blasting

3.3.1 No guarantee is given or implied that blasting will not be required.

3.3.2 Should blasting be necessary and approved by the Department, the Contractor shall obtain the necessary authority from the relevant Government Departments and Local Authorities. The Contractor shall take full responsibility and observe all conditions and regulations set forth by the above authorities.

3.4 Routes

3.4.1 Trenches shall connect the points shown on the drawings in a straight line. Any deviations due to obstructions or existing services shall be approved by the Department beforehand. Refer also to par. 10.4.

3.4.2 The Department reserves the right to alter any cable route or portion thereof in advance of cable laying. Payment in respect of any additional or wasted work involved shall be at the documented rates.

3.4.3 The removal of obstructions along the cable routes shall be subject to the approval of the Department.

3.5 Shoring and Waterlogging

3.5.1 The Contractor shall provide shoring for use in locations where there is a danger of the sides of the trench collapsing due to waterlogging or other ground conditions. Refer to the The Occupational Health and Safety Act.

3.5.2 The strength of shoring must be adequate for site conditions prevailing and the shoring must be braced across the trench.

3.5.3 The Contractor shall provide all pumps and equipment required to remove accumulated water from trenches. Water or any other liquid removed shall be disposed of without any nuisance or hazard.

3.6 Trenching

3.6.1 Trenching shall be programmed in advance and the approved programme shall not be departed from except with the consent of the Department.

3.6.2 Trenches shall be as straight as possible and shall be excavated to the dimensions indicated in this specification.

3.6.3 The bottom of the trench shall be of smooth contour, and shall have no sharp dips or rises which may cause tensile forces in the cable during backfilling.

3.6.4 The excavated material shall be placed adjacent to each trench in such a manner as to prevent nuisance, interference or damage to adjacent drains, gateways, trenches, water furrows, other works, properties or traffic. Where this is not possible the excavated materials shall be removed from site and returned for backfilling on completion of cable laying.

3.6.5 Surplus material shall be removed from site and disposed of at the cost of the Contractor.

3.6.6 Trenches across roads, access ways or footpaths shall not be left open. If cables cannot be laid immediately the Contractor shall install temporary "bridges" or cover plates of sufficient strength to accommodate the traffic concerned.

3.6.7 In the event of damage to other services or structures during trenching operations the Contractor shall immediately notify the Department and institute repairs. (Refer to par. 3.1.3 and 3.1.4)

3.6.8 Prior to cable laying the trench shall be inspected thoroughly and all objects likely to cause damage to the cables either during or after laying shall be removed.

3.6.9 Where ground conditions are likely to reduce maximum current carrying capacities of cables or where the cables are likely to be subjected to chemical or other damage or electrolytic action, the Department shall be notified before installing the cables. The Department will advise on the course of action to be taken.

3.6.10 Extreme care shall be taken not to disturb surveyor's pegs. These pegs shall not be covered with excavated material. If the surveyor's pegs are disturbed, they shall be replaced by a person qualified to do so.

3.7 Dimensions of trenches

3.7.1 Cable trenches for one or two cables shall not be less than 300 mm wide and need not be more than 450 mm wide. This dimension shall be valid for the total trench depth.

3.7.2 The width shall be increased where more cables are installed to allow for the spacings stipulated in par. 4.2.

3.7.3 Where trenches change direction or where cable slack is to be accommodated, the Contractor shall ensure that the requirements of the relevant SANS Specification regarding the bending radii of cables are met when determining trench widths.

3.7.4 Trench depths shall be determined in accordance with cable laying depths and bedding thickness.

3.7.5 Payment will be made on a volumetric excavation rate calculated on the basis of the given maximum dimensions or the actual dimensions, whichever is the lesser. Refer also to par. 3.2.2 and 3.7.1 above.

3.8 Joint Holes

Where cable joints are required to be made in the course of a cable run, a joint hole shall be excavated of sufficient size to enable the cable jointer to work efficiently and unimpeded.

3.9 Bedding

3.9.1 The bottom of the trench shall be filled across the full width with a 75mm layer of suitable soil sifted through a 6mm mesh and levelled off.

3.9.2 Only sandy clay or loam soil with a satisfactory thermal resistivity (not exceeding 1,5°C m/W) may be used for this purpose. Sea or river sand, ash, chalk, peat, clinker or clayey soil shall not be used. The use of crusher sand is acceptable.

3.9.3 Where no suitable soil is available on site, the Contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for bedding purposes shall be included in the unit rates for excavations.

3.9.4 After cable laying a further layer of bedding shall be provided to extend to 75 mm above the cables.

3.9.5 The bedding under joints shall be fully consolidated to prevent subsequent settling.

3.10 Cable Sleeves

3.10.1 Where cables cross under roads, railway tracks, other service areas, etc. and where cables enter buildings, the cables shall be installed in Polyethylene (6mm thickness), asbestos cement pipes or earthenware pipes. Pitch fibre and PVC pipes are not acceptable because of the adhesion that occurs after a period of time between the pipe and the sheathing or outer serving of the cables.

3.10.2 Pipes shall be joined in accordance with the manufacturer's instructions.

3.10.3 Sleeves shall cross roads and railway tracks at right angles.

3.10.4 Sleeves shall have a minimum diameter of 100mm. They shall extend at least 2m beyond the tracks of a railway line or of the outermost tracks where there is more than one line. In the case of roads, the sleeves shall extend at least 1m beyond the road edge or kerb on both sides of the road.

3.10.5 All sleeves shall be graded 1:400 for water drainage.

3.10.6 Cable sleeves shall be installed to the spacings and depths stated in paragraph 4 below.

3.10.7 Galvanised metallic sleeves up to and including 76mm dia. shall be supplied and installed by the contractor.

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

3.11 Backfilling

3.11.1 The Contractor shall not commence with the backfilling of trenches without prior notification to the Department so that the cable installation may be inspected. Should the Contractor fail to give a timeous notification, the trenches shall be re-opened at the Contractor's cost. Such an inspection will not be unreasonably delayed.

3.11.2 For high voltage cables (1 kV to 11 kV) a coloured plastic marking tape shall be installed 400 mm above the cable. The tape shall be yellow, marked with the words "ELECTRIC CABLE/ELEKTRIESE KABEL" in red. These markings shall not be more than 1m apart from centre to centre.

3.11.3 Backfilling shall be undertaken with soil suitable to ensure settling without voids. The maximum allowable diameter of stones present in the backfill material, is 75mm.

3.11.4 The Contractor shall have allowed in his tender for the importation of suitable backfill material if required.

3.11.5 The backfill shall be compacted in layers of 150mm and sufficient allowance shall be made for final settlement. The Contractor shall maintain the refilled trench at his expense for the duration of the contract. Surplus material shall be removed from site and suitably disposed of.

3.11.6 On completion, the surface shall be made good to match the surrounding area.

3.11.7 In the case of roadways or paved areas the excavations shall be consolidated to the original density of the surrounding material and the surface finish reinstated.

3.12 Cable Markers (for HV cables only, except where otherwise specified)

3.12.1 Cable markers shall be provided along all HV cable routes but need only be provided along LV cable routes where specified.

3.12.2 Cable markers shall consist of concrete blocks in the shape of truncated pyramids, approx. 300mm high, 150 x 150mm at the top and 250 x 250mm at the bottom.

3.12.3 Brass plates shall be cast into the tops of the blocks in such a manner that they cannot be prised loose. The wording "ELECTRIC CABLE/ELEKTRIESE KABEL" shall be stamped on the brass plates as well as direction arrows and the cable voltage rating.

3.12.4 Cable markers shall be installed on the surface along all the underground routes and shall project 35 mm above normal ground level unless the projected markers could be a hazard to pedestrian or other traffic in which case they shall be installed flush with the surface.

3.12.5 Cable markers shall be installed at the beginning and end of a cable run (e.g. where a cable enters a substation or building), at all changes of direction, above all joints, above cable pipe entries and exits and at intervals not exceeding 50 m along the cable route.

3.12.6 The position of cable markers shall be indicated on the "as built" drawings.

3.13 TRANSNET, Provincial Administration or National Road Crossings

3.13.1 The Contractor shall not trench beneath any railway tracks without the TRANSNET Administration's supervision. The Contractor shall request the Department timeously to arrange for the necessary supervision. The cost of such supervision will be paid for by the Department.

3.13.2 The Department will arrange for the necessary wayleave and permission to cross TRANSNET property and railway tracks, or Provincial or National road reserves and TELKOM Authority approval of proposed cable routes.

3.13.3 The Contractor shall carry out the crossing installation in strict accordance with the TRANSNET and Provincial Administration's requirements and stipulations. Where these requirements are in contradiction with this specification, the Department's ruling shall be sought.

3.13.4 The Contractor shall ensure that he will comply with the various Administration's requirements regarding crossing of Provincial and National roads, especially with regard to the safeguarding of the public. The Contractor shall also provide proof of adequate insurance cover against any claim from any accident as a result of work done by the Contractor during the crossing operation. The Department shall also be indemnified from all liability in this regard.

3.13.5 The Contractor shall liaise with the various Administrations well in advance regarding the intended dates, times and expected duration of the crossing operations and obtain their approval of the programme and method of operation before commencing with the work.

4. INSTALLATION OF UNDERGROUND CABLES

4.1 Installation Depths

4.1.1 Cables shall be installed at the following minimum depths below final ground level :

Up to 11kV : 8OOmm

4.1.2 All cable depth measurements shall be made to the top of the cable when laid directly in ground or to the top of the duct or sleeve where these are provided.

4.1.3 The above depths shall apply to the top layer where cables are installed in layers.

4.1.4 The Contractor may only deviate from the above depths provided prior authority in writing has been obtained from the Department. In this event the cables shall be protected with a suitable concrete covering.

4.1.5 The depth of cable pipes or ducts beneath railway lines or roads shall be not less than 1,1 m below the formation level.

4.2 Cable Spacings

4.2.1 Cables installed in the same trench shall be laid parallel to each other with the following spacings between cables (LV: up to 1 kV; HV: 1 kV to 11 kV):

LV/LV	:	2 cable diameters
LV/HV	:	150mm minimum
HV/HV	:	150mm minimum
LV/HV/PILOT	:	1 cable diameter

4.2.2 Where HV and LV cables have to be installed in the same trench, both shall be laid at a depth of 800 mm and then covered with 200mm of soil. The soil shall then be compacted, and then backfilled layer by layer and compacted until the trench is completely backfilled.

4.2.3 Cables for telephones, communication systems and other low voltage systems (less than 50 V) shall be separated from power cables by at least 1m. All control or pilot cables without a lead sheath and steel armouring shall be laid at least 300mm from power cables.

4.2.4 Cables shall not be buried on top of each other unless layers are specified. The minimum spacing between layers shall be 200mm.

4.3 Cable Laying

4.3.1 Except where ducts, tunnels or pipes are provided, cables shall be laid directly in the ground.

4.3.2 The cable shall be removed from the drum in such a manner that the cable is not subjected to twisting or tension exceeding that stipulated by the cable manufacturer.

4.3.3 Cable rollers shall be used as far as possible to run out cables. Rollers shall be spaced so that the length of cable in the trench will be totally suspended during the laying operation and sufficiently close to prevent undue sagging and the cable from touching the ground. Rollers shall also be placed in the trench in such a manner that they will not readily capsize.

4.3.4 Cable rollers shall have no sharp projecting parts liable to damage the cables.

4.3.5 Where cables have to be drawn around corners, well-lubricated skid plates shall be used. The skid plates shall be securely fixed between rollers and shall constantly be examined during cable laying operations.

4.3.6 Where cables have to be drawn through pipes or ducts, a suitable cable sock shall be used and particular care shall be exercised to avoid abrasion, elongation or distortion of any kind. In the case of oil filled cables, a cable sock may never be used. Special eyes giving access to the interior of the cable, must be utilised.

4.3.7 The maximum allowable tension when pulling a cable, is 70 N/mm2 of conductor area.

4.3.8 It will be assumed that the price or rates contained in the tender includes for the installation of cables in pipes and ducts or below existing or newly installed services.

4.3.9 The Department shall be informed timeously of the intention to carry out all cable laying operations to allow an inspection of the works by the Department if so required.

5. INSTALLATION OF CABLES IN CONCRETE TRENCHES

5.1 General

This paragraph covers the installation of cables in building trenches, service ducts, etc. The trenches, ducts, etc. inside buildings will be constructed and installed by others.

5.2 Installation

Cables shall be installed in one of the following ways:

(a) On horizontal cable trays.

(b) On horizontal metal supports with suitable clamps.

(c) On vertical cable trays or metal. supports fixed to the side of the trench. The cables shall be clamped in position.

Cables shall not be bunched and laid on the floor of the building trenches.

5.3 Covers

5.3.1 The covering of concrete trenches shall as a rule fall outside the scope of the electrical installation. The Contractor shall however be responsible for the cutting or drilling and smoothing of holes for cables through chequer plates, concrete or other coverings as required.

5.3.2 Cables shall enter and exit the trench through sleeves protruding 300mm beyond the covering. The sleeves shall be permanently secured in position and the open space between the cable and sleeves shall be sealed with a non-hardening, watertight compound.

5.4 Filled trenches

5.4.1 Where specified, floor trenches shall be filled with fine crusher sand (no river or see sand).

5.4.2 If a sand filling is specified, the cables shall be fixed to non-corroding supports.

5.4.3 Sand-filled trenches other than in substations shall be covered in one of the following ways:

(a) Reinforced concrete covers.

(b) Sand and cement screed.

(c) Removable chequer plates.

5.4.4 Method (a) above shall be used where vehicular traffic may be encountered over trenches. Unless otherwise specified allowance for a mass of 2 tons shall be made.

5.4.5 Cable trenches in substations, switch rooms and generator rooms shall be covered in accordance with the Department's standard specification for "COVERING AND SEALING OF CABLE TRENCHES", Par. 9 of Section B13.

6. FIXING OF CABLES TO TRAYS OR STRUCTURES

6.1 Installation

Cables may be installed in one of the following ways:

(a) On horizontal cable trays.
(b) Against vertical cable trays with suitable clamps.
(c) Against horizontal or vertical metal supports or brackets with suitable clamps.
(d) On clamps which are fixed to the structure.

6.2 Clamps

Suitable clamps (cleats) which will secure cables without damage shall be used. Metal clamps or drilled hard wood blocks shall be used. Clamps shall consist of adjustable metal wings which clamp to a metal support, or consist of two halves that are bolted together. The correct clamp size to fit the cable shall be used. Cables of different sizes nay only be fixed by a common clamp when the clamp is specially made to accommodate the various cables.

6.3 Spacing of Supports

Two methods of supporting cables are found in practice. The most generally known method is the restrained installation where the distance between supports is small enough to prevent any noticeable sag in the cable. The alternative method is the unrestrained installation where the distance between supports should be great enough to ensure that there will be obvious sag in each span between supports.

6.4 Spacing of Supports of Unrestrained Cables

Large single core cables shall always be installed according to this method. Generally, single core cables with conductors exceeding a cross sectional area of 185mm² should be supported at spacings in excess of 2m since the sag between supports will safely accommodate any thermal expansion.

Reducing the spacing between the supports to 1,5m or less shall be avoided at all costs, as expansion cannot be taken up by a change of sag and chances of sheath failure become considerable.

6.5 Spacing of Supports of Restrained Cables

Additional cleats shall be installed at each bend or offset in the cable run. The maximum distance between supports or cleats for multi-core control cables shall be 20 times the outside diameter of the cable with a maximum spacing of 550mm for unarmoured cables and 30 times the outside diameter of the cable with a maximum spacing of 900mm for armoured cables. Spacing of supports for cables for high voltage lighting shall be in accordance with Table 8 of SANS 10142. A minimum of 20mm ventilation clearance shall be maintained between cables and the wall to which they are cleated.

7. GROUPING AND SPACING OF CABLES IN BUILDINGS AND STRUCTURES

7.1 Spacing correction factors

Cables shall as a rule be spaced two cable diameters apart, for which no grouping correction factor need be applied.

7.2 Cables on Different Levels

Where parallel cable runs are installed at different levels (e.g. on parallel cable trays) and where the spacing of the layers is not specified, a minimum spacing of 300mm shall be maintained.

7.3 Single Core Cables

Where single core cables are installed along a three-phase circuit, the cables shall be installed in trefoil formation and bound together at 300mm intervals.

7.4 High Voltage Cables

High voltage cables shall be separated from other cables and services throughout the installation and shall as far as possible be installed in separate floor trenches, pipes or metal channels. Where this is not feasible a minimum spacing of 500 mm shall be maintained.

7.5 Cables for Other Services

Cables for telephones, communication systems and other low voltage systems (less than 50 V) shall be separated from power cables. In building ducts a physical barrier shall be provided between power cables and cables for other services. Where armoured cables are used for such other services, they shall be installed on separate cable trays or shall otherwise be at least 1m away from power cables. Where unarmoured cables are used for these other services, they shall be installed in separate conduits or metal channels.

TABLE B6.1

Cross-Sectional Area of Cable Conductors (mm²)	MAXIMUM SPACING OF SUPPORTS (CLEATS) (mm) FOR RESTRAINED CABLES			
	Wire Armoured Cables		Other than Wire Armoured Cables and Unarmoured Cables	
	Horizontal Cable Routes	Vertical Cable Routes	Horizontal Cable Routes	Vertical Cable Routes
1,5	450	750	300	400
2,5	450	750	300	400
4,0	600	750	300	400
6,0	600	750	300	400
10,0	750	900	400	450
16,0	750	1000	400	550
25,0	900	1000	450	550
35,0	900	1000	450	550
Bigger than 35,0	900	1000	450	550

For larger cables the spacing shall be 10 x outside diameter of the cable.

8. TERMINATION AND JOINTING OF CABLES

8.1 General

8.1.1 Cable ends shall be terminated with glands or in cable boxes with the associated accessories such as clamps, shrouds, etc. complying in all respects with the Department's quality specifications, Section C.

8.1.2 Connection of cables to switchgear shall always be effected in such a way that the various phases, seen from the front of the switchgear will be in the following positions:

No. 1 conductor : left (red) (A)
No. 2 conductor : centre (white) (B)
No. 3 conductor : right (blue) (C)

8.1.3 Exposed armouring shall be covered with bitumen-base paint.

8.1.4 All cable ends shall be supplied with the necessary earth connection.

8.1.5 A channel or other approved means of support shall be provided to remove mechanical stress from the glands.

8.1.6 Cable cores shall be marked with heat-shrunk sleeves where necessary to identify the phases. Refer to SANS 10142.

8.1.7 The current-carrying capacity and breakdown voltage of the cable end shall be the same as for the complete cable.

8.1.8 Cables shall be terminated in accordance with the recommendations laid down by the manufacturers of the cables and glands employed.

8.2 Termination of Paper-Insulated Cables

8.2.1 The ends shall be terminated in cable end boxes filled with bituminous, cold filling or resin oil semi-fluid compound or heat-shrinkable terminations in accordance with the Department's standard specification for "CABLE END BOXES AND COMPOUND", Section C8 or "CABLE TERMINATIONS AND JOINTS", Section C6.

8.2.2 Heat-shrinkable materials shall only be used in exceptional circumstances with the written permission of the Department.

8.2.3 Before terminating or jointing paper-insulated cables, a test to establish the presence of moisture must be carried out.

The following procedure may be followed:

(a) Place an adequate quantity of cable impregnating oil in a suitable container and heat up to 130 C ± 5 C.

(b) Cut a small length (± 300mm) of the cable concerned and remove the armouring and sheath, taking care not to handle the dielectric in any way.

(c) Dip a section of the outer insulating impregnated paper (belt paper) in the heated oil, taking care not to contaminate the tapes with moisture from the hands. If frothing appears on the surface of the oil, this is a clear indication of the presence of moisture in the paper.

(d) The same procedure should then be repeated on the insulating impregnated paper around the conductors (especially those layers closest to the conductors). Frothing will also indicate the presence of moisture.

(e) Should only a small number of bubbles appear on the surface of the oil, this is an indication of air bubbles on the paper and not moisture since the presence of moisture will result in a series of bubbles rising to the surface of the oil for a number of seconds, until all moisture has been removed.

8.2.4 The armouring shall be bonded to the main earth bar of the switchgear or transformer, but the bond shall be easily removable for testing purposes.

8.2.5 The lead sheath shall be wiped against the conical wiping gland.

8.2.6 All cut cable ends which will be exposed to the atmosphere for more than two hours shall be sealed and wiped to prevent penetration of moisture.

8.3 Termination of XLPE Cables

8.3.1 These cables shall only be used in exceptional circumstances and only with the written permission of the Department.

8.3.2 Cross-linked polyethylene cables (XLPE) shall be terminated in accordance with the Department's standard specification for "CABLE TERMINATIONS AND JOINTS", Section C6 unless a pre-fabricated system based on pre-moulded slip-on EPR stress cones is used.

8.3.3 The copper tapes of the earth screen on the cable shall be bonded to the main earth bar of the switchgear or transformer, but the bond shall be easily removable for testing purposes.

8.3.4 The cable shall be firmly secured on the switchgear by means of a clamp to prevent mechanical stress on the cable and terminations.

8.4 Termination of PVC-insulated Cables

8.4.1 Cable ends shall be terminated by means of adjustable glands in accordance with the Department's standard specification for "GLANDS FOR PVC-INSULATED CABLES", Section C5.

8.4.2 The glands shall be fitted in accordance with the cable and gland manufacturers instructions.

8.4.3 The correct size and type of gland shall be used for the particular cable and application.

8.5 Connection of Cable Conductors

8.5.1 Suitable lugs shall be used, preferably solidly sweated to the cable conductor ends. Lugs may be crimped, using mechanical or pneumatic tools designed for this purpose, on condition that evidence is submitted that the method used complies with the performance requirements of BS 4579, Part 1 : "COMPRESSION JOINTS IN COPPER".

8.5.2 Contact surfaces shall be thoroughly cleaned and smoothed and fixing bolts shall match the hole size of the lug.

8.5.3 Cables that are connected to clamp type terminals where the clamping screws are not in direct contact with the conductor, need not be lugged but the correct terminal size shall be used.

8.5.4 Ferrules shall be used as far as possible where cable conductors are connected directly to equipment with screws against the conductor strands.

8.5.5 When cutting away insulation from cable conductors to fit into lugs, care shall be taken that no strands are left exposed. Under no circumstances may any of the conductor strands be cut away to fit into lugs.

8.6 Joints

8.6.1 Joints in cable runs will not be allowed unless specified in the Detail Technical Specification or authorised by the Department.

8.6.2 Jointing shall be carried out strictly in accordance with the manufacturer's instructions and by personnel competent in jointing the types of cables used.

8.6.3 During outdoor jointing operations, the joint bays shall be adequately covered by tents of waterproof material suitably supported. Where necessary a trench shall be excavated around the bay to prevent the ingress of moisture. The sides of the hole shall be draped with small tarpaulin or plastic sheeting to prevent loose earth from falling in during jointing operations.

8.6.4 The joint shall not impair the anti-electrolysis characteristics of the cable.

8.6.5 The Contractor shall notify the Department timeously of the day on which jointing is to be carried out in order than an inspection may be arranged if so required. Any cable joint not inspected by the Department because of insufficient notice being given, shall be opened for inspection and redone at the discretion of the Department at the cost of the contractor.

8.6.6 HV cable joints on paper insulated cables shall be of the compound cast type and the compound used shall comply with the Department's standard specification for "CABLE END BOX FILLING COMPOUND", par. 2 of Section C8.

8.6.7 HV cable joints on XLPE-insulated cables shall be of the heat shrinkable type and shall comply with the Department's standard specification for "CABLE TERMINATIONS AND JOINTS" Section C6, or shall be based on a prefabricated system utilising pre-moulded slip-on stress cones.

8.6.8 LV cable joints shall be of the epoxy-resin type.

8.6.9 Joints shall be fully water and air tight and shall be free of voids and air pockets.

8.6.10 The crossing of cores in joints will not be permitted under any circumstances.

9. TESTING

9.1 Each cable shall be tested after installation in accordance SANS 1507 (up to 1 kV) and SANS 97 (up to 11 kV) as well as the requirements of the Local and Supply Authorities.

9.2 LV Cables shall be tested by means of a suitable megger at 1 kV and the insulation resistance shall be tabulated and certified.

TABLE B6.2

Cable Rating (kV)	TEST VOLTAGE (Applied for 15 minutes) (kV)				
	Paper-insulated cables				XLPE-insulated cables
6,6 11	Between conductors		Conductors to sheath		Conductors to screen
	AC (r.m.s)	DC	AC (r.m.s)	DC	DC
	12 20	18 30	12 20	18 30	11 18

* High Voltage test with DC to 2kV for 1 minute only. Discharge cable slowly via discharge stick (1 minute). Clamp all conductors to earth for 24 hours.

9.3 HV Cables shall be high voltage tested in accordance with Table B6.2 and the exact leakage current shall be tabulated and certified.

9.4 The Contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The cost of testing shall have been included in the tender price.

9.5 The Contractor shall notify the Department timeously so that a representative of the Department may witness the tests.

9.6 On completion of the tests on any cable, the Contractor shall without delay, submit three copies of the certified Test Reports to the Department.

10. MEASUREMENTS

10.1 All measurements for payments shall be made jointly by the representatives of the Department and the Contractor and the Contractor shall obtain the signature of the Department's representative including approval of such measurements.

10.2 No allowance shall be made for the breaking away of the trench sides, other earth movements or for trenches excavated in excess of the stipulated dimensions. Refer also to par. 3.7.5 above.

10.3 The classification shall be as follows:

Very hard rock shall mean rock that can only be excavated by means of explosives.

Hard rock shall mean granite, quartzitic sandstone, slate and rock of similar or greater hardness, solid shale and boulders in general requiring the use of jack hammers and other mechanical means of excavations.

Soft rock and earth shall mean rock and earth that can be loosened and removed by hand-pick and shovel.

10.4 Where very hard rock and hard rock are encountered, the prior approval of the Department shall be obtained before proceeding with the excavation. This requirement is stipulated in order to afford the Department the opportunity to determine whether an alternative cable route is justified.

10.5 All cable lengths indicated in the Detail Technical Specification and/or shown in the cable route drawings shall be regarded as estimates and are given for tendering purposes only. The successful tenderer shall measure actual cable lengths on site before ordering.

10.6 The final price for the supply and installation of all cables will be adjusted, on the basis of the actual lengths of installed cables, in accordance with the unit rates quoted at the time of tendering. Cable lengths shall be measured on site to the nearest 500mm for this purpose and surplus cable will not be paid for.

11. COMPLETION

11.1 The Department reserves the right to inspect the installation at any stage during the course of construction. Such inspections will however not deem the portions inspected as being complete or accepted and the Contractor shall remain responsible for completing the installation fully in accordance with the Contract Documents.

11.2 The Contractor shall carry out a final "as built" survey of the cable routes and present to the Department "as built" route plans of the complete installation. The following information shall be reflected on the plans or submitted as separate schedules with the plans :

(a) Overall length of each cable.

(b) Locations of all joints (if any) in relation to permanent reference points. Dimensions shall be shown and the method of triangulation i.e. two dimensions to each joint, shall be used.

(c) Identification of each cable.

11.3 The works will be deemed to be incomplete until all tests have been conducted successfully and all "as built" drawings and schedules have been handed to the Department.

SECTION B7

B.7 INSTALLATION OF LIGHT SWITCHES AND SOCKET-OUTLETS

1. GENERAL

1.1 Standards

Light switches and socket-outlets shall comply with the Department's quality specification for "LIGHT SWITCHES", Section C10 and UNSWITCHED AND SWITCHED SOCKET-OUTLETS", Section C11. Surface or flush mounted boxes and cover plates, complying with the Department's quality specification for "CONDUIT AND CONDUIT ACCESSORIES", Section C1, shall be provided.

1.2 Position of Outlets

Switches and socket-outlets shall be accurately positioned in accordance with the drawings. It is the Contractor's responsibility to ensure that all outlets are installed level and square, at the correct height from the floor and at the correct position relative to building lines and equipment positions as specified. It is the Contractor's responsibility to determine the correct final floor level and ceiling level in conjunction with the Main Contractor.

1.3 Cover Plates

All switches and socket-outlets shall be fitted with standard metal cover plates. The colour of cover plates shall be as specified or shall otherwise match the surrounding finishes as closely as possible. Unless specified to the contrary, ivory cover plates shall be installed on painted walls. Cover plates in the same area shall have the same colour. Flush mounted cover plates shall overlap the draw-box and edges of the recess. Cover plates shall under no circumstances be cut unless authorised by the Department.

1.4 Escutcheon Plates

Where flush mounted switches or socket-outlets are installed in special wall finishes e.g. wood or board panels, acoustic tiles or other cladding, etc. and where the wall finishes must be cut to accommodate the switch, it may be necessary to fix an escutcheon plate to the wall to cover the cut-outs. The escutcheon plate shall fit closely around the outlet boxes and shall be fixed independently of the boxes and cover plates. Bevelled cover plates shall be fixed to the outlet boxes and shall fit firmly against the escutcheon plate.

1.5 Appearance

The sides of adjacent switches, plugs, push-buttons etc. shall be parallel or perpendicular to each other and uniformly spaced. A common escutcheon plate shall be placed around flush mounted outlets and accessories where the standard cover plates do not cover the cut-outs in the finishes.

1.6 Deep Boxes

Where switch or socket-outlet boxes have been set deep, spiral type steel wire spacers shall be used to fix the yoke of the switch or socket.

2. INSTALLATION OF SOCKET-OUTLETS

2.1 Mounting Height

Unless specified to the contrary, socket-outlets shall be installed at the following heights above finished floor level, measured to the centre of the outlet:

Flush mounted in general:	300mm
Showrooms, shops, servants quarters:	1,4m
Domestic kitchens, tea kitchens:	1,05m
Commercial kitchens:	1,4m

Factories, workshops, garages: 1,4m

2.2 Walls

In cases where socket-outlets must be mounted at a nominal height of 300mm and where the lower portion of the wall consists of face bricks and the upper portion is plastered, the outlets shall be installed in the plastered portion of the wall. If however the plastered portion of the wall commences 500mm or more above floor level the outlets shall be installed in the face bricks. Where a wall has different surface finishes the outlets shall be installed within the same finish and not in the dividing lines between the different wall finishes. All outlets shall be installed at least 150mm away from door frames.

3. INSTALLATION OF LIGHT SWITCHES

3.1 Mounting

Light switches shall be installed 1,4m above finished floor level unless specified to the contrary. Mounting heights given shall be measured from the finished floor level to the centre of the switch. All single switches shall be installed with the long side of the toggle vertical.

3.2 Doors

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

3.3 Walls

Where the lower portion of a wall is face brick and the upper portion plastered, light switches shall be installed wholly in the plaster provided that the lower edge of the plaster is not higher than 1,6m above the finished floor level. In general where different wall finishes are used in the same area. Switches shall be installed within the same finish and not on the dividing lines between finishes.

3.4 Partitions

Light switches installed in partitions shall preferably be of the type designed to be accommodated in the partition construction. Switches installed in the metal supports do not require switch boxes. Switches may not be flush mounted in partition walls without switch boxes.

3.5 Watertight Switches

Switches that are exposed to the weather or are installed in damp areas, shall be of the watertight type complying with the Department's quality specification for "WATERTIGHT SWITCHES", par. 3 of Section C1O.

3.6 Multiple Switches

Where several switches are required in one position, multi-lever switches in a common switch box shall be provided wherever possible. All circuits wired into this box shall be on the same phase in order that voltages in excess of 250 V are not present in the box. Where it is not possible or practical to do this, barriers shall be installed and a label shall be prominently displayed within the box stating that voltages in excess of 250 V are present.

SECTION B8

B.8 PHOTO-ELECTRIC DAYLIGHT SENSITIVE SWITCH FOR OUTSIDE LIGHTING

1. INSTALLATION

1.1 The outside lighting of each individual building i.e. light circuits marked "T" on the drawings, shall be controlled by photo-electric daylight sensitive switches.

1.2 The positions of the switches as indicated on the drawings are provisional and the exact positions shall be confirmed with the representative of the Department on site.

1.3 Individual outside lighting circuits on a building may be connected directly to the daylight sensitive switch.

1.4 Where two or more lighting circuits are to be controlled by a single daylight sensitive switch, a contactor actuated by the unit shall be provided in the switchboard.

1.5 A by-pass switch enabling the lights to be turned on at any time, shall be provided.

1.6 Standard control circuits are indicated in fig. B8.1 and B8.2.

2. CONSTRUCTION

2.1 The unit shall comprise a photo cell, thermal actuator and change-over switch. The cover of the unit shall be manufactured from a tough, durable material providing protection against tampering. The cover shall have good weathering properties. It shall be ultraviolet-resistant and shall not deteriorate when exposed to sunlight for prolonged periods.

2.2 The unit shall be of the wall mounting type and shall be supplied complete with a suitable bracket.

2.3 The operational level shall be factory preset for "ON" at a light level of approximately 54 lux and "OFF" at approximately 108 lux. Voltage variations shall not materially affect the operational levels.

2.4 A time delay of not less than 15 seconds shall be provided to prevent the unit from functioning due to short period changes in illumination.

2.5 The unit shall be effectively safeguarded against voltage surges by means of a suitable surge protector which shall preferably form an integral part of the unit.

SECTION B9

B.9 INSTALLATION OF LUMINAIRES

1. POSITIONS

The mounting positions of luminaries shall be verified on site. All luminaries shall be placed symmetrically with respect to ceiling panels, battens, beams, columns or other architectural features of the space unless otherwise indicated. The layout as shown in the Documents shall generally be adhered to but any discrepancies or clashes with structural or other features must be referred to the Department, before commencing erection of the installation.

2. COVER PLATES

Cover plates shall be fitted over all draw-boxes and outlets intended for luminaries that are not covered by the luminaries canopy, lamp-holder, ceiling rose or similar accessories.

3. FIXING TO DRAW-BOXES

Where an outlet box or draw-box provides the necessary support for a luminaries, all luminaries with the exception of fluorescent luminaries mounted against ceilings, shall be fixed directly to the box. Fluorescent luminaries and luminaries with a mass in excess of 10kg shall however be suspended independently of the outlet box.

4. HANGERS AND SUPPORTS

Where provision has not been made for the fixing of luminaries, the Contractor shall supply the necessary supports, hangers, conduit extensions, angle brackets or any other fixing method approved by the Department.

5. SUSPENDED LUMINAIRES

The necessary hangers shall be provided where luminaries which are of the non-suspension type have to be fixed below false ceilings or roof slabs. The use of 20mm conduits fixed to the roof slab or ceiling is preferred. Provision shall be made for adjustments to enable the levelling of luminaries. Suspended conduits shall be fixed to the ceiling by means of screwed dome lids, bolts and nuts. Ball-and-spigot type domelids shall be used where conduit lengths exceed 600mm. Wiring shall be installed in the conduit hangers.

6. SUSPENDED WIRING CHANNELS

Luminaries (especially fluorescent luminaries) may also be suspended from ceilings by means of suspended metal channels. The metal channel may be supported by conduits or threaded rods. Should metal rods be utilised, these shall be screwed to anchor bolts fixed in the roof slab. Wiring shall either be installed in conduits fixed to the metal channel or in the metal channels and covered with a suitable cover plate. Purpose-made clamps shall be used to fix the luminaries to the cable channel.

7. CEILING BATTENS

Where wooden blocks are used to suspend luminaries, ceiling battens shall not be cut. The wooden blocks shall be cut to fit around battens and shall be screwed to the ceiling. Battens may however be cut where fluorescent or incandescent luminaries with metal canopies have to be installed against a false ceiling.

8. GLASS-BOWL LUMINAIRES

Unless specified to the contrary, suspended glass-bowl luminaries shall be installed with the underside at least 2,1 m above finished floor level.

9. FLUORESCENT LUMINAIRES FIXED TO CONCRETE SLABS

Fluorescent luminaries to be installed directly against concrete slabs or walls shall be securely fixed to the outlet box and at two additional points. Shot-fired fixings are not acceptable. Where approved, fluorescent luminaries may be installed against metal wiring channels in which the wiring is housed. The channel fixing may in this case be shot-fired. Purpose-made fluorescent fixing adaptors shall be used to fix luminaries to cable channels.

10. FLUORESCENT LUMINAIRES FIXED TO CEILINGS

10.1 In all cases where luminaries are fixed to false ceilings, the Contractor shall ensure that the ceiling is capable of carrying the weight of the luminaries before commencing installation. Should any doubt exist in this regard, the matter shall be referred to the Department.

10.2 In cases where the weight of the luminaire is not carried by the ceiling but by a support or other suspension method, provision shall be made to prevent relative movement between the ceiling and luminaire, ceiling rose or connection point.

10.3 Surface mounted fluorescent luminaries shall fit firmly against the ceiling brandering without leaving gaps between luminaire and ceiling. The luminaire shall be fixed directly to the ceiling by means of brass plated round-head wood screws and washers.

10.4 In the case of tiled ceilings with exposed or concealed T-section supports, surface mounted luminaries shall be fixed only to the tiles by means of butterfly screws or bolts with nuts and washers. The tiles shall be suitably reinforced.

10.5 Luminaries may alternatively be fixed to metal cross-pieces resting in the ceiling tees.

10.6 Drilling of holes in ceiling tees to support luminaries will not be allowed.

10.7 Luminaries shall be fixed in neat relation to the ceiling lay-out.

11. CONTINUOUS ROWS OF LUMINAIRES

In cases where fluorescent luminaries are installed in tandem, only one connection outlet need be supplied per circuit. All luminaries shall be coupled to one another by means of nipples or brass bushes and locknuts to ensure that wiring is not exposed and that earth continuity is maintained. Luminaries on the same circuit may be wired through the channel formed by the luminaire bodies. In this case silicon-rubber insulated conductors shall be used and internal connections shall be made at porcelain terminal blocks. "SCREW-IT" or similar connectors may only be used if prior permission is obtained from the Department. The wiring for any other circuits or outlets, even though these may be in the same row, may not be installed through the luminaire bodies. The Contractor shall ensure that continuous rows are straight and parallel to the relevant building lines.

12. RECESSED LUMINAIRES

12.1 Where recessed luminaries are specified, the Contractor shall maintain close liaison with the ceiling Contractor. In the case of tiled ceilings, the luminaries shall preferably be installed while the metal supports are being installed and before the tiles are placed in position. The Electrical Contractor shall be responsible for the co-ordination of the cutting of ceiling tiles with the other contractors concerned.

12.2 All mounting rings and other accessories shall fit closely into cut-outs to ensure a proper finish.

12.3 In all false ceilings where wiring channels are used, recessed luminaries shall be connected to the wiring channels by means of unswitched 5 A socket-outlets.

12.4 The following requirements shall be adhered to:

(a) Socket-outlets used shall comply with the Department's quality specification for "UNSWITCHED AND SWITCHED SOCKET-OUTLETS", par. 4 of Section 11 and shall be of 5 A minimum rating.

(b) The connector cord attached to the luminaire may not exceed 3m in length and shall consist of 1,5mm² minimum, 3-core, PVC-insulated flexible cord.

(c) The 5A socket-outlets shall be positioned such that they are not more than 600mm above the false ceiling.

13. SPECIAL CEILINGS

In cases where special ceilings e.g. aluminium strips, decorative glass, metal leaves, etc. are to be installed, the Contractor and the Manufacturer of the ceiling shall agree upon the method of fixing of luminaries in the ceiling.

14. BULKHEAD LUMINAIRES

Surface mounted bulkhead luminaries shall not be screwed directly to conduit ends. The conduit shall terminate in a round draw-box at the top or rear of the luminaire. The PVC-insulated conductors shall terminate in a porcelain terminal strip in the draw-box. Silicon-rubber-insulated conductors shall be installed from the terminal strip to the luminaire lamp-holder. "SCREW-IT" or similar connectors may only be used if prior permission is obtained from the Department.

15. TYPE OF CONDUCTOR

PVC-insulated conductors, unless protected by an approved heat-resistant sheathing, shall not be used where the temperature of the insulation is likely to exceed 70°C. In unventilated luminaries or luminaries capable of housing incandescent lamps over 60W, the interconnecting wiring from the lamp-holder to the circuit wiring shall consist of silicon-rubber insulated conductors. Silicon-rubber insulated conductors shall be used exclusively in the case of high bay fittings. Refer also to the provisions of SANS 10142.

16. WIRING OF LAMPHOLDERS

The central terminal of Edison Screw (E.S.-type) LAMP-HOLDERS shall be connected to the phase conductor and the screwed housing to the neutral conductor.

17. HIGH BAY LUMINAIRES

17.1 High bay luminaries shall be securely suspended from the roof structure.

17.2 The luminaries nay be fixed to suspended wiring channels containing the wiring on condition that:

(a) rigid channels with a maximum width of 42 mm be used,

(b) the channels are supported at intervals that will prevent sag or warp and

(c) the channels are large enough to accommodate the wiring.

17.3 Luminaries may be suspended from metal roof trusses with the aid of "CADDY" or similar fasteners.

17.4 Luminaries shall preferably be connected to unswithed 5A socket outlets. Silicon-rubber insulated flexible cord shall be used exclusively to connect the luminaire to the outlet.

17.5 A safety chain to keep the luminaire from falling when loosened shall be provided.

SECTION B10

B.10 CONNECTIONS TO EQUIPMENT

1. GENERAL

This section covers the final electrical connections to switchboards and various equipment in general electrical installations under normal environmental conditions for system voltages up to 600 V. Refer also to the Department's standard specifications for "WIRING", Section B5 and "INSTALLATION OF CABLES", Section B6.

2. CONNECTIONS TO SWITCHBOARDS

2.1 Conduit Entries

2.1.1 Where sufficient space for conduit entries as well as adequate space for future conduit entries is available, conduits may be terminated directly on the switchboard.

2.1.2 Alternatively, conduits connected to switchboards shall terminate in a common fabricated sheet steel draw-box installed in the vicinity of the switchboard. In open roof spaces this draw-box shall be placed in a roof space of not less than 900mm clearance.

2.1.3 Lighting and socket-outlet circuits may be separately grouped in common conduits or metal ducts (trunking) from the distribution board to the draw-box. The drawbox shall be of sheet steel with a minimum thickness of 1,6mm and shall be fitted with a removable cover plate.

2.2 Flush Mounted Switchboards

Where flush mounted switchboards are required, the recessed switchboard tray shall be built into the brick or concrete wall. All conduits from the floor or roof shall be fully recessed and shall be bonded directly to the tray by means of locknuts on both sides and the ends of the conduits fitted with a brass bush.

2.3 Surface Mounted Switchboards

Where surface mounted switchboards are specified but where the conduits can be fully recessed, the conduit shall be connected to a recessed connection box installed behind the switchboard. An opening with the same dimensions as the connection box shall be cut in the back of the switchboard and fitted with a suitable grommet.

2.4 Spare Conduits

Where conduits from a switchboard run into a false ceiling space above the board, a minimum of two 25mm and two 20mm spare conduits shall be installed into the ceiling space immediately above the board.

2.5 Cable Connections

2.5.1 Where underground cables are to be connected to switchboards, it shall be the responsibility of the Contractor to ensure that metal, earthenware, asbestos-cement or other approved sleeves are built in correctly to enable installation and connection of the cable to the switchboard.

2.5.2 PVC or pitch fibre sleeves are not acceptable - refer to par. 3.10 of the Department's standard specification for "INSTALLATION OF CABLES", Section B6.

2.5.3 Sleeves shall tie installed with a fall from inside to outside of the building to facilitate drainage. The sleeves shall be sealed with a non-hardening compound after installation of the cables to render the installation vermin proof and waterproof.

2.5.4 A metal cable channel with removable metal cover plate shall be installed by the Contractor and shall extend from the switchboard to the floor or into the ceiling void as required. The channel shall

coincide with the position of sleeves. The channel shall be flush mounted except in the case of surface mounted switchboards and then only with the permission of the Department's representative.

2.5.5 The cable channel shall be large enough to permit the installation of cable glands and future cables, particularly where spare sleeves have been provided.

2.5.6 The colour of the channel cover shall match that of the associated switchboard.

2.6 Cable Trenches

Where cables in floor trenches have to be connected to wall mounted switchboards, approved sleeves or conduits shall be installed from the side of the trench to the bottom of the switchboard. These sleeves shall be positioned and fixed before the concrete is cast.

3. CONNECTIONS TO MOTOR DRIVEN EQUIPMENT.

3.1 An isolator or starter containing an isolator shall be installed within 2m of motor driven equipment. The requirements of SANS 10142 shall be met. If this isolator cannot be installed on a wall, switchboard or other suitable place, an approved free-standing pedestal shall be provided. The pedestal shall be 1m high and outside normal walkways, access routes, etc.

3.2 The connection to the equipment shall be carried out as follows:

(a) Metal reinforced plastic or PVC-covered flexible metal conduits with individual conductors or a multi-core PVC insulated cable and separate bare earth conductor installed inside the conduit may be used. The flexible conduit shall not exceed 600mm. Screwed conduit shall be used from the end of the flexible conduit to the isolator and/or starter. Refer to the department's standard specification for "FLEXIBLE CONDUIT", Section B1, par. 5.

(b) Multi-core armoured PVC- or rubber-insulated cable and earth conductor. The installation and termination of the cables shall comply with the Department's specification for "INSTALLATION OF CABLES, Section B6.

(c) Cables and flexible conduits shall be provided with sufficient slack to allow positional adjustment of the equipment.

3.3 Supply cables to equipment may not be installed across floors which are for general use.

4. CONNECTIONS TO WATER HEATERS

4.1 Each water heater shall be connected to a separate circuit with a separate earth conductor.

4.2 The conduit from the switchboard to the water heater shall terminate in a draw-box within 1 m of the water heater terminals. The connection from the draw-box shall be conductors in conduit or PVC-insulated cable. Only in instances where heaters are mounted out of normal reach may flexible conduit and round boxes with dome lids be used for the final connection.

4.3 Three-phase supplies to fixed storage water heaters shall be in accordance with the wiring diagram, Fig. B10.1.

4.4 The mounting of the water heater and the provision of the water connections will be undertaken by others. The Contractor shall ensure that the elements and thermostats can easily be replaced.

4.5 Before testing a water heater, the Contractor shall confirm with the Plumbing Contractor that the unit is filled with water.

4.6 Unless otherwise specified in the Detail Technical Specification, the wiring of hot water heater circuits not exceeding 4 kW shall consist of 4mm² conductors and 2,5mm² earth conductor.

4.7 Unless it is specified that isolators for water heaters shall be provided in the switchboard, a local isolator shall be provided for each water heater. In the case of water heaters not exceeding 4 kW, a 30 A double-pole metal-clad isolator shall be surface mounted over the flush conduit outlet box.

5. CONNECTIONS TO HEATERS, FANS AND AIRCONDITIONING UNITS

5.1 Isolators

A flush mounted suitably rated double-pole isolator shall be provided within 1m of the unit. Where the equipment is mounted out of reach, the isolator shall be installed at 1,5m above floor level. Only where units are mounted in easily accessible positions and where an isolating switch is incorporated in the unit, may this isolator be omitted. Where flush isolators are used, flush conduit shall be installed to link with the equipment outlet point. Flexible cords of sufficient rating may be used for the final connection to the equipment.

5.2 Wiring

The minimum conductor size to be used shall be 4 mm^2. Each fan, heater or air-conditioning unit shall be on a separate circuit.

5.3 Flush Mounted Convection Heaters

The heater frame or tray shall be built or cast into the wall at a height such that the underside of the heater is at 250mm above floor level. Conduits shall terminate on the frame near the terminals.

5.4 Surface Mounted Equipment

5.4.1 Connections to surface mounted equipment shall consist of a draw-box located in the vicinity of the terminals of the unit. In workshops and industrial areas the connections shall be made by means of flexible conduit connected to dome lids on the draw-box. Conductors shall be connected directly to the unit.

5.4.2 In non-industrial applications PVC-insulated 3-core flexible cables may be used for the connection.

5.4.3 Where flexible cables are used, a bush shall be provided at the rear of the unit for cable entry and a bush and clamp (or gripper gland) at the draw-box. The clamp shall tightly grip the outer insulation of the cable to prevent tension on the connections between cable and conductors in the draw-box.

5.4.4 Where heaters or air-conditioning units are situated above power skirting, the isolator shall be installed in the power skirting and the flexible cable or cord to the unit shall be installed in the power skirting through a gripper or compression gland. The cable shall be made as short as practical and shall be neatly saddled to the surface of the wall.

5.5 Radiant Heaters

The installation of radiant heaters and asbestos heaters, where specified, shall comply with the requirements of paragraph 5.4, with the exception that they shall be mounted on spacers, 25mm away from the mounting surface.

5.6 Fan Heaters

5.6.1 The contractor shall allow for the supply, installation and electrical connection of the fan heaters as indicated on the drawings. The fan heaters shall be rated at 3 kW and shall be complete with control units.

5.6.2 The heaters shall be secured by means of approved expansion bolts at 2,4m above floor level in positions as shown, with the control units at 1,5m above floor level, directly below the unit.

5.6.3 The fan heater shall be installed on a box directly behind the unit.

5.6.4 Each connection shall be protected by means of a single-pole circuit-breaker on the associated switchboard.

5.6.5 Brass bushes shall be provided to protect the wiring at the rear cable entries to the control unit and fan connection box.

6. CONNECTIONS TO UNDERFLOOR HEATING

6.1 Where underfloor heating cable is specified, the Contractor shall supply the cable and thermostats which shall be purchased from a specialist supplier. The cable shall be laid by the specialist supplier and connected by the Contractor. The Contractor shall also be responsible for testing of the cables prior to their being covered by the screed and immediately thereafter. Details of circuit wiring and control of underfloor heating will be specified in the Detail Technical Specification.

6.2 PVC-insulated heating cable with a rating of not higher than 13 W per linear metre shall be used. Thermal insulation will be provided by the Builder.

6.3 The capacity of the heating cable shall he sufficient to give a 20°C temperature rise with an outside ambient temperature of 5°C.

6.4 The total heating load shall, however, not he more than 135 W/m².

7. CONNECTIONS TO INCINERATORS

7.1 General

This section covers connections to incinerators used for domestic purposes in buildings. Unless specified to the contrary, the supply and installation of incinerators will form part of the electrical installation and shall comply with the Department's quality specification, "INCINERATORS", SECTION C14.

7.2 Flush Mounted Incinerators

Where flush mounted incinerators have been specified, the Contractor shall supply the mounting tray to the Builder in good time for it to be built into the structure.

7.3 Mounting Height

Unless specified to the contrary, incinerators shall be installed with the bottom 1m above finished floor level.

7.4 Isolator

A flush mounted 30 A double-pole isolator shall be installed approximately 1,5m above the finished floor level adjacent to each incinerator. The isolator cover plate shall wholly fall within either the tiled or plastered surface of the wall. Unless specified to the contrary, the cover plate shall be finished in white baked enamel. An engraved label shall be provided at each isolator marked as follows:

"SWITCH OFF TO CLEAN AND REMOVE ASH"
"SKAKEL AF VIR SKOONMAAK EN ASVERWYDERING"

7.5 Flues

The Contractor shall supply flue pipes to the Builder for installation. Two bends and an "H" piece exhaust canopy shall be allowed for each flue pipe.

7.6 Exhaust Fans

Where more than 5 incinerators are connected to the same flue or where more than two 90° bends are used in the flue, an exhaust fan shall be installed at the flue outlet. In addition a small fan must be provided at each incinerator.

7.7 Wiring

Single incinerators shall be connected by means of 2 x 4mm² PVC insulated conductors and a 2,5mm² bare copper earth conductor in a 20mm conduit. Each incinerator shall be connected to a separate circuit where a common exhaust fan is not used. Where a common exhaust fan is needed, the following applies:

(a) All fans and incinerators connected to the same flue shall be on the same circuit.

(b) The current rating of the circuit-breaker shall be sufficient to allow the simultaneous operation of all the fans and 50 % of the incinerators.

(c) A 30 A double-pole isolator shall be flush mounted adjacent to each incinerator as described in paragraph 7.4. <u>However if the current rating of the circuit-breaker protecting the circuit is larger than 15A, a 15A fuse and fuse holder shall be installed at each incinerator in addition to the isolator.</u> The draw-box and cover plate for the isolator shall be large enough to accommodate the isolator and fuse. Alternatively, a 15A circuit-breaker may be installed adjacent to each incinerator in lieu of the isolator and fuse.

(d) The circuitry shall be arranged to ensure that all the fans will operate when any one of the incinerators is switched on.

(e) Earth leakage protection shall be installed on all incinerator circuits.

8. CONNECTIONS TO COOKING APPLIANCES

8.1 Unless specified to the contrary, the circuit connection to each cooking appliance shall consist of:

(a) 2 x 10mm² PVC-insulated conductors and 6mm² bare copper earth conductor for single phase connections, or

(b) 4 x 4mm² PVC-insulated conductors and 2,5mm² bare copper earth conductor for three phase connections.

8.2 A 60A double pole or 30A triple pole micro-gap isolator flush mounted in a wall outlet box, shall be installed 1,5m above floor level to the left or right of the appliance in accordance with SANS 10142. A white baked enamel cover plate shall be provided, situated wholly on the tiled or plastered surface as applicable.

8.3 The conduit shall terminate 450mm above floor level behind the appliance position. The conduit end shall be approximately 75mm long and shall face downwards. Connections from the conduit end to the appliance shall be installed in accordance with SANS 10142. Sufficient slack shall be provided in the flexible connection to move the appliance 600mm away from its normal position for cleaning or maintenance.

8.4 Alternatively a 45A, 3-pin socket-outlet may be mounted on a round draw-box 450mm above floor level. The connection to the appliance shall consist of a plug and 10mm², rubber-insulated and sheathed cable in accordance with SANS 1520. The cable shall be long enough to enable the appliance to be moved 600mm from its normal position for cleaning or maintenance.

8.5 Crimped or soldered lugs shall be provided on all conductors intended for connection to cooking appliances.

8.6 Each appliance shall be connected to a separate circuit. A separate earth wire shall be provided for each appliance.

SECTION B11

B.11 EARTHING

This section covers the earthing of electrical installations in buildings or other structures. The total earthing system of any electrical installation shall be in complete accordance with SANS 10142.

1. GENERAL RECOMMENDATIONS ON THE PRACTICAL INSTALLATION OF EARTH ELECTRODES

1.1 Requirements of an Effective Earth

1.1.1 An effective earth must prevent dangerous over voltages arising between metallic structures, frames, supports or enclosures of electrical equipment and the ground during fault conditions.

1.1.2 An effective earth must be able to permit fault currents of sufficient magnitude to flow so as to operate protective devices to isolate the fault before damage can occur.

1.1.3 The ohmic resistance of an effective earth must be low enough to ensure that the step potential on the ground in the vicinity of the earthing point is within safe limits under fault conditions i.e. a voltage gradient not exceeding 40 V/m for fault durations exceeding 1s.

1.2 Types of Earth Electrodes

Three types of earth electrodes are suitable:

1.2.1 Trench Earths

Trench earths comprise a bare copper or galvanised iron conductor laid at a minimum of 800mm below ground level, usually when underground cables are installed. This type of earth electrode provides a relatively large contact area between electrode and surrounding ground, makes contact with a variety of types of soil and soils of varying moisture content en route and is economical to install.

1.2.2 Spike Earths

Spike earths comprise rods of bare copper, copper-coated steel, stainless steel or galvanised steel designed for the purpose of penetrating ground to depths of up to several metres. A low resistance earth may sometimes be obtained by driving multiple spikes at some distance from each other in order to provide parallel paths.

In hard or rocky ground, it is usually necessary to drill holes into which earth spikes are inserted and then packed with soft soil.

1.2.3 Foundation Earths

Foundation earths comprise bare copper or galvanised iron conductors laid under the foundations of buildings, miniature substations, distribution pillars, bases of wooden, concrete or steel poles and structures. Because soil under foundations usually retains moisture, foundation earths are located to take advantage of this favourable condition. Furthermore, they are economical to install.

1.3 Materials for Earth Electrodes

1.3.1 Bare copper, either in stranded, strip or rod form, is considered the most suitable general purpose material for earth electrodes. Its main disadvantage is its cost and susceptibility to theft.

1.3.2 Bare galvanised iron and steel, either in stranded, strip or rod form, has a satisfactory record of survival in non-aggressive soils and is more economical than copper.

1.3.3 Bare aluminium is unsuitable as electrode material.

1.4 Corrosion

Because galvanised ferrous metals corrode sacrificially to copper, galvanised iron and steel electrodes should not be buried in close proximity to bare copper.

2. TECHNICAL REQUIREMENTS OF NEUTRAL EARTHING

The following relevant aspects have been extracted from the "AMEU CODE OF PRACTICE FOR THE APPLICATION OF NEUTRAL EARTHING ON LOW VOLTAGE DISTRIBUTION SYSTEMS."

2.1 Distribution Systems

Multiple Earthed Neutral (MEN) and Protective Multiple Earthing (PME) systems.

Distribution equipment associated with transformer substations that are either ground mounted or pole mounted and fed by underground cable or overhead line, with or without an earth continuity conductor, (ECC), should be installed, connected and earthed in accordance with the following requirements:

(a) Where the resistance to earth of the HV equipment earth is 1 ohm or less, it is permissible to earth the LV neutral to the HV earth electrode.

(b) Where the HV equipment earth exceeds 1 ohm the LV neutral shall be earthed at a minimum distance of 6m from the HV equipment earth (i.e. 6m from the HV electrode/s and also from any earthed metalwork connected thereto).

(c) Notwithstanding the requirements of (a) above, where transformers are associated with HV overhead lines, it is considered good practice to separate the HV and LV earth electrodes. The minimum earth separation should be 6m or one LV span.

(d) The overall resistance to earth of the neutral of an LV distributor or distribution system must not exceed 10 ohms.

(e) The LV neutral may be connected to other supply neutrals, earth electrodes, cable sheaths and armouring and these connections used to obtain the required earthing value of 10 ohms or less specified in par. (d). above.

(f) The neutral of underground and overhead LV distributors must be earthed at the remote ends of each distributor.

(g) Where the overall resistance to earth of the neutral of the distribution system exceeds 10 OHMS, the neutral shall be earthed at intermediate positions on the distributor/s to reduce its resistance to earth to below this limit.

(h) The cross-sectional area of the neutral of all LV distributors must not be less than that of a phase conductor.

(i) No circuit-breakers, isolators, fuses, switches or removable links shall be installed in the neutral between the transformer star point and the remote end of any LV distributor or service connection.

(j) All metallic sheathing and armouring of cables and all metalwork associated with meter cabinets, fuse pillars, etc., supporting or enclosing LV cables shall be bonded to the distributor neutral conductor.

(k) Where a Separate Neutral Earth (SNE) cable is part of an MEN or PME system, the armouring and/or metallic sheath and any ECC shall be bonded to the neutral at the supply end of the cable.

(l) To ensure the integrity of the neutral, it is recommended that all connections and joints on or to overhead line conductors be made by compression fittings or, alternatively double bolted connectors.

(m) MEN or PME may be applied to any single LV distributor without alterations to other LV distributors supplied from the same transformer.

2.2 Protective Neutral Bonding (PNB) System

Since the neutral is earthed at one point only, the question of multiple earthing does not arise and there is therefore no necessity to meet the MEN/PME technical requirements.

2.3 Service Connections

2.3.1 MEN System

The following conditions apply to consumers' service connections as well as service connections to traffic signals, road signs, street lighting and other power-consuming equipment installed in public places:

(a) All service connections must be by means of cable with an insulated phase, an insulated neutral conductor and an ECC.

(b) A single phase service connection comprises a live, a neutral and an ECC.

(c) A polyphase service connection comprises two or three phase conductors, a neutral and an ECC.

(d) The service neutral and ECC must be solidly and separately connected to the distributor neutral at the tee-off point.

(e) The consumer's earthing lead is connected to the Supply Authority's earth terminal which is in turn connected to the ECC in the service cable at the consumer's supply point.

(f) The neutral must not be connected to earth at the consumer's supply point.

(g) If required by the Supply Authority, and earth electrode must be installed at the consumer's supply point.

(h) In a service connection to traffic signals, street light and other power-consuming equipment installed in public places, such equipment is earthed to the ECC of the service connection.

2.3.2 PME System

(a) All service connections must be by means of a cable with an insulated phase and an insulated neutral conductor.

(b) A single phase service comprises a live conductor and a neutral.

(c) A polyphase service connection comprises two or three phase conductors and a neutral.

(d) The consumer’s earthing lead is connected to the supplier's neutral and to a mandatory earth electrode at the consumer's supply point.

(e) A label must be attached at the consumers supply point on his premises indicating that the installation is part of a PME system.

Note: It is not recommended that the PME system be applied to supply traffic signals, street signs or other power-consuming equipment installed in public places, because the PME system is inherently unsafe under "broken-neutral" conditions.

3. SUBSTATION EARTHING

In order to comply with the requirements of par. 1 and 2 above, an earth resistivity measurement shall be undertaken at the site of a new substation or miniature substation, preferably be a specialist firm. The contractor shall then submit to the Department details of a proposed substation earth indicating whether a

trench earth, spike earth or foundation earth is intended and the proposed interconnections with the installation.

4. FENCES OF OUTDOOR SUBSTATIONS

In cases where substations contain transformers or switchgear installed outdoors, the compulsory fence shall be earthed as follows, if no other method is specified :

(a) A 70mm² earth wire shall be installed 400mm below ground level and 500mm from the fence on the outside of the sub-station along the entire length of the fence. This earth wire shall be earthed at each corner by means of a 1,8m earth rod and the rod and earth wire bonded to the fence. The earth wire shall also be bonded, at least at two points, to the main earthing system.

(b) A 70mm² earth wire shall also be buried at a depth of 400mm around each transformer and switch and bonded to the main earthing system.

5. EARTHING OF A GENERAL ELECTRICAL INSTALLATION

5.1 General

All earth conductors shall be stranded copper with or without green PVC insulation. The conductors shall comply with the Department's quality specification for "PVC-INSULATED CABLES", Section C4. All earth conductor sizes shall be determined in accordance with SANS 10142, par. 4.6 where the earth does not form an integral part of the cable.

5.2 Switchboards

A separate earth connection shall be supplied between the earth busbar of the main switchboard and the earth busbar of every sub-switchboard. These connections shall consist of bare or insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors. Alternatively armoured cables with earth continuity conductors included in the armouring may be utilised.

5.3 Sub-circuits

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

5.4 Ring Mains

Common earth conductors may be used where various circuits are installed in the same wiring channel in accordance with SANS 10142. In such instances the sizes of earth conductors shall be specifically approved by the Department. Earth conductors for individual circuits branching from the ring main shall be connected to the common earth conductor with T-ferrules or soldered. <u>The common earth shall not be broken.</u>

5.5 Connections

Under no circumstances shall connection points, bolts, screws, etc. used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided. Unless earth conductors are connected to proper terminals, the ends shall be tinned and lugged. Lugs may be crimped, using mechanical or pneumatic tools designed for this purpose, on condition that evidence is submitted that the method used complies with the performance requirements of BS 4579, Part 1: "COMPRESSION JOINTS IN COPPER."

5.6 Non-metallic Conduit

Where non-metallic conduit is specified or allowed, stranded copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaries, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

5.7 Flexible Conduit

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

5.8 Water Pipes

Metal cold water mains shall be bonded to the earth busbar in the Main Switchboard by solid 15 x 2mm copper strapping. All other hot and cold water pipes shall be connected by 12 x 0,8mm perforated or solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipe work by brass nuts and bolts and against walls be brass screws at 150mm centres. In all cases where metal water pipes, down pipes, flues, etc. are positioned within 1,6 m of switchboards, an earth connection consisting of copper strapping shall be installed between the pipe work and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each switchboard.

5.9 Roofs

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

SECTION B12

B.12 SUBSTATIONS SWITCH ROOMS AND GENERATOR ROOMS

This section covers the general building arrangement and special requirements for high and low voltage switch rooms, transformer rooms and generator rooms.

1. STANDARD BUILDINGS

The following list indicates the standard substation designs and corresponding standard departmental drawing number which are available.

1.1 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for one emergency generator set from 200 to 500kVA ..... EE/136/131A.

1.2 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for one emergency generator set from 80 to 200kVA ..... EE3/136/131B.

1.3 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for one emergency generator set up to 30kVA ..... EE3/136/131C.

1.4 High voltage room, transformer room for one transformer up to 800kVA and low voltage room ..... EE3/136/131D.

1.5 High voltage room, transformer room for one transformer up to 800kVA, low voltage room and a generator room for two emergency generators up to 200kVA each ..... EE3/136/131E.

1.6 Large high voltage room, transformer room for one transformer up to 800kVA and low voltage room..... EE3/136/131F.

1.7 High voltage room, transformer room for two transformers of up to 800kVA each, large low voltage room and a store room ..... EE3/136/131G.

1.8 Emergency generator buildings..... EE3/136/118.

2. OTHER BUILDINGS

If the standard buildings cannot accommodate the equipment required, suitable substation rooms complying with the following constructional details shall be provided:

2.1 The rooms shall have a ceiling height of at least 2,8 m above finished floor level.

2.2 A concrete roof slab shall be provided or alternatively a roof consisting of corrugated iron, or clay or cement tiles with an asbestos ceiling.

2.3 The rooms shall be waterproof, vermin proof and fireproof.

2.4 Door openings shall be 1,85 m wide by 2,5 m high with steel louvered ventilation openings over at least 60 % of the door area. Doors shall open outwards and it shall be possible to readily open them from the inside. Provision shall be made for a night latch and a padlock.

2.5 The floor and transformer base shall be on the same level. Each transformer base shall be able to support a mass of 5 tons on castors.

2.6 Vermin proof steel louvered ventilation openings shall be provided with an area of at least 20 % of the total floor area for transformer and generator rooms and 10 % for switch rooms if not specified to the contrary. 50 % of the ventilation openings shall be installed in the lower part of the walls, not more than 300 mm above floor level and the other 50 % of the ventilation openings shall be installed in the

upper part of the walls, not more than 300 mm below ceiling level to achieve good cross and convection ventilation. Louver's contained in the doors can normally be considered to provide the 50 % required in one of the walls.

2.7 Where possible, windows with an area equal to 5 % of the floor area shall be included to provide natural lighting. It shall not be possible to open these windows. The windows shall be in the upper portion of the walls, as high as possible.

2.8 Corners of transformer bases and cable ducts shall be cut off at an angle of 45° with the splay at least 100mm wide.

2.9 Cable entrance openings shall be at least 600mm wide x 500mm deep and level with the bottom of the cable trenches. Alternatively a separate sleeve for each cable and at least one spare sleeve, shall be provided.

2.10 Cable trenches shall be 600mm wide and 800mm deep unless specified to the contrary.

2.11 The floors of cable trenches shall have a fall of 1:100 to make provision for the natural draining of water.

2.12 At least one light with a switch adjacent to the entrance and one standard 16A 3-pin earth leakage protected socket outlet shall be provided in each room. The illumination level in the substations shall not be less than 200 lux. If a battery supply is available one incandescent light per substation room shall be connected to this supply and the switch in the circuit marked "EMERGENCY LIGHT"/"NOODLIG".

2.13 The floors shall be floated to a smooth finish with a steel trowel.

2.14 Any one of the following interior wall finishes is acceptable:

(a) Plastered and painted white.

(b) Unpainted face brick (preferably light colour brick).

(c) Off-shutter concrete painted white.

3. NOTICES

The following notices in both official languages shall be exhibited at all entrances to and suitable places within premises in which are situated generating plant and transforming, switching or linking apparatus:

A notice showing the "Lightning" sign with the wording: Danger-Ingozi-Gevaar.

3.1 A notice prohibiting unauthorised persons from entering such premises.

3.2 A notice prohibiting any unauthorised persons from handling or interfering with electrical apparatus.

3.3 A notice detailing procedure in case of fire.

3.4 A notice containing directions for resuscitation of persons suffering from the effects of electric shock.

4. HIGH VOLTAGE SWITCH ROOMS (above 1 kV)

4.1 The equipment shall be installed and secured to the floor in accordance with the manufacturer's specification.

4.2 Sufficient space shall be provided between the switchboard and the walls of the switch room to allow for the installation, maintenance and operation of the switchboard.

4.3 In the case of switchboards with uninsulated conductors accessible from the back, a clear space of at least 1,2 m shall be provided between the back and sides of the board and the wall.

4.4 In the case of switchboards which are of a totally enclosed construction the minimum clear space between the back and sides of the board and the wall shall be at least 900mm.

4.5 A space of at least 1,2 m shall be provided in front of a switchboard for operating and maintenance personnel. If the circuit breakers are of the withdrawable carriage type this space shall be at least 900 mm when the breaker carriages are in the fully withdrawn position.

4.6 The access door into the room shall be in front of the switchboard.

4.7 The tools and earthing and operating devices for the switchgear shall be contained in a purpose-made sheet metal cupboard secured to the wall of the substation.

4.8 A reticulation diagram displaying sufficient detail to be able to assess problems and trace faults (both on the HV and LV sides of the system) shall be mounted against a wall in the HV switch room behind clear plastic.

5. LOW VOLTAGE SWITCH ROOMS (below 1 kV)

5.1 The equipment shall be installed and secured firmly to the floor or wall of the switch room.

5.2 Sufficient space shall be provided between the switchboard and the walls of the switch room to allow for the installation, maintenance and operation of the switchgear. In general this space shall be 900mm at the back and sides of the board and 1,2 m in front of the switchboard.

5.3 In the case of switchboards with uninsulated conductors which are exposed and accessible from the back a clear space of at least 1,2 m shall be provided at the back.

5.4 A LV reticulation diagram displaying sufficient detail of at least the main LV reticulation in order to be able to assess problems shall be mounted against a wall in the LV switch room behind clear plastic.

6. TRANSFORMER ROOMS OTHER THAN IN STANDARD BUILDINGS

6.1 Transformer rooms shall be large enough to accommodate the transformer with a 900mm clear space between the walls and the transformer. The minimum dimensions of a transformer room shall in any case be not less than 3,5m wide and 4,0m long.

6.2 The dimensions of the room shall be determined by using the transformer dimensions of TABLE 2 of SANS 780.

6.3 Where natural cross ventilation of the transformer room is not possible, adequate forced ventilation shall be provided to dispose of the transformer's losses and to prevent the air temperature in the transformer room from exceeding 40 C.

6.4 The cable entrances to the transformer room shall be sealed off after the cables have been installed.

7. GENERATOR ROOMS OTHER THAN IN STANDARD BUILDINGS

7.1 The ventilation of generator rooms shall be sufficient to dispose of the heat radiated from the engine while delivering full power.

7.2 The heat from the radiator shall be released outside the building via a ventilation duct or an external heat exchanger.

7.3 The exhaust emission shall be released outside the building and shall comply with the local environmental control regulations.

7.4 The fuel storage tank shall be installed in compliance with SANS 10131 and the position shall be approved by the local Fire Department. When the storage tank must be located outdoors, it should be underground to insulate the fuel from severe temperature variations which may impede fuel flow.

7.5 An electrical schematic diagram indicating mains supply and change-over arrangement as well as all standby plant electrical control circuitry, shall be mounted on a wall behind clear plastic.

7.6 An emergency light with automatically rechargeable Nickel-Cadmium batteries shall be installed above the generator set to facilitate manual starting or fault tracing in the event that the set does not start during a power failure.

8. CABLES

8.1 Cables shall be installed in cable trenches which shall be provided for this purpose. The installation shall comply with the Department's standard specification for "INSTALLATION OF CABLES", par. 5 of Section B6.

8.2 Under normal circumstances cables shall not be installed directly on the floor.

9. COVERING AND SEALING OF CABLE TRENCHES

9.1 All the cable trenches shall be covered with steel chequer plate or a compound wood, bound with a water resistant binder, or an approved fibreglass grating. The following types of compound wood coverings are acceptable:

(a) Five ply marine ply, 12 mm thick.

(b) Exterior grade particle board, 22mm thick.

(c) Tempered hardboard, 12,7mm thick.

9.2 The trench coverings shall be ridged and shall not sag more than 5 mm with two normal persons standing on one section.

9.3 The trench covering shall be in sections not exceeding 1,25 m.

9.4 The trench coverings shall be provided with holes or recessed handles to make it possible to remove and replace the covers easily.

9.5 The trench coverings shall be neatly cut where necessary to accommodate cables.

9.6 The covers shall overlap the trench on both sides and shall be recessed to fit flush with the surface of the floor.

9.7 The cable entrances in the trenches of the switch rooms, transformer rooms and generator rooms shall be closed and sealed after the cables have been installed to prevent the backfill material and water from entering the trenches in the building.

9.8 The cable entrances shall be closed with bricks, without mortar, in such a way as to prevent the weight of the bricks from resting on the cables. These bricks shall be plastered on the inside with a 10:1 ratio of sand and cement.

9.9 If the cables enter the trenches via sleeves, these sleeves shall be plugged on both sides with weak mortar, an asbestos and cement mixture or a non-hardening compound.

SECTION B13

B.13 INSPECTIONS, TESTING, COMMISSIONING AND HANDING OVER

1. PHYSICAL INSPECTION PROCEDURE

1.1 Once the Contractor has completed the installation, written notice shall be given to the Department in order that a mutually acceptable date can be arranged for a joint inspection.

1.2 During the course of the inspection, the representative of the Department will compile a list of items (if any) requiring further attention. A copy of this list will be provided to the Contractor who will have a period of 7 days in which to rectify the offending items of the installation.

1.3 The Contractor shall then provide written notice that he is ready for an inspection of the remedial work to the offending items.

1.4 This procedure will continue until the entire installation has been correctly completed to the satisfaction of the Department.

2. TESTING AND OPERATIONAL INSPECTION PROCEDURE

2.1 In addition to the above the Contractor shall have the complete installation tested and approved by the local authorities where applicable.

2.2 Subsequent to the above testing and approval, the Contractor shall in the presence of the representative of the Department test all circuits with respect to:

(a) Phase balance.

(b) Insulation level.

(c) Polarity.

2.3 Upon completion of the installation and within 3 months of the handover date, the Contractor shall provide and make available a recording voltmeter to record the voltage at three locations in the complex over a period of 48 hours each. These locations will be nominated by the Department.

3. "AS BUILT" DRAWINGS

3.1 As each portion of the work is completed, the Contractor shall provide the Department with as-built drawings showing the exact location measured from fixed points of all cables, transmission lines, each outlet point, etc.

3.2 In addition a complete reticulation diagram showing all supply cables and switchboards shall be provided behind a plastic cover in the substation or adjacent to the Main Switchboard if not located in a substation.

3.3 The installation will not be regarded as complete until all of the above requirements listed in 1, 2 and 3 above have been met.

= END OF SPECIFICATION =

PART 4: BILLS OF QUANTITIES

PREAMBLE

TYPICAL ITEMS/PREAMBLES TO BE INSERTED IN THE BILLS OF QUANTITIES

1. The conditions of contract and the application of the Contract Price Adjustment Provisions (if applicable) shall be as set out in the JBCC for Electrical Installations.

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

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

4. The Bills of Quantities shall not be used for ordering purposes. The Contractor shall check the lengths of cables and overhead conductors on site before ordering any of the cables. Any allowance for off-cuts shall be made in the unit rates.

5. The rates shall exclude Value-Added Tax and the total carried over to the final summary.

6. All material covered by this **Specification** shall, wherever possible, be of South African manufacture.

PART 5: ELECTRICAL WORK MATERIAL SCHEDULE

The Contractor shall complete the following schedules and submit same with the tender.

The schedules will be scrutinised by the Representative/Agent and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NB: **Only one manufacturer's name to be inserted for each item.**

Item	Material	Make or trade name	Country of origin
1.	Distribution boards		
2.	Circuit breakers 1P, 2P, 3P		
3.	On load isolators without trips		
4.	Contactors 1P, 2P, 3P		
5.	Earth leakage relays 1 & 3 phase		
6.	H.R.C. fuse switches		
7.	Kilowatt hour meter		
8.	Current transformers		
9.	Voltmeter		
10.	Maximum demand ammeter		
11.	Daylight sensitive switch		
12.	Time switch		
13.	Conduit		
14.	Conduit boxes		
15.	Power skirting		
16.	Surface switches		
17.	Watertight switches		
18.	16A flush socket outlets		
19.	16A surface socket outlets		
20.	16A watertight socket outlets		
21.	Luminaires		
22.	PVCA cable		

ANNEXURE A

SCHEDULE OF IMPORTED MATERIALS AND EQUIPMENT TO BE COMPLETED BY TENDERER

Item	Material/Equipment	Rand (R) (Excluding VAT)
1		
2		
3		
4		
5		
6		

The Contractor shall list imported items, materials and/or equipment, which shall be excluded from the Contract Price Adjustment Provisions (if applicable) and shall be adjusted in terms of currency fluctuations only. Copies of the supplier's quotations for the items, materials or equipment (provided that such costs shall not be higher than the relevant contract rate as listed above) should be lodged with the Representative/Agent of the Department within 60 (sixty) days from the date of acceptance of the tenders. No adjustment of the local VAT amount, nor the contractor's profit, discount, markup, handling costs, etc shall be allowed.

These net amounts will be adjusted as follows

FORMULA:

The net amount to be added to or deducted from the contract sum:

$$A = V \left(\frac{Z}{Y} - 1 \right)$$

A = the amount (R) of adjustment

V = the net amount (supplier's quotation) (R) of the imported item

Y = exchange rate at the closing date of tender submission

Z = exchange rate on the date of payment.

PARTICULARS OF ELECTRICAL CONTRACTOR

(To be completed by tenderers and submitted together with the tender form).

TENDER NO: _____ REFERENCE: _____

SERVICE: _____

NAME OF ELECTRICAL CONTRACTOR: _____

ADDRESS _____

_____

ELECTRICAL CONTRACTOR'S REGISTRATION NUMBER AT THE ELECTRICAL CONTRACTING BOARD OF S.A. _____

_____ _____

DATE SIGNATURE OF TENDERER

PART 6: DRAWINGS

Main LV Reticulation: Plan Layout	2107-WP1-ELEC-01
LV Supplies to Kiosks: Plan Layout	2107-WP1-ELEC-02
Perimeter/Security Lighting: Plan Layout	2107-WP1-ELEC-03
Sally Port 01: Electrical Installation & DB Single Line Diagram	2107-WP1-ELEC-04
Sally Port 03: Electrical Installation & DB Single Line Diagram	2107-WP1-ELEC-05
Sally Port 05: Electrical Installation & DB Single Line Diagram	2107-WP1-ELEC-06
Sally Port 10: Electrical Installation & DB Single Line Diagram	2107-WP1-ELEC-07
Generator Air-Circulation Duct Details	2107-WP1-ELEC-08

PART 6: X-Ray and Walk-Through Metal Detector Specification

Part 1:	Integrated Electronic Specification
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	**X-Ray and Walk-Through Metal Detector Specification (This Document)**
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification

TABLE OF CONTENTS

TECHNICAL SPECIFICATION
FOR
X-RAY INSPECTION UNIT

CLAUSE	DESCRIPTION	STATE DETAILS OF OFFER
1.1	**GENERAL**	
1.1.1	A licence for the X-ray machine, issued in terms of the Hazardous Substances Act (Act 15 of 1973), must be submitted with the tender, failing which the tender will not be considered. Plus the ID No's and SANS BIN No. of the service technicians registered to carry out the servicing of the X-ray machines in accordance with the requirements of the SANS.	_____ _____
	Name and tel. No. of the tenderer's contact person to make arrangements with: Name: _____ Tel. No. _____	
1.1.2	The X-ray inspection unit shall complete with:	
	- Dual Energy Detector system (Multi Energy Imaging) - Colour monitor (remotely operated) - Conveyor belt - Screening for full profile of inspection tunnel	_____ _____ _____ _____
1.2	**GENERAL SPECIFICATION**	
1.2.1	**Construction Details**	
1.2.1.1	The unit must incorporate a facility to be controlled either from the right or the left-hand side.	_____
1.2.1.2	In addition a facility must be incorporated so that, the operating keyboard and monitor can be operated remotely, at least 5m from the unit.	_____
1.2.1.3	Maximum height including the tunnel shall not exceed 1400mm from the floor level.	_____
1.2.1.4	The unit must be quiet when in operation.	_____
1.2.1.5	X-ray high voltage generator, shall be rated at 160kV and operate at 140kV	_____
1.2.1.6	Ambient conditions, under which the unit must operate: -0°C to 40°C -relative humidity 95%, non-condensing	 _____ _____
1.2.1.7	Control elements (pushbuttons, switches, etc.) are to be of sturdy design, selected for severe operating conditions.	_____
1.2.1.8	The unit must be of steel base construction on roller castors and not exceeding 700kg in total weight.	_____

1.2.1.9 Discharge rollers to be included with the unit. The discharge roller platform shall be long enough to prevent articles being X-rayed from falling off before it is recovered by the owner. _____

1.2.1.10 The conveyor belt must be designed for 24 hour, heavy-duty operation. _____

1.2.1.11 The unit shall not be longer than 900mm wide and 2600mm in overall length, including the conveyor belt platform. _____

1.2.2 **Power ratings**

1.2.2.1 The unit has to operate from 230V ±5%, 50 Hz, single phase power supply. _____

1.2.2.2 The maximum running current shall be less than 5A. _____

1.2.2.3 A suitable power point will be provided on the site by others. _____

1.2.3 **Image presentation**

1.2.3.1 Objects of the following dimensions must be able to be passed through the tunnel without any obstruction:

- Height: at least 400mm _____
- Width: at least 600mm _____
- Length: unlimited _____

Monitor display shall cover not less than 500mm of the object length. _____

Full scan volume must be seen on the screen, without any corner cut-off. This is a firm requirement. _____

1.2.3.2 Imaging scale of all objects should be constant with the minimum distortion. _____

1.2.3.3 A zoom facility is essential. The optimum requirement is for the push-button selection of at least 9, independent zoom sectors. The selected sector must be identified by light frame before zoom is activated. _____

1.2.3.4 A colour monitor (non-interlaced), screen size of at least 34cm, is required. Parallel operation of additional monitors, without modification to the unit, must be available. _____

1.2.3.5 The image on the monitor screen must be flicker free. _____

1.2.3.6 Control of brightness and of contrast must be provided on the front panel of the monitor. _____

1.2.3.7 Possibility of switching over from “POSITIVE” to “NEGATIVE” image should be available as an option. _____

1.2.3.8 A digital memory is essential. _____

1.2.3.9 The capacity of the digital memory must exceed 1Mbyte. _____

1.2.3.10 The number of solid state detectors shall be not less than 1152. _____

1.2.3.11 Dual (Multi) energy colour system with a four (4) colour (Industry Standard) is a firm requirement. _____

1.2.3.12	Organic/Inorganic colour stripping.	_____
1.2.3.13	High and low penetration.	_____
1.2.3.14	Variable colour stripping and variable gamma edge enhancement.	_____
1.2.3.15	Automatic density (variable) threat alert.	_____
1.2.3.16	Automatic organic material threat alert.	_____
1.2.3.17	Operator log-in identification facility.	_____
1.2.3.18	Video output capabilities for recording of images shall be included.	_____
1.2.3.19	Voltage stabiliser must be included.	_____
1.2.3.20	UPS shall be included to provide 10 – 15 minutes back-up.	_____
1.2.4	**Resolution and penetration**	
1.2.4.1	A sample wire with diameter of 0.16mm (AWG 34) must be distinguished on a monitor, and 30AWG wire must be visible behind 21mm of aluminium.	_____
1.2.4.2	The image quality on the monitor must be uniform, without distortion in the centre or the edges.	_____
1.2.4.3	Penetration of 25mm steel minimum must be guaranteed.	_____
1.2.4.4	A pre-selectable density threat level must be a feature of the equipment, with a visual and/or audible alarm if any item being screened exceeds that pre-selected density.	
1.3	**CONTROL OPERATION – MINIMUM REQUIREMENTS**	
1.3.1	**Controls**	
1.3.1.1	A mains key switch for 230V main power supply is required.	_____
1.3.1.2	Push button – power “ON”.	_____
1.3.1.3	3 Push buttons for conveyor control, “GO”, “STOP” & “REVERSE”.	_____
1.3.1.4	As a minimum, 9 push button keyboard for zoom sector selection and a separate push button for zoom activation is required.	_____
1.3.1.5	A robust, RED, emergency stop push button, fitted in a prominent position on the keyboard, as well as on the X-ray unit.	_____
1.3.1.6	Light symbols indicating “X-ray on”.	_____
1.3.1.7	X-ray warning signs, in accordance with the requirements of the SA Radiation Board, must be attached to each end of the tunnel in a visible position.	_____
1.3.1.8	Easy operation of the unit is essential.	_____

1.3.2 **Passage of luggage through X-ray unit**

1.3.2.1 Objects must be able to be conveyed through the unit in any orientation. _____

1.3.2.2 All objects, also those which is only partially lying flat on the conveyor belt (e.g. guitars, etc.) must be fully screened. _____

1.3.3 **Object representation**

1.3.3.1 The conveyor belt speed should be such that each point of an object, when passing through the unit, will be visible for at least 5 seconds _____

1.4 **CONVEYOR BELT**

1.4.1 **Loading**

1.4.1.1 At least 75kg overall weight _____

1.4.1.2 The conveyor belt must be driven by an almost noiseless drum-motor. _____

1.4.2 **Dimensions**

1.4.2.1 Belt length: < 2100mm _____

1.4.2.2 The height of the top of the conveyor belt above floor level shall be not less than 600mm, but shall not exceed 800mm _____

1.4.3 **Speed and duty cycle**

1.4.3.1 Conveyor belt speed: approximately 0.2 m/sec. _____

1.4.3.2 Up to 2400 objects must be screened per hour. _____

1.4.4 **Operation**

1.4.4.1 Normal: Continuous operation in forward direction. _____

1.4.4.2 Stop: _____

1.4.4.3 Reverse: Intermitted operation by pressing the reverse button. _____

1.4.4.4 Duty cycle: no warm-up period will be accepted. _____

1.5 **SAFETY**

1.5.1 **X-ray dose: Screened object**

1.5.1.1 Standard –0.1 mrem per inspection. Lower dose units may be offered as an alternative. _____

1.5.2 **Radiation leakage to surrounding**

1.5.2.1 Less than 0.5 mrems/h at any point on the surface, 5cm from the surface _____

1.5.2.2 The unit must comply with all ruling international safety regulations such as the German TUV, Swiss SEV, UK NRPB or USA FDA. _____

1.5.3 **Conveyor belt**

1.5.3.1 The feed and discharge ends of the conveyor belt are to be of such design that fingers, etc. cannot be caught during normal operation. _____

1.5.4 **Operation under fault conditions**

1.5.4.1 The X-ray tube shall be automatically de –energised when conveyor belt is stopped. _____

1.5.4.2 X-ray radiation shall only be switched on with the moving conveyor belt, before the object passes through the unit. _____

1.5.4.3 X-ray radiation shall be automatically switched off if the radiation shielding covers are removed. _____

1.5.5 **Film safety**

1.5.5.1 Tenderers must guarantee the unconditional safety of photographic material of professional quality. _____

1.5.5.2 Typical standards must allow for highly sensitive films of 1000 ASA to be irradiated at least 30 times without damage. _____

1.6 **PLACING IN POSITION AND ASSEMBLING**

1.6.1 The unit shall be placed in position and assembled on site by the successful tenderer.
NOTE: The final placing will be determined on site. _____

1.7 **BROCHURES**

1.7.1 Brochures, furnishing description and technical specification, etc. of the unit offered, shall be submitted with the tender. If the brochures have information, which does not comply with the specification, the tenderer must submit a covering letter listing all brochure items, which do not comply and confirm that the equipment offered will comply with the specification, referring to these items. _____

1.7.2 The following information is also required:

Manufacturer: _____

ISO Rating: _____

Country of origin: _____

Model number of the unit offered _____

Date of manufacture _____

1.8 **MAINTENANCE, SERVICE AND REPAIR**

1.8.1 The unit design must be of the low maintenance type and with minimum future service. **A statement confirming this is required from the tenderer, together with a copy of the service/maintenance schedule.** _____

1.8.2 An overall design of modular type is preferred. _____

1.8.3 Electronic modules must be easily exchanged. _____

1.8.4 All sub-assemblies in the unit must be of such a design that, maintenance and repair can be carried out by a single person, including removal and exchange of the X-ray generator tanks. _____

1.8.5 Spare parts must be locally stocked and availability guaranteed for a ten-year period, starting from the date of delivery. _____

1.9 **GUARANTEE AND SERVICE**

1.9.1 The successful tenderer shall guarantee and service the complete unit for a period of twelve (12) months from the date of delivery to site, and successful commissioning of the unit. _____

1.9.2 During the period of guarantee, the successful tenderer shall, at his own expense, carry out all necessary repair work, including material and labour, (excluding work required due to damage by others) in order to maintain the unit in a working condition. _____

1.9.3 The successful tenderer shall, during the period of guarantee, repair the unit to the satisfaction of the Department, within 24 hours after he has been notified that the unit is not operating. _____

1.10 **TRAINING**

1.10.1 The successful tenderer shall thoroughly train and instruct all the operators and supervisors, designated by the User Department in the operation of the unit. _____

1.11 **ONBOARD COMPUTER**

1.11.1 Video Memory: at least 64MB

1.11.2 Processor Speed: at least 3.2GHz

1.11.3 Storage Capacity: At least 160GB

1.11.4 A two part training programme must be incorporated in the system.

1.11.4.1 Part 1 – Initial training
Pre-loaded images must be recalled by the computer, some without and some with threats. The operator must detect the threats and his progress is logged.

1.11.4.2 Part 2 – Ongoing training
The system must merge fake threat images into real time images and the performance of the operator must be logged.

1.12 **MANUALS**

Three complete sets of manuals, each with the following information shall be handed over to the Department when the unit is delivered to site:

(a) Operating instructions _____

(b) Technical description with diagrams and instructions for maintenance and repairs. _____

1.13 **DEVIATIONS FROM SPECIFICATION AS ALTERNATIVE (STATE BRIEFLY)**

_____

_____

_____

_____

1.14 **DELIVERY ARRANGEMENTS/ADDRESS**

Delivery arrangements shall be co-ordinated with

Contact Person:
Tel:

And the unit to be delivered to: -

Address

2. **TECHNICAL INFORMATION**

State the following information of the unit offered:

2.1 Total height above floor level _____

2.2 Maximum X-ray voltage _____

2.3 Dimensions of the unit
Height _____
Width _____
Length (including conveyor belt) _____

2.4 Total running current _____

2.5 Maximum dimensions of objects:
Height _____
Width _____
Length _____

2.6 Number of detectors _____

2.7 Capacity of digital memory _____

2.8 Number of shades of grey _____

2.9 Maximum over-all loading on conveyor belt _____

2.10 Conveyor belt speed _____

2.11 X-ray dose per inspection _____

2.12 Radiation leakage at any point, 5cm away from surface _____

2.13 Multi-Energy mode – State colours for material discrimination _____

TECHNICAL SPECIFICATION
FOR
ITEM - 2: ONE METAL DETECTOR

CLAUSE	DESCRIPTION	STATE DETAILS OF OFFER
3.1	**GENERAL**	
3.1.1	In addition to complying with the specification, the metal detector shall meet the requirements of this Specification.	_____
	Name and tel. no. of the tenderer's contact person to make arrangements with: Name: _____ Tel. No.: _____	
3.1.2	The metal detector shall consist of a free standing walk-through frame with an integral control unit, and shall be suitable to detect metallic objects on a person by means of the magnetic field principle.	_____
3.1.3	The metal detector shall be suitable to detect ferrous and non-ferrous metals.	_____
3.1.4	The metal detector shall be equipped to eliminate false alarms.	_____
3.1.5	The metal detector shall scan the entire area of the walk through area and detect metal objects on a person passing through to the levels as specified.	_____
3.1.6	The metal detector will incorporate self-test button to confirm that the system is operating correctly.	_____
3.1.7	The metal detector shall be completely tamper proof.	_____
3.1.8	The programme and sensitivity push buttons shall be so arranged that tampering by unauthorised persons is entirely eliminated.	_____
3.1.9	The metal detector shall not be adversely affected by stationary metal bars or structures in the vicinity of the unit or moving metal near the archway.	_____
3.1.10	The metal detector shall be capable of operating adjacent to an X-Ray inspection unit.	_____
3.1.11	The detector is intended for indoor use at an altitude of up to 1800m above sea level.	_____
3.1.12	The detector shall be capable of operating in the following conditions:	
3.1.12.1	Min. temperature: 0ºC	_____
3.1.12.2	Max. temperature: 40ºC	_____
3.1.12.3	Max. relative humidity:80%	_____

3.1.13 The operation of the metal detector shall not be adversely affected by repositioning of the frame within certain limits of its original adjusted position. _____

3.2 **CONSTRUCTION**

3.2.1 The metal detector shall comprise a free standing walk-through frame containing the detector coils and the control unit, complete with a 5m length of flexible cable and 16A 3-pin plug top. The cord and plug top shall comply with the relevant SANS specifications. _____

3.2.2 The frame and the control unit shall be of robust construction and the base of the frame shall be designed to ensure rigidity. _____

3.2.3 The unit shall be able to execute a full body scan and detect metal objects down to the lower feet level within the settings specified. _____

3.2.4 The finish shall be durable and maintenance free. _____

3.2.5 The type of material used for the construction of the frame and control unit must be stated by tenderers. _____

3.2.6 The colour range in which the metal detectors are available must be stated by tenderers. The Department will select a colour finish to suit the environment. _____

3.2.7 All material consisting of metal shall be treated against corrosion. _____

3.2.8 The approximate internal dimensions of the frame shall be as follows:

3.2.8.1 Walk-through height : 2m _____

3.2.8.2 State Walk-through width _____

3.3 **CONTROL SYSTEM**

3.3.1 The system shall operate by means of automatic level control adjustable to environmental changes, Without the need to reset. _____

3.3.2 The control unit shall be equipped with the following:

3.3.2.1 "ON-OFF" main switch and "MAINS ON" indicator light. _____

3.3.2.2 Selector switch with at least ten sensitivity settings, with a maximum sensitivity to consistently detect metal at least the size of a R5, 00 coin. _____

The sensitivity settings shall be consistent at average walking speed. _____

3.3.2.3 Visual indication in the form of an LED Bar graph indicator having at least five green lights and five red lights representing the "PROCEED" and "ALARM" zones respectively. The indicator shall give an indication of the volume of metal on a person in accordance with the sensitivity settings of the selector switch. When the "ALARM" zone is activated it shall simultaneously activate an audible alarm having a continuous tone and adjustable volume. The alarm system will automatically reset after the metal has passed through the frame. _____

3.3.2.4 The system shall be modular to facilitate maintenance and repairs. _____

3.4 **SAFETY FEATURES**

3.4.1 All electronic and electrical components shall be protected by lockable panels. _____

3.4.2 The detectors shall not have any effect on heart pacemakers. _____

3.4.3 The detector shall not effect magnetic storage media or camera film. _____

3.5 **ELECTRICAL SUPPLY SYSTEM**

3.5.1 The detectors shall be designed for connection to a 230V +/-5%, 50Hz, single phase, three wire (phase, neutral and earth) power supply. _____

3.5.2 The existing connection points on site comprises standard 16A, 3-pin, socket outlets. _____

3.5.3 A suitable and efficient battery back-up system to facilitate power failures of up to 1 hour must be incorporated in the detectors. _____

3.6 **THROUGHPUT**

The system shall accept a passage of at least 50 persons per minute without functional overload. _____

3.7 **PLACING IN POSITION AND TESTING**

3.7.1 The detector shall be placed in position, tested, commissioned and adjusted to the user Department's requirements by the successful tenderer.
NOTE: The final positioning will be determined on site. _____

3.7.2 The system must be arranged so that the traffic-flow is channelled through the metal detector. _____

3.8 **BROCHURES**

3.8.1 Brochures furnishing descriptions and technical specifications, etc., of the unit offered shall be submitted with the tender. _____

3.8.2 The following information is also required:

Manufacturer _____

Year of manufacture _____

Country of origin _____

Model number _____

3.9 **MAINTENANCE**

3.9.1 The unit must be relatively maintenance-free and with minimum future service. A statement confirming this is required from the tenderer. _____

3.9.2 Electronic modules must be easily exchangeable. _____

3.9.3 Spare parts must be locally stocked and availability guaranteed for a ten year period starting from date Of delivery. _____

3.10 **GUARANTEE AND SERVICE**

3.10.1 The successful tenderer shall guarantee and service the complete unit for a period of twelve (12) months from date of delivery of every unit to site. _____

3.10.2 During the period of guarantee the successful tenderer shall at his own expense, carry out all necessary repair work including material and labour (excluding work required due to damage by others) in order to maintain the unit in a working condition. _____

3.10.3 The successful tenderer shall, during the period of guarantee, repair the unit to the satisfaction of the Department within 24 hours after he has been notified that the unit is not operating. _____

3.10.4 After the lapse of the initial twelve-month period of servicing under the guarantee, the successful tenderer may be required to enter into a service agreement with the Department. _____

3.11 **TRAINING**

The successful tenderer shall thoroughly train and instruct operators designated by the user Department in the operation of the unit. _____

3.12 **MANUALS**

Two complete sets of manuals, each with the following information shall be handed over to the Department when the unit is delivered to site:

(a) Operating instructions _____

(b) Technical description with diagrams and Instructions for maintenance and repairs. _____

3.13 **DEVIATIONS FROM SPECIFICATION AS ALTERNATIVE (STATE BRIEFLY)**

_____

_____

_____

_____

_____

3.14 **DELIVERY ARRANGEMENTS**

Delivery arrangements shall be co-ordinated with

Contact Person:
Tel:

And the unit to be delivered to: -

Address

PRICE SCHEDULE FOR ITEM 1 & 2

ITEM 1 – ONE X-RAY INSPECTION UNIT

LOCAL CONTENT	R
IMPORTED CONTENT	R
LABOUR	R
TRAINING	R
TRANSPORT AND DELIVERY	R
TENDER PRICE (EXCLUDING VAT)	R

ITEM 2 – ONE WALK-THROUGH TYPE METAL DETECTOR

LOCAL CONTENT	R
IMPORTED CONTENT	R
LABOUR	R
TRAINING	R
TRANSPORT AND DELIVERY	R
TENDER PRICE (EXCLUDING VAT)	R

TENDERER'S SIGNATURE_____ DATE _____

Part 7

SUPPLY, DELIVERY AND INSTALLATION OF STANDBY GENERATOR SETS AT ST ALBANS CORRECTIONAL FACILITY

TABLE OF CONTENTS

SPECIFICATION FOR THE SUPPLY DELIVERY AN INSTALLATION OF STANDBY GENERATOR SETS

SECTION 1 – GENERAL

TABLE OF CONTENTS

SECTION 1 – GENERAL

1. Intent of Document

The specification is intended to cover the complete installation of the generator plant. The minimum equipment requirements are outlined, but do not cover all the details of design and construction. Such details are recognised as being the exclusive responsibility of the contractor.

In all cases where a device or part of the equipment is referred to in the singular, it is intended that such reference shall apply to as many devices as are required to complete the installation.

2. Standards and Codes

All work and equipment shall be in accordance with the requirements of BS5514 and shall comply with the Occupational Health and Safety Act, No 85 of 1993 and current regulations of all other codes applicable to this work.

All equipment shall be Y2K compliant.

3. Regulations

The installation shall be erected and tested in accordance with the following Acts and regulations:

a) The latest issue of SANS 10142: “Code of Practice for the Wiring of Premises”,

b) The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,

c) The Local Government Ordinance 1939 (Ordinance 17 of 1939) as amended and the municipal by-laws and any special requirements of the local supply authority,

d) The Fire Brigade services Act 1993 Act 99 of 1987 as amended,

e) The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as emended,

f) The Post Office Act 1958 (Act 44 of 1958) as amended,

g) The Electricity Act 1984 (Act 41 of 1984) as amended and

h) The Regulations of the local Gas Board where applicable.

4. Scope of Work

The extent of work covered under this specification includes

1. Supply, delivery and installation of four (4) complete standby generator sets as specified in this document.
2. Supply, delivery and installation of four (4) Main Distribution Boards.
3. Supply and installation two (2) generator air circulation ducts.
4. Removal of existing two (2) 40kVA enclosed standby generator sets.
5. Relocation of existing main LV cable to accommodate the new generator sets.
6. Test and commissioning of complete installations and issuing of Certificates of Compliance.

The plant rooms have already been provided. The contractor shall ensure that the space allowed is sufficient for the installation of the generator set and that the ventilation of the plant room is adequate.

5. Co-ordination

The standby generator rooms have already been provided as shown on plan layout drawings which form part of this specification.

The Contractor shall co-ordinate his program with his Specialist Subcontractors who are required to be appointed for Building Work, Mechanical Installation and Electrical Installation.

Delays due to lack of co-ordination between the Contractor's shall not form a basis for claims be the Contractor of this Contract.

6. Test Certificates and Inspections

The following tests are to be carried out:

(a) At the supplier's premises, before the generating set will be delivered to site Representatives of the Employer may be present during the test to satisfy them that the generating set complies with the specification and delivers the specified output. The test must be carried out in accordance with BSS 5514, Part 2 and 3. The Representative of the Employer must be timeously advised of the date for the test.

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

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

(d) Test reports of both tests as specified under (a) and (b) are to be submitted to the University.

7. Guarantee and Maintenance

The Contractor shall guarantee the complete plant for a period of twelfth months after the first delivery has taken place.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design or workmanship, the Contractor will be notified and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site at his own expense.

The Contractor shall maintain the plant in good working condition for the full twelfth month period to the final delivery of the installation. However, should the Contractor fail to hand over the plant in good working order on the expiry of the specified twelfth months, the Contractor shall be responsible for further monthly maintenance until final delivery is taken.

During this period the contractor will undertake to arrange that the plant be inspected at least once per month by a qualified member of his staff who shall: -

(a) Report to the Officer-in-charge, keeping the maintenance records, and enter into a log book the date of the visit, the tests carried out, the adjustments made, and any further details that may be required.

(b) Grease and oil moving parts, where necessary.

(c) Check the air filter and, when necessary, clean the filter and replace filter oil.

(d) Check the lubricating oil and top-up when necessary.

(e) After the plant has run one oil change for the number of hours stipulated by the manufacturers, drain the sump and refill with fresh lubricating oil. The reading of the hour meter on the switchboard will be taken to establish the number of hours run by the plant.

Under this heading only the cost of the actual oil used, shall be charged as an extra on the monthly account.

(f) Clean the lubricating oil filter and/or replace the filter element at intervals recommended by the engine manufacturer, the cost of a new filter element to be charged as an extra on the monthly account.

(g) Check and when necessary adjust the valve settings and the fuel injection equipment.

(h) Check the battery and top-up the electrolyte when necessary.

(i) Test-run the plant for 0,5 hour and check the automatic starting with simulated faults on the mains, the proper working of all parts, including the electrical gear the protective devices with fault indicators, the changeover equipment and the battery charger. Make the necessary adjustments.

(j) Report to the Representative of Employer and to the Contractor on any parts that become unserviceable through fair wear and tear, or damaged by causes beyond the control of the Contractor.

The Contractor on receiving the report, shall immediately submit a detailed quotation for the repair or replacement of such parts to the Representative of Employer.

(k) Advise the University when it has become necessary to de-carbonise the engine and submit a quotation for this service.

(l) Top up the water of the radiator, if applicable.

(m) Clean the plant and its components.

8. <u>Materials and Workmanship</u>

(a) The work throughout shall be executed to the highest standards and to the entire satisfaction of the Representative/Agent who shall interpret the meaning of the Contract Document and shall have the authority to reject any work and materials, which, in his judgement, are not in full accordance therewith. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

(b) All work shall be executed in a first-class manner by qualified tradesman.

(c) The Contractor shall warrant that the materials and workmanship shall be of the highest grade, that the equipment shall be installed in a practical and first-class manner in accordance with the best practices and ready and complete for full operation. It is specifically intended that all material or labour which is usually provided as part of such equipment as is called for and which is necessary for its proper completion and operation shall be provided without additional cost whether or not shown or described in the Contract Document.

(d) The Contractor shall thoroughly acquaint himself with the work involved and shall verify on site all measurements necessary for proper installation work. The Contractor shall also be prepared to promptly furnish any information relating to his

own work as may be necessary for the proper installation work and shall co-operate with and co-ordinate the work of others as may be applicable.

(e) All components and their respective adjustment, which do not form part of the equipment installation work, but influence the optimum and safe operation of the equipment shall be considered to form part of, and shall be included in the Contractor's scope of works.

(f) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

(g) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the installation and guarantee periods to ensure the safety of the public and the User.

(h) The Contractor is to include for all scaffolding required to complete the work required.

9. Imported Content

This equipment will not be subject to fluctuations in the rate of exchange.

However, should the Contractor choose to be protected against fluctuations in the rate of exchange on imported equipment, the following conditions will apply:

a) The Materials Offered Ex-Import (Annexure A), which forms part of this tender document, must be completed by the Contractor.

b) Any fluctuations in the rate of exchange will be for the account of the Government and shall be calculated from a date seven (7) days prior to the date of the Contractor's tender to a date seven (7) days after receipt by the Contractor's bank of the negotiable bill of lading or the exporter's invoice, provided this latter date is not later than 30 days after the date of payment. Thereafter, fluctuations in the rate of exchange shall not be for the account of the Government.

10. Brochures

Detailed brochures of all equipment offered shall be presented together with the tender documents.

11. Submittals

The following information must accompany the tender documents

(a) Full particulars, performance curves and illustrations of the equipment offered, must be submitted with the Tender.

(b) The design of the control system to comply with the requirements for automatic starting, stopping, interlocking and isolation as specified.

(c) Curves furnished by the engine makers, showing the output of the engine offered against the speed, for both intermittent and continuous operation **as** well as fuel consumption curves when the engine is used for electric generation

The successful Tenderer must, as soon as possible after receipt of the order, submit detailed drawings and wiring diagrams of the plant and the switchgear. One diagram shall be contained in a metal pouch on the side of the switchboard.

SPECIFICATION FOR THE SUPPLY DELIVERY AN INSTALLATION OF STANDBY GENERATOR SETS

SECTION 2 – EQUIPMENT REQUIREMENTS

TABLE OF CONTENTS

SECTION 2 – EQUIPMENT REQUIREMENTS

1. Engine

1.1 General

The engine must comply with the requirements as laid down in BS 5514 and must be of the atomised injection, compression ignition type, running at a speed not exceeding 1500 r.p.m. The engine must be amply **rated** for the required electrical output of the set, when running under the site conditions. The starting period for either manual or automatic switching-on until the taking over by the generating set, in one step, of a load equal to the **specified** site electrical output, shall not exceed 15 seconds. This must be guaranteed by the Tenderer.

Turbo-charged engines will only be accepted if the Tenderer submits a written guarantee that the engine can deliver full load within the specified starting period.

1.2 Rating

The set shall be capable of delivering the specified output continuously under the site conditions, without overheating. The engine shall be capable of delivering an output of 110 % of the specified output for one hour in any period of 12 hours consecutive running in accordance with BS 5514.

1.3 De-Rating

The engine must be de-rated for the site conditions as set out in the Technical Specification, Section 3 of this document.

The de-rating of the engine for site conditions shall be strictly in accordance with BS 5514 of 1977 as amended to date. Any other methods of de-rating must have the approval of the Employer's Representative/Agent and must be motivated in detail. Such de-rating must be guaranteed in writing and proved by the successful Tenderer at the site test.

1.4 Starting and Stopping

The engine shall be fitted with an electric starter motor and be easily started from cold, without the use of any special ignition devices under summer as well as winter conditions.

Tenderers must state what arrangements are provided to ensure easy starting in cold weather. Full details of this equipment must be submitted. In the case of water cooled engines, any electrical heaters shall be thermostatically controlled. The electrical circuit for such heaters shall be taken from the control panel, and must be protected by a suitable circuit breaker.

1.5 Starter Battery

The set must be supplied a fully charged lead-acid type battery, complete with necessary electrolyte. The battery must have sufficient capacity to provide the starting torque stipulated by the engine makers. The battery capacity shall not be less than 120 Ah and shall be capable of providing three consecutive start attempts from cold and thereafter a fourth attempt under manual control of not less than 20 seconds duration each. The battery must be of the heavy duty "low maintenance" type, house in a suitable battery box.

1.6 Cooling

The engine may be either of the air or water cooled type. In the case of water-cooling, a built-on heavy duty, tropical type pressurised radiator must be fitted. Only stand-by sets that are water cooled shall have electric heaters.

For either method of cooling, protection must be provided against running at excessive temperatures. The operation of this protective device must give a visual and audible indication on the switchboard. Water-cooled engines shall in addition be fitted with a low water cut-out switch, installed in the radiator, to switch the set off in the event of a loss of coolant. The protection shall operate in the same way as the other cut-outs (e.g. low oil pressure). All air ducts for the cooling of the engine are to be allowed for. The air shall be supplied from the cooling fan cowling/radiator face to air outlet louvers in the plant room wall.

1.7 Lubrication

Lubrication of the main bearings and other important moving parts shall be by forced feed system. An automatic low oil pressure cut-out must be fitted, operating the stop solenoid on the engine and giving a visible and audible indication on the switchboard.

1.8 Fuel Pump

The fuel injection equipment is suitable for operation with the commercial brands of diesel fuel normally available in South Africa.

1.9 Fuel Tank

A fuel tank shall be provided within the enclosure of the generator set. The tank shall have sufficient capacity for standby sets to run the engine on full load for a period of 12 hours.

A water trap is fitted in the fuel pipeline from the tank to the engine.

The tank shall be fitted with a suitable filter, a full height gauge glass, “low fuel level” alarm, giving an audible and visible signal on the switchboard as well as a low-low fuel level cut-out.

An electrically operated pump with sufficient length of oil resistant hose to reach 2m beyond the door shall be supplied, for each set for filling the fuel tank/s from 200 litre drums.

The interconnection fuel piping shall consist of copper tubes and the connection to vibrating components shall be in flexible tubing with armoured covering.

1.10 Governor

The speed of the engine shall be controlled by a governor in accordance with class A2 of BS 5514 of 1977 if not otherwise specified in the Technical Specification.

The permanent speed variation between no load and full load shall not exceed 4,5% of the normal engine speed and the temporary speed variation shall not exceed 10% External facilities must be provided on the engine, to adjust the normal speed setting by ± 5% at all loads zero and rated load.

1.11 Flywheel

A suitable flywheel must be fitted, so that lights fed from the set will be free from any visible flicker.

The cyclic irregularity of the set must be within the limit laid down in BS 5514 of 1977.

1.12 Exhaust Silencer

It is essential to keep the noise level as low as possible. An effective exhaust silencing system of the residential type must be provided.

The exhaust pipe shall be installed in such a way that the expulsed exhaust fumes will not cause discomfort to the public. The exhaust pipe must be flexibly connected to the engine to take up vibrations transmitted from the engine, which may cause breakage. The exhaust piping and silencer shall be lagged to reduce the heat and noise transmission into the plant room and shall be protected against the ingress of driving rain at 45° to the horizontal.

1.13 Accessories

The engine must be supplied complete with all accessories, air and oil filters, 3 instruction manuals, spare parts lists, the first fill of all lubricating oils, fuel, etc.

2. Alternator

2.1 General

The alternator shall be of the self excited brush less type, with enclosed ventilated drip proof housing and must be capable of supplying the specified output continuously with a temperature rise not exceeding the limits laid down in BS 5000 for rotor and stator windings.

The alternator shall be capable of delivering an output of 110% of the specified output, for one hour in any period of 12 hours consecutive running.

Both windings must be fully impregnated for tropical climate and must have an oil resisting finishing varnish.

2.2 Regulation

The alternator must preferably be self-regulated without the utilisation of solid state elements. The inherent voltage regulation must not exceed plus or minus 5% of the nominal voltage specified, at all loads with the power factor between unity and 0,8 lagging and within the driving speed variations of 4,5% between no-load and full load.

2.3 Performance

The excitation system shall be designed to promote rapid voltage recovery following the sudden application of the load. The voltage shall recover to within 5% of the steady state within 300 mili-seconds following the application of full load and the transient voltage dip shall not exceed 18%.

2.4 Coupling

The engine and alternator must be directly coupled by means of a high quality flexible coupling, equal and similar to the “HOLSET” type.

3. Switchboard

3.1 General

A switchboard must be supplied and installed to incorporate the equipment for the control and protection of the generating set and battery charging.

The switchboard must conform the specification as set out in the following paragraphs.

3.2 Construction

The switchboard shall be manufactured from 3CR12 stainless steel.

The switchboard shall be a totally enclosed and installed inside the soundproof generator enclosure.

The board shall be flush fronted and all equipment to be mounted behind the front plate, on suitable supports.

All equipment, connections and terminals shall be easily accessible from the front. The front panels may be either hinged or removable and fixed with studs and chromium-plated cap nuts. Self tapping screws shall be used in the construction of the board.

All pushbuttons, pilot lights, control switches, instrument and control fuses, shall be mounted on hinged panels with the control wires in flexible looms.

The steelwork of the boards must be thoroughly de-rusted, primed with zinc chromate and finished with two coats of signal red quality enamel, or a baked powder epoxy coating.

Suitably rated terminals must be provided for all main circuits and the control and protection circuits. Where cable lugs are sued, these shall be crimped onto the cable strands. Screw terminals shall be of the type to prevent spreading of cable strands. All terminals shall be clearly marked.

For the control wiring, each wire shall be fitted with a cable or wire marker of approved type, and numbering of these markers must be shown on the wiring diagram on the switchboard. Control wiring shall be run in PVC trunking. The trunking shall be properly fixed to the switchboard steelwork. Adhesives shall not be acceptable for the fixing of trunking or looms.

The automatic control and protection equipment shall be mounted on a separate easily replaceable small panel with printed circuits. The equipment shall mainly be the “solid state” type. After mounting the equipment on the panel, the rear of this panel shall be sealed with epoxy-resin. However, other proven control systems may also be considered, but must be described in detail.

All equipment on the switchboard, such as contactors, isolators, busbars, etc., shall have ample current carrying capacity to handle at least 110% of the alternator full load current.

3.3 Protection and Alarm Devices

All switchboards shall be equipped with protection and alarm devices as described below.

A circuit breaker and an adjustable current limiting protection relay must be installed for protection of the alternator. The protection relay shall be of the type with inverse time characteristics. The relay shall cause contactor to isolate the alternator and stop the engine.

Protection must be provided for overload, high engine temperature, low lubricating oil pressure, over speed, start-failure, and low water level.

Individual relays with reset pushed are required, to give a visible signal and stop the engine when any of the protective devices operate. In the case of manual operation of standby sets, it shall not be possible to restart the engine.

The indicators and re-set pushes must be marked in English.

“OVERLOAD”
“TEMPERATURE HIGH”
“OIL PRESSURE LOW”
“OVER-SPEED”

"START FAILURE"
"LOW WATER LEVEL"

In addition two relays with reset pushes must be fitted giving and audible and visible signal when:

(a) The fuel level in the service tank is low. The reset push of this relay must be marked "FUEL LOW".

In addition, a low-low level sensor must be provided. At this level the engine must stop to prevent air entering the fuel system.

(b) The battery charger failed. The reset push of this relay must be marked "CHARGER FAIL".

This is also applicable to the engine driven generator/alternator.

All relays must operate an alarm hooter. A pushbutton must be installed in the hooter circuit to stop the audible signal, but the fault indicating light on the control panel must remain lit until the fault has been rectified.

An on/off switch is not acceptable. After the hooter has been stopped, it must be re-set automatically, ready for a further alarm.

The hooter must be of the continuous duty and low consumption type. Both hooter and protection circuits must operate from the battery.

Potential free contacts from the alarm relay must be brought down to terminals for remote indication of alarm conditions.

A test pushbutton must be provided to test all indicators lamps.

3.4 Manual Starting

Each switchboard shall be equipped with two pushbuttons marked "START" and "STOP" for manual starting and stopping of the set.

3.5 Battery Staring Equipment

Each switchboard shall be equipped with battery charging equipment.

The charger shall operate automatically in accordance with the state of the battery and shall generally consist of an air-cooled transformer, a full wave solid state rectifier, and the necessary automatic control equipment of the constant voltage system.

The charger must be fed from the mains. An engine driven alternator must be also a provided for charging the battery while the set is operational. Failure of this alternator must also activate the battery charger failure circuit.

3.6 Switchboard Instruments

Each generating set shall have a switchboard equipped as follows:

(a) One flush square dial voltmeter, reading the alternator voltage, scaled as follows:

(i) 0-300V for single phase generators.
(ii) 0-500V for three phase generator. In this case a six position and off selector switch must be installed for reading all phase and phase to neutral voltages.

(b) A flush square dial combination maximum demand and instantaneous ampere meter for each phase, with resettable pointer suitably scaled 20% higher than the alternator rating. A red arc stripe above scale markings from 0-20A and a red

radial line through the scale at full-load current shall be provided. These instruments shall be supplied complete with the necessary current transformer.

(c) One flush square dial vibrating type frequency meter, indicating the alternator frequency.

(d) A six digit running hour meter with digital counter, reading the number of hours the plant has been operating. The smallest figure on this meter must read $^{1}/_{10}$ hour.

(e) Fuses or m.c.b.'s for the potential voltage circuits of the meters.

(f) One flush square dial ampere meter suitably scaled for the battery charging current.

(g) One flush square dial voltmeter with a spring loaded pushbutton or switch for the battery voltage.

3.7 Marking

All labels, markings or instructions on the switchgear shall be in both official languages.

3.8 Earthing

An earth bar must be fitted in the switchboard, to which all non-current carrying metal parts shall be bonded.

The neutral point of the alternator must be solidly connected this bar by means of a removable link labelled "EARTH". Suitable terminals must be provided on the earth bar for connection of up to three earth conductors, which will be supplied and installed by others.

3.9 Operation Selector Switch (by Electronic Controller)

A four position selector switch must be provided on the switchboard marked "AUTO", "MANUAL", "TEST" and "OFF".

With the selector on "AUTO", the set shall automatically start and stop, according to the mains supply being available or not.

With the selector on "TEST", it shall only be possible to start and stop the set with the pushbuttons, but the running set shall not be switched to the load.

With the selector on "MANUAL", the set must take the load when started with the pushbutton, but it must not be possible to switch the set on to the mains, or the mains onto the running set.

With the selector on "OFF", the set shall be completely disconnected from the automatic controls, for cleaning and maintenance of the engine.

3.10 Automatic Change-over System

A fully automatic change-over system must be provided to isolate the mains supply and connect the standby set to the outgoing feeder in case of a mains failure and reverse this procedure on return of the mains.

Allowance has been made for the automatic change-over system to be installed on a separate switchboard cubicle.

All cabling required between the generator set and the aforementioned switchboard shall be provided under this contract.

3.11 By-pass Switch and Main Isolator

The switchboard shall be equipped with an on-load isolator to isolate the mains and a manually operated on-load by-pass switch, which shall either connect the incoming mains to the automatic control gear or directly to the outgoing feeder. In the latter position the automatic control gear, including the main contactors, shall be isolated for maintenance purposes. It shall not be possible to start the engine except with the selector switch in the "TEST" position.

It is required that this by-pass switch and mains isolator be mounted away from the automatic control gear, in a separate compartment either on the side or in the lower portion of the switchboard cubicle, and that the switches operated from the front of the compartment.

3.12 Start Delay

Starting shall be automatic in event of a mains failure. A 0-15 second adjustable start delay timer shall be provided to prevent start-up on power trips or very short interruptions.

3.13 Stop Delay

A stop delay with timer is required for the set, to keep the set on load for an adjustable period of one to sixty seconds after the return of the mains supply, before changing back to the supply. An additional timer shall keep the set running for a further adjustable cooling period of 5 to 10 minutes at no-load before stopping.

3.14 Electronic Controller

The abovementioned controller should also be provided with digital communications port of a standard RS232/485 or Ethernet interface suitable for TCP/IP. The controller shall be able to forward via the aforementioned port/s all the status indicators of the generator set including that of the AMF-contactors to a third party software.

4. Electrical Installation

Allowance has been made in this specification for the supply and installation / relocation of existing LV PVCAS cables within the generator room and in-between the main distribution boards within Sally Ports.

The tenderer must include for the complete installation and wiring of the plant in running order.

The connecting of the cable and control cabling to the generator and the control terminals in the LV board remains the responsibility of the tenderer.

5. Warning Notices

Notices, in English, must be installed in the plant rooms.

The contents of these notices are summarised below.

(a) Unauthorised entry prohibited.

(b) Unauthorised handing of equipment prohibited.

(c) Procedure in case of electric shock.

(d) Procedure in case of fire.

The successful tenderer must consult the Occupational Health and Safety Act 83 of 1993 and get approval of the wording from the Employer's Representative, prior to ordering the notices.

Lettering must be black on a yellow background.

Notices (a) must be installed outside next to the entrance of the plant room and (b-d) inside the plant room.

In the plant room, a clearly legible and indelible warning notice must be mounted in a conspicuous position.

The motive shall be made of a non-corrodible and non-deteriorating material, preferable plastic, and must read as follows:

DANGER: This engine will start without notice. Turn selector switch on control board to “OFF” before working on the plant.

6. Construction

The engine and alternator of the set shall be built together on a common frame, which must be mounted on a skid base on anti-vibration mountings. The set must be placed direct on the concrete of the generator room. A drip tray must be fitted under the engine. The tray must be large enough to catch a drip from any part of the engine.

The frame must be of the ‘DUPLEX’ type.

A soundproof canopy shall be provided over the engine, alternator and control panel to reduce the noise levels to max. 60dBA at 1 metre from the generator set. The canopy shall be constructed using 3CR12 steel or aluminium which shall be painted to a white finish colour and epoxy coated.

Hot dipped galvanised steel shall be used for the base and support steelwork.

7. Operation

The set is required to supply the lighting and power requirements in the case of a mains power failure.

The set shall be fully automatic i.e. it shall start when any one phase of the main supply fails or get switched and shall shut down when the normal supply is re-established. In addition it shall be possible to manually start and stop the set by means of pushbuttons on the switchboard.

The automatic control shall make provision for three consecutive starting attempts. Thereafter the set must be switched off, and the start failure relay on the switchboard must give a visible and audible indication of the fault.

To prevent the alternator being electrically connected to the mains supply when the mains supply is on and vice versa, a safe and fail proof system of suitably interlocked contactors shall be supplied and fitted to the changeover switchboard.

SPECIFICATION FOR THE SUPPLY DELIVERY AN INSTALLATION OF AN EMERGENCY GENERATOR SET

SECTION 3 – TECHNICAL SPECIFICATION

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SECTION 3 – TECHNICAL SPECIFICATION

1. General

Supply, deliver, install, commission, test and maintain standby generating sets at the St Albans Correctional Facility (EC) in Gqeberha.

This installation must comply fully with all the sections and drawings of this document. This technical specification is supplementary to the Equipment Requirements, Section 2, and must be read together where they are at variance the Technical Specification shall apply.

The set must be installed in the generator room provided and it is the sole responsibility to ensure that the proposed set will be able to fit into the room provided.

2. Site Information And Conditions

2.1 Location

The sites are in Gqeberha, ±30km from the Central Business District.

2.2 Site Conditions

The following site conditions will be applicable and equipment shall be suitably rated to develop their assigned rating and duty at these conditions.

a)	Height above sea level	: 80 meters
b)	Temperature	: 6 - 38°C
c)	Humidity	: 70%

3. Output And Voltage

After the de-rating factors for the engine and generator due to site conditions have been taken into account, the set must have a site output and voltage as follows: -

No load voltage	:	400/230 Volt
Rating in kW at 0.8power factor/kVA		
Sally Port S01	:	65kW/81kVA
Sally Port S03	:	50kW/62.5kVA
Sally Port S05	:	80kW/100kVA
Sally Port S10	:	105kW/131kVA
Frequency	:	50Hz
Fault Level	:	5kA

The generating set is required to feed the following electrical load:

Discharge lighting
Fluorescent lighting
Heaters & plugs
Computers & radios

4. Switchboard/Control Panel Unit

All switch- and control gear shall be rated for a fault current level of 5kA.

The generator set offered shall be the “closed” type with the switchboard/control panel mounted inside the housing.

5. Cables

The contractor will be responsible for all electrical cable connections associated with the complete generating set installation.

6. Engine

A sump drainpipe must be fitted with a shut-off valve placed in a convenient position outside the base frame to facilitate drainage.

Recommended oil types must be indicated on the engine, or base frames, by means of suitable labels.

All engine instruments shall have clear markings on the faceplates, indicating the normal operating zone(s), maximum and minimum allowable values/limits and danger zone(s).

The flywheel shall be covered by approved hoods.

7. Alternator

The Alternator shall be of the low harmonic type.

8. Load Acceptance

The generator set shall be capable of accepting 75% of the specified site electrical output 10 seconds after the starter motor is energised and the remaining 25%, 5 seconds thereafter, i.e. 100% load acceptance shall not exceed 15 seconds.

9. Generator Room

The generator set shall be installed in existing room which have been designed as generator rooms in locations shown on drawings.

10. Alarms

The successful tenderer must pay particular attention to the requirements of the alarms as described in the Equipment Requirements, Section 2.

One alarm hooter and red light shall be supplied and installed on the outside wall of the generator room in the position as shown on the drawing in this specification.

The hooter shall consist of an electronic unit similar and equal to a “Klaxon” - type SY2/725 hooter with a continuously rated output and 110 db at a distance of 2 metres, and shall be IP55 weatherproof rated.

The warning light shall consist of a 40W flashing red light, which shall be mounted on a galvanised steel frame together with the hooter.

The hooter and light shall be switched on or off simultaneously after initiation or cancellation of an alarm condition. The supply and installation of the wiring between the control board and the alarm unit forms part of this contract.

The successful tenderer must ensure that the hooter control circuit resets automatically after cancellation due to a low fuel condition or battery charger failure, but the visible fault indication must remain, i.e. should the operator continue to run the set, the hooter must sound, should any other condition develop.

11. Remote Control Generator Switch

Not applicable

12. Fuel Drip Tray

A drip tray approximately 100mm deep shall be mounted below the fuel tank and must be large enough to collect any fuel that drips from the tank accessories. The drip tray shall be manufactured from 3CR12 steel. The thickness of the drip tray sheet steel shall not be less than 2mm.

13. Completion Time

The generator sets will be provided to supply existing electrical installations therefore the completion period shall be based on the manufacturer's delivery period plus time required for delivery and installation on site.

14. Inform

The successful tenderer shall inform the Engineer when the set is ready for installation.

SPECIFICATION FOR THE SUPPLY DELIVERY AN INSTALLATION OF AN STANDBY GENERATOR SET

SECTION 4 – SCHEDULES OF TECHNICAL INFORMATION

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SECTION 4 – SCHEDULES OF TECHNICAL INFORMATION

1. Engine

NO	ITEM	REMARKS
1.	Manufacturer's Name:	
2.	Country of Origin:	
3.	Manufacturer's model No. and year of manufacture	
4.	Continuous sea level rating after allowing for ancillary equipment (in b.h.p and in kW):	
	Sally Port s01	
	Sally Port S03	
	Sally Port S05	
	Sally Port S10	
5.	Percentage de-rating for site conditions, in accordance with BS 551.4 a) For altitude b) For temperature c) For humidity d) Total de-rating	
6.	Net output on site in kW:	
	Sally Port s01	
	Sally Port S03	
	Sally Port S05	
	Sally Port S10	
7.	Nominal speed in r.p.m.	
8.	Number of cylinders	
9.	Strokes per working cycle	
10.	Stroke in mm	
11.	Cylinder bore in mm	
12.	Swept volume in cm^3	
13.	Mean piston speed in m/min	
14.	Compression ratio	
15.	Cyclic irregularity	
	Fuel consumption of the complete generating set on site in l/h of alternator output : Sally Port S01: a) Full load b) ¾ load c) ½ load Sally Port S03: a) Full load b) ¾ load c) ½ load	

NO	ITEM	REMARKS
	Sally Port S05: a) Full load b) ¾ load c) ½ load Sally Port S10: a) Full load b) ¾ load c) ½ load NOTE : A tolerance of 5% shall be allowed above the stated value of fuel consumption.	
16.	Make of fuel injection system.	
17.	Capacity of fuel tank in litres:	
	Sally Port s01	
	Sally Port S03	
	Sally Port S05	
	Sally Port S10	
18.	Is gauge glass fitted to tank?	
19.	Is electric pump for filling the fuel tank included?	
20.	Method of starting	
21.	Voltage of starting system	
22.	Method of cooling	
23.	Type of radiator if water-cooled	
24.	Type of heater for warming cylinder heads	
25.	Capacity of heater in kW	
26.	Method of protection against high temperature	
27.	Method of protection against low oil pressure	
28.	Type of governor	
29.	Speed variation in % a. Temporary b. Permanent	
30.	Minimum time required for as assumption of full load in seconds	
31.	Recommended interval in running hours for : a. Lubricating oil change b. Oil filter element change c. Decarbonising	
32.	Type of base	
33.	Can plant be placed on solid concrete floor?	
34.	Are all accessories and ducts included?	
35.	Is engine naturally aspirated?	

NO	ITEM	REMARKS
36.	Are performance curves attached?	
37.	Diameter of exhaust pipe	
38.	Noise level in plant room in dBA:	
	Sally Port S01	
	Sally Port S03	
	Sally Port S05	
	Sally Port S10	
39.	Noise level at tail of exhaust pipe in dBA	Included under Item No. 38.
40.	BMEP (4 stroke) at continuous rating (kPa)	
41	% Load acceptance to BS 5514, Part 4, with 10% transient speed drop	

2. <u>Alternator</u>

NO	ITEM	REMARKS
1.	Maker's name and model no.	
2.	Country of Origin and year of manufacture	
3.	Type of enclosure	
4.	Nominal speed in r.p.m.	
5.	Number of bearings	
6.	Terminal voltage	
7.	Sea level rating kVA at 0,8 power factor:	
	Sally Port S01	
	Sally Port S03	
	Sally Port S05	
	Sally Port S10	
8.	De-rating for site conditions	
9.	Input required in kW:	
	Sally Port S01	
	Sally Port S03	
	Sally Port S05	
	Sally Port S10	
10.	Method of excitation	
11.	Efficiency at 0,8 power factor and : Sally Port S01: a) Full load b) ¾ load c) ½ load Sally Port S03:	

NO	ITEM	REMARKS
	a) Full load b) ¾ load c) ½ load Sally Port S05: a) Full load b) ¾ load c) ½ load Sally Port S10: a) Full load b) ¾ load c) ½ load	
12.	Maximum permanent voltage variation in %	
13.	Transient voltage dip on full load	
14.	Voltage recovery on full load application in milli-seconds	
15.	Is alternator brushless?	
16.	Class of insulation of windings	
17.	Is alternator tropicalised?	
18.	Symmetrical short circuit current at terminals n Ampere	
19.	Type of Coupling	

3. <u>Switchboard</u>

NO	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Is board floor mounted?	
4.	Finish of board	
5.	Make of volt, amp, and frequency meters	
6.	Dial size of meters in mm	
7.	Scale range of voltmeter	
8.	Scale range of ammeters	
9.	Ration of current transformers	
10.	Make of hour meter	
11.	Range of cyclometer counter	
12.	Smallest unit shown on counter (Item 11)	
13.	Make of circuit breaker	
14.	Type of circuit breaker	
15.	Rating of circuit breaker in Amp and fault level in kA	
16.	Setting range of overload trips	

NO	ITEM	REMARKS
17.	Setting range of instantaneous trips	
18.	Make of change-over equipment	N/A
19.	Make of voltage relay	
20.	Is control and protection equipment mounted on a small removable panel?	
21.	Type of control equipment	
22.	Make of mains isolator	
23.	Type of indicators for protective devices	
24.	Make of rectifier	
25.	Type of rectifier	
26.	Is battery charging	
27.	Are volt- and ammeters provided for charging circuit?	
28.	Is the alarm hooter of the continuous duty type?	
29.	Rating in Amps of: Sally Port S01: a. Change-over equipment b. Mains on load isolator c. By-pass switch d. Circuit breaker to outgoing feed Sally Port S03: a. Change-over equipment b. Mains on load isolator c. By-pass switch d. Circuit breaker to outgoing feed Sally Port S05: a. Change-over equipment b. Mains on load isolator c. By-pass switch d. Circuit breaker to outgoing feed Sally Port S10: a. Change-over equipment b. Mains on load isolator c. By-pass switch d. Circuit breaker to outgoing feed	
30.	Is manufacture of switchboard/control panel to be sub-let?	
31.	If yes, state name and address of specialist manufacturer	

4. Battery

NO	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Type of battery	
4.	Voltage of battery	
5.	Number of cells	
6.	Capacity in cold crank amp	

5. Dimensions

NO	ITEM	REMARKS
1.	Overall dimensions of set in mm: Sally Port S01: Sally Port S03: Sally Port S05: Sally Port S10:	
2.	Overall mass: Sally Port S01: Sally Port S03: Sally Port S05: Sally Port S10:	
3.	Are generator rooms adequate for the installation of the sets	

6. Deviation from the Specification as An Alternative (State Briefly)

NO	DESCRIPTION

7. Spare Parts and Maintenance Facilities

NO	ITEM	REMARKS
1	Approximate value of spares carried in stock for this particular diesel engine and alternator	
2	Where are these spares held in stock	
3	What facilities exist for the servicing of the equipment offered	
4	Where are these facilities available	

8. Particulars of the Electrical Contractor

NO	ITEM	REMARKS
1	Electrical Contractor: Name Address Tel & Cel Numbers	
2	Is the Contractor registered as an Electrical Contractor with the Department of Labour?	
3	Name of the Registered Person as an a three phase installation electrician.	
4	Attached a certified copy of the Registered Person's Certificate	

SPECIFICATION FOR THE SUPPLY DELIVERY AN INSTALLATION OF AN STANDBY GENERATOR SETS

SECTION 5 – BILL OF QUANTITIES

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SCHEDULE OF IMPORTED MATERIALS AND EQUIPMENT
TO BE COMPLETED BY TENDERER

The Contractor shall list imported items, materials and/or equipment which shall be excluded from the Contact Price Adjustment Provisions and shall be adjusted in terms of currency fluctuations only. Copies of the supplier's quotations for the items, materials or equipment (not higher than the Contract rate as listed below) should be lodged with the Representative of the University of Fort Hare within 60 (sixty) days from the date of acceptance of the tenders. No adjustment of the contractor's profit, local VAT amount, discount, mark-up, handling costs, etc. shall be allowed.

ITEMS	MATERIAL / EQUIPMENT	RAND (R) EXCLUDING VAT
1		
2		
3		
4		
5		
6		

FORMULA:

The net amount to be added to or deducted from the contract sum:

$$A = V \times \frac{Z}{Y}$$

A = the amount (R) of adjustment

V = the net amount (R) (Supplier's Quotation) of the imported item (Material or Equipment)

Y = exchange rate at the closing date of tender submission

Z = exchange rate on the date of payment

ANNEXURE B: List of drawings:

Drawing No. …….: Main LV Site Plan Layout

Drawing No.: …….: …Plan Layout

Drawing No.: ……: … Single Line Diagrams

SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic Specification
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	**Uninterruptible Power Supply Specification (This Document)**
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification

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SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

SECTION 1 – GENERAL

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SECTION 1 – GENERAL

1. Intent of Document

The specification is intended to cover the complete installation of the uninterrupted power supply. The minimum equipment requirements are outlined, but do not cover all the details of design and construction. Such details are recognised as being the exclusive responsibility of the contractor.

In all cases where a device or part of the equipment is referred to in the singular, it is intended that such reference shall apply to as many devices as are required to complete the installation.

2. Standards and Codes

Refer to clause 1 of Section 2 of this document for the relevant standards and codes.

All equipment shall be Y2K compliant.

3. Scope of Work

Supply, delivery, installation and commissioning of the complete uninterrupted power supply specified in this document.

The plant room will be provided by other trades and the contractor shall ensure that the space allowed is sufficient for the installation of the UPS and that the ventilation of the plant room is adequate. If any changes to the design have to be made the contractor must inform the consulting engineer in writing.

The extent of work covered under this specification shall consist of the following:

a) Testing for proper operation of existing six (6) x 10kVA three phase UPS units on site including installation of these units if are found to be operational. Any repairs which may be required to get these units into functional state shall be resolved during the course of the project. It has been assumed the aforementioned UPS are capable of parallel operation.
b) Supply and installation of two (2) x 10kVA three phase UPS units which shall be suitable for parallel redundant configuration.
c) Supply and installation of thirty seven (37) 2kVA single phase UPS units.

4. Ambient Operating Conditions

a)	Ambient Temperature	: 6 - 38°
b)	Relative Humidity	: 70%
c)	Altitude	: 80 above sea level
d)	Dust	: Low
e)	Corrosion	: High

5. Site Information

St Albans Correctional Facility is located at Gqeberha, Kariega Farms, Old Cape Road, GPS co-ordinates -35.90770, 25.34638.

The 10kVA UPS units shall be installed inside existing brick-built rooms which have already been provided with cable ducts, UPS sub-distribution boards and air-conditioning facility.

The 2kVA UPS unit shall be suitable for installation in a 19” rack facility which will be provided inside outdoor ventilated enclosures.

6. Co-ordination

Due to the nature of the installation, a fixed sequence of operation is required to properly install the complete uninterrupted power supply. The work shall be closely scheduled in order not to delay the entire project.

The contractor shall familiarise himself with the requirements of the other trades and shall examine the plant and specification covering each of these sections.

The space requirements shall be carefully checked with the other trades to ensure that the equipment can be installed in the proper sequence in the space allocated.

7. Test Certificates and Inspections

The following tests are to be carried out:

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

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

(c) Test reports of both tests as specified under (a) and (b) are to be submitted to the Representative/Agent.

8. Guarantee and Maintenance

The Contractor shall guarantee the complete plant for a period of twelve months after first delivery has taken place.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design or workmanship, the Contractor will be notified and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site at his own expense.

The Contractor shall maintain the plant in good working condition for the full twelfth month period to the final delivery of the installation. However, should the Contractor fail to hand over the plant in good working order on the expiry of the specified twelve months, the Contractor shall be responsible for further monthly maintenance until final delivery is taken.

During this period the contractor will undertake to arrange that the plant be inspected at regular intervals (whatever number of visits the contractor deems necessary to fully maintain the equipment) by a qualified member of his staff who shall: -

(a) Check the mechanical soundness of all parts

(b) Check and adjust all the output and control values of the system (voltage, frequency, control voltages, etc.)

(c) Take control measurements on the major system components and record these measurements.

(d) Replace all defective components.

(e) Service batteries.

(f) Check ventilation UPS equipment.

(g) Clean all equipment and/or rooms as required.

(h) Provide 24 hour standby maintenance and repair service at all times, including statutory holidays.

Note: At each visit, which shall be arranged in advance with the client's representative, a record of maintenance carried out shall be kept. The time and date of visits shall be entered in a logbook, which shall be kept in the plant room.

9. Materials and Workmanship

(a) The work throughout shall be executed to the highest standards and to the entire satisfaction of the Representative/Agent who shall interpret the meaning of the Contract Document and shall have the authority to reject any work and materials, which, in his judgement, are not in full accordance therewith. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

(b) All work shall be executed in a first-class manner by qualified tradesman.

(c) The Contractor shall warrant that the materials and workmanship shall be of the highest grade, that the equipment shall be installed in a practical and first-class manner in accordance with the best practices and ready and complete for full operation. It is specifically intended that all material or labour which is usually provided as part of such equipment as is called for and which is necessary for its proper completion and operation shall be provided without additional cost whether or not shown or described in the Contract Document.

(d) The Contractor shall thoroughly acquaint himself with the work involved and shall verify on site all measurements necessary for proper installation work. The Contractor shall also be prepared to promptly furnish any information relating to his own work as may be necessary for the proper installation work and shall co-operate with and co-ordinate the work of others as may be applicable.

(e) All components and their respective adjustment, which do not form part of the equipment installation work, but influence the optimum and safe operation of the equipment shall be considered to form part of, and shall be included in the Contractor's scope of works.

(f) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

(g) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the installation and guarantee periods to ensure the safety of the public and the User Client.

(h) The Contractor is to include for all scaffolding required to complete the work required.

10. Brochures

Detailed brochures of all equipment offered shall be presented together with the tender documents.

11. Submittals

The following information must accompany the tender documents

(a) The information requested in the schedule of information.

(b) A paragraph by paragraph schedule of compliance with detailed description of any deviations from this specification.

(c) If alternative systems are offered, a clear description of the operating characteristics and special features of the equipment along with a motivation for offering the alternative.

(d) Descriptive and illustrated brochures and other information pertaining to the inverter and ventilation equipment and switchgear.

(e) The proposed layout as stated.

(f) Arrangement of batteries.

(g) A sample test report as stated.

(h) The circuit diagram requested.

(i) The information requested.

(j) Tenderers shall submit a list of successful installations completed in the Republic of South Africa.

SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

SECTION 2 – EQUIPMENT REQUIREMENTS

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1. QUALITY, STANDARDS AND REGULATIONS

All material and equipment supplied for this contract shall be new and the best of their respective kind. All new materials and equipment supplied, shall comply fully with the requirements laid down in the specification. The whole of the works shall be executed in accordance with best practice and to approval of the engineer. The equipment shall comply with the latest issues of the following standard specifications:

1.1 South African Bureau of Standards

SABS 150	Insulated wire.
SANS 1091	Colour standards for paint.
SANS 0142	Wiring code of practice.
SANS 1474	UPS units.

1.2 Regulations and Rights of Engineer

Apart from any other authority, which the engineer may have in terms of the contract, he shall have the right to set the standard and to accept or reject part of the specified equipment depending on the quality of material and workmanship offered.

The contractor shall be notified if the quality of such materials and/or workmanship is not acceptable. In such an event, the contractor shall replace the specific part or repair it to the satisfaction of the engineer, all at the cost of the contractor. Such an instruction shall not exempt the contractor from any of his obligations in terms of the contract.

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

a) The Basic Conditions of Employment Act and the Machinery and Occupational Safety Act of 1983, as amended.

b) The local Municipality by-laws and Regulations as well as the regulations of the local Supply Authority.

c) The local Fire regulations.

d) The Regulations of the Department of Posts and Telecommunications.

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

In addition the contractor shall at his cost issue all notices in respect of the installation to the local authorities, and shall exempt the client from all losses, costs or expenditures which may arise as a result of the contractor's failure to comply with the requirements of the regulations enumerated above.

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

2. UNINTERRUPTED POWER SUPPLY (UPS)

2.1 Definitions

(a) **UPS** shall denote the complete UPS unit with associated controls, remote alarm panel and batteries and any accessories required by the system for its successful operation.

(b) **Power Converter Module** shall denote a rectifier, battery charger, inverter, electromechanical by-pass switch and manually operated by-pass switch.

(c) **Rectifier** shall denote that portion of the converter module containing the equipment and controls to convert the incoming AC power to regulated DC power required by the inverter.

(d) **Inverter** shall denote that part that converts the DC supplied by the rectifier to AC satisfying the load requirements.

(e) **Electro-mechanical** by-pass static switch shall denote a by-pass system provided break free switching from inverter to mains operation and vice versa.

(f) **Battery charger** shall denote that portion of the power converter module containing the equipment and controls to convert the incoming AC power to precisely regulated DC power required for battery charging.

(g) **Critical load** denotes the load as presented to the UPS by the computer or other load requiring constant supply and associated circuits and apparatus.

(h) **Mean-Time-Between-Failure (MTBF)** shall denote an overall MTBF of the UPS as a complete system.

(i) **A system failure** shall denote any interruption to, or degradation of the critical load bus voltage or frequency beyond the limits set forth herein.

(j) **Efficiency** shall denote the ratio of real output power (kW) to real input power (kW) with the UPS operating at a defined load power at the defined power factor, the battery fully charged and with nominal input voltage.

2.2 System Requirements (The Required Input and Output Voltages Are Detailed In Part 2 Of This Specification)

(A) Input to the UPS

(a) Input voltage : 400/231V ± 10% or 231V ± 5%

(b) Frequency : 50Hz ± 4%

(c) System : 1 phase 2 wire or 3 phase 4 wire with operative earth conductor, supplied from utility network or standby generator set. Refer to detail specification.

(d) Power factor Not less than 0,8 lagging.

(e) Max starting current: 10 times full load current for not more than ½ a cycle with rectifier soft starting facility.

(B) **Output to Load**

(a) Rating : Refer to detail specification.

(b) Output voltage : Refer to detail specification.

(c) Frequency : 50 Hz ± 0,5 Hz.

(d) System : 1 phase 2 wire or 3 phase 4 wire with operative earth conductor. Refer to detail specification.

(e) Voltage regulator : ± 10% maximum deviation of steady state voltage recovering to within 5% in less than 50 ms and to within 1% less in that 100 ms.

(f) Frequency stability : Normally automatically synchronised to mains frequency if the latter is within 50 Hz ± 2% (adjustable window) Runs free at 50 Hz ± 0,5 Hz at any load when mains is out of limits.

(g) Harmonic content : Less than 4% total distortion.

(h) Amplitude modulation : Less than 2%

(C) Overall Performance

Efficiency (overall) : 80 - 85%

(D) Ambient Operating Conditions

Refer to Section 1, General – Clause 5

(E) System Description

The system shall consist of a static UPS complete with the following components :

(a) Rectifier/charger.

(b) Inverter.

(c) Battery.

(d) Automatic electronic no-break bypass circuit and switch.

(e) Separate manual bypass switch.

(f) Protective devices and measuring equipment.

(g) The required controls and necessary equipment.

(h) A self monitoring system with digital readout by means of which all critical functions can be checked.
Note: Requirement (h) Is Only For Ups Systems Above 200 kVA

The system shall be capable of providing an uninterrupted supply to the load with the output characteristics as specified for a minimum period of **30 minutes** during a total mains failure (i.e. normal mains and standby generator supply failure). The batteries shall be rated at an AC load power factor of 0,8 lagging.

The complete system, including all controls shall be designed in such a way that the failure of any one vital central component will **NOT** cause a complete system failure. If necessary such a failure must be avoided by connecting the load directly to the mains by means of the bypass switch.

The UPS shall operate satisfactorily synchronous with the mains supply even under severe conditions of up to 100% unbalanced load.

The UPS shall be amply rated to carry the stated full load current. The UPS shall furthermore be capable of withstanding the following overloads.

Static Overloads: 100% of full load continuously.
125% of full load for 5 minutes.
150% of full load for 2 minutes.
165% of full load for 1 second with inductive decay after initial equipment switch on surge current.

Dynamic Overload : 300% for less than 5 msec.
1000% for less than 1 msec.

All component parts, cables and other connections shall be amply rated to withstand the overloads stated and maintain the input voltage **at the load** within the tolerances stated.

The equipment shall be designed for the maximum operating efficiency. The efficiency shall be determined when the system is delivering full load at 0,8 power factor with the batteries fully charged. The load required by the auxiliary equipment (controls, alarms, etc). electronic switches and cabinet fan shall be included in the determination of overall efficiency. A typical test report clearly showing how the efficiencies are calculated, shall be submitted with the tender.

It shall be the responsibility of the successful tenderer to ensure satisfactory operation of the complete system for the load to be supplied. It is, therefore, essential that the tenderer acquaint himself fully with typical load conditions before the tender closing date.

All cabinets containing thyristors shall be adequately screened and earthed to prevent direct radio frequency radiation.

Tenderers shall submit with their tenders a schematic diagram showing :

Input circuit breakers.
System busbars.
Rectifiers.
Batteries.
Inverters.
Electronic switches.
Bypass circuit.
Detour circuit.
Fuse protection.
Output circuit breakers.
Oscillator.
Power supply circuits to oscillator, alarms, controls, etc.
Battery isolator.

The diagram shall also show the relative phase displacement of the rectifier transformers.
NOTE: This Is Not Applicable To Systems Below 200kVA.

(F) Inverter Oscillator

The inverter shall contain an oscillator capable of operating and maintaining the inverter output frequency as specified. The inverter oscillator shall be capable of frequency synchronisation and phase locking to the mains (or standby generator) power source frequency. When operating as a slave to the mains or standby power and a failure occurs in the slaving signal, the invertor oscillator shall automatically revert to a free running state and maintain the specified limits. All changes in output frequency to free run or synchronise shall be gradual to suit the load requirements.

(G) Rectifier

The UPS shall have its own rectifier and rectifier transformer which shall operate satisfactorily from the mains or standby supply.

The rectifier shall be of the solid state type providing full wave rectification of the input voltage suitably regulated to suit the input requirements of the inverter. Where necessary, a high grade DC filter shall be utilised to limit the output ripple to within acceptable levels for the inverter input. Current limiting features shall be provided to protect the rectifier. The current limiting settings shall be variable for final adjustment on site.

Voltage free contacts shall be provided for the malfunction alarms of the rectifier.

An input monitoring circuit shall be provided for the rectifier. This circuit shall switch off the rectifier when the r.m.s. value or frequency of the input voltage falls below present values.

The necessary protection circuitry shall be provided to switch off the rectifier if any one of the rectifier phases should fail, thus presenting an unbalanced load to the incoming supply.

The output of the rectifier shall be connected in parallel to the battery and inverter.

The rectifier shall have over temperature protection. Temperature sensing probes shall be placed on the thyristor housing, thyristor mounting, or on the heat sink close to the thyristor. The sensing of the off coming air temperature alone is not acceptable.

Tenderers shall take into account the possible effects of harmonics that may be present on the input supply due to non-sinusoidal waveforms at the rectifier input, phase commutation, the effect of reactance during phase commutation etc. The input voltage monitoring circuits of the rectifiers shall be adequately filtered and buffered to ensure reliable load control and to prevent continuous on-off switching of the rectifiers.

For three phase units each of the three rectifier transformers shall have a different primary to secondary phase displacement in order to minimise the harmonics generated by the rectifiers.
NOTE: This Is Not Applicable For Systems Below 200 kVA

(H) Inverter

The inverter shall be adequately protected against any excessive overload or short circuits that occur in the load. Reactive current limiting or other methods shall be employed to render the thyristors short circuit proof. The successful tenderer shall replace any thyristors or any inverter components at his own expense if these should be damaged.

The necessary feedback and control circuits shall be incorporated to ensure satisfactory operation separately or in synchronisation with the mains supply under all conditions of dynamic load variations, stated overloads, severe unbalanced conditions and high operating temperatures. The thyristor bridge shall contain the necessary auxiliary circuitry to ensure satisfactory operation.

The output of the inverter shall be connected in parallel with the thyristor switch output.

Each inverter shall have over temperature protection similar to the over temperature protection for the rectifier.

A discharge device shall be provided across the D.C. input to the inverter, which will discharge any capacitors in the inverter module when it is switched off.

(I) Battery charger

The battery charger shall be a solid state, constant voltage type providing full wave rectification of the input voltage with the output regulated to an accuracy as specified. A high grade D.C. filter shall be utilised to limit the output ripple to the stated tolerance. Current limiting features shall be provided. The value of the current limit setting, shall be in accordance with the maximum allowable charging current that the batteries can withstand.

The maintained voltage on float charge shall be such as to give maximum life to the batteries whilst maintaining the maximum charge conservation and minimising gas formation and water loss. The optimum float charge voltage shall be specified by the battery manufacturer but is expected to be approximately 2,23 volts per cell. The voltage shall be kept within ± 0,5% of the nominal value for all loads from no load to the full rated battery charger current when supplying the full output with batteries discharged.

(J) Computer rooms/office UPS installation

The rectifier shall be equipped with **2 independent** over voltage shutdown contacts for maximum charger security.

The battery charger shall be designed to charge the batteries to 90% of its fully charged capacity within 14 hours and to 100% capacity within 20 hours.

The battery charger shall be capable of boost charging the batteries to 2,6 volt per cell. The boost facility shall be manually operated.

The battery charger shall be provided with a current limiting circuit.

The current limit setting shall be variable for easy adjustment on site.

The necessary voltage free contacts for the alarms and battery charger failures shall be allowed for in the tender price.

The battery charger shall have over temperature protection similar to the protection specified for the rectifier.

The battery charger shall have circuitry to inhibit the charging of batteries from the standby generator. This circuitry shall be activated by normally open contacts on the generator control panel. The interconnecting cables will be supplied and installed as part of this contract.
NOTE: This requirement is only applicable for UPS systems above 200kvA

(K) Battery

The battery capacity shall be sufficient to provide full load for the specified time. The capacity shall be rated at a maximum specific gravity of 1,245 at 25 C and correctly filled.

Tenderers shall state the discharge capacity of the battery after 10 hours of charge and the battery voltage at its terminals under various conditions. The inverter shall switch off on low battery voltage.

The battery cells shall be of the maintenance free type.

The batteries shall give satisfactory service for a minimum period of **3 years**. Tenderers shall state the maximum expected lifetime of the batteries and motivate their statement, and provide a statement by the battery manufacturer supporting this and stating that the charger offered is suitable for the battery.

The cells must be mounted in a matching steel cabinet or in the same cabinet as the control equipment. The vented type cells should be mounted on a wooden stand, consecutively, numbered with positive and negative terminals clearly marked in a ventilated battery room.

The batteries shall be complete with cell inter-connectors and row inter-connectors. The output terminals shall be robust and adequately dimensioned for the output cable terminations.

The inter-connectors between cells and shall be made in a manner giving the lowest volt drop and maximum resistance to corrosion.

All connections to cells must consist of flexible cable to avoid mechanical stress at the cell terminals.

The tenderer shall describe the method of removal and replacement of a faulty cell.

The battery shall be complete with a battery fuse isolator capable of breaking the full load current drawn by the inverter. These battery fuse isolators shall be installed in the inverter unit room or cabinet.

Terminal posts should be effective for the expected lifetime of the battery and should be effective even if the cell is overfilled.

The battery may be resistance grounded through 5000 ohm to 10000 ohm for the purpose of ground fault.

Tenderers shall submit full details with dimensioned drawings of the batteries offered.

Tenderers shall submit the calculations and motivations complete with curves supporting the selection of a specific battery cell.

All cabling for the battery shall be installed on PVC cable trays and fitted to the satisfaction of the engineer.

(L) Automatic by-pass switch

An integral automatic bypass switch shall be provided to transfer the critical load without break to the mains should the UPS unit fail. The latter unit shall simultaneously be disconnected from the critical load bus. This transfer shall, however, be inhibited if the mains is out of synchronism with the UPS output. Retransfer to the UPS output shall be on a manual or automatic command. This switch must have a cover fitted screwed to the panel so as to make the operating of this switch impossible without having first removed the cover. This switch cover must also have the following words etched in white with a red background mounted on or adjacent the cover: **CAUTION : BYPASS SWITCH ONLY : ONLY TO BE OPERATED BY QUALIFIED PERSONNEL**

The static switch should prevent "hunting" and after trying unsuccessfully to switch a maximum of **three** times the static switch should be inhibited from further switching.

3. CONSTRUCTION OF CUBICLES AND SWITCHBOARDS

All the converter equipment shall be housed in totally enclosed, free standing, floor mounted cubicles, designed top provide adequate ventilation for the equipment.

All cubicles shall be rigid with suitably braced doors providing front access.

All cubicles shall be vermin proof.

All equipment shall be mounted on the metal framework suitably arranged to provide safe operation and ease of access. Fuses and switchgear in particular should be safely accessible even under load conditions.

All power bridges, filters and other major components both in the inverter and rectifier, shall be completely withdrawable to facilitate rapid repair and/or replacement. The method of withdrawal shall be such that a complete module can be extracted in the operating condition so that checks and measurements may be made while in operation and access to all components facilitated.

All electronic printed circuit cards shall be of a good quality and shall be easy and simple to interchange.

All auxiliary power supplies shall be duplicated and shall be connected so as to operate in parallel redundancy. At least two primary sources of power shall be provided for each of the power supplies in the system.

Flexible wires shall not be soldered directly onto terminals but shall have a crimped tab, which is soldered onto a terminal or post. The wire wrapping technique shall be employed for electronic circuits where possible.

The front panel alarms shall be clearly and adequately marked in both official languages. A single line mimic layout of the switchgear shall be provided on the front of the cubicles providing a graphic display of the circuitry of the equipment involved.

All input and output power cables shall be terminated using approved cable glands, onto a cable gland support bracket. The cable conductors shall terminate at the connecting busbars or shall be connected directly to the appropriate switchgear. All power cables

shall be properly numbered with wrap around cable markers with punched figures to identify cables at each termination point.

4. INSTRUMENTATION AND CONTROLS

All the required instrumentation as indicated on the drawings shall be provided.

Supply and install all the necessary controls for the operation of the system. Facilities shall be provided for controlling the rectifier, switching the inverter on, switching the inverter output to the synchronous motor/alternator and controlling the bypass thyristor switch circuit.

All control switching of the rectifier and inverter as well as the bypass operation shall be pushbutton initiated.

Standard electronic equipment from overseas manufactures shall **not be accepted** if not duly protected with transsorbs and metal oxide varistors in power supplies and external communication lines. Standard electronic equipment not internally protected with transsorbs or MOV's may be protected externally by means of transsorbs and MOV's mounted on klippon type terminals. All external communication and remote power supply lines shall be protected by means of transsorbs and MOV's of sufficient rating mounted on klippon type terminals.

5. ALARMS

All alarms shall be of the tell tale type with memory features e.g. a flashing light indicates a fault coupled with an audible alarm. The pressing of the appropriate button shall cancel the audible alarm and allow the alarm lamp to burn continuously until the fault is removed.

The following minimum alarm conditions shall be monitored on the equipment:

(1) Normal
(2) Mains failure
(3) Inverter failure
(4) Shutdown imminent
(5) Load on mains
(6) Overload
(7) Charger fails

Where required a remote panel must be supplied and installed. The alarms indicated must duplicate all the alarms indicated on the UPS control panel. In addition a buzzer must be provided. Any alarm occurring must sound the buzzer to draw attention. An alarm accept pushbutton to silence the buzzer must be provided.

Provision shall be made on all the alarms mentioned above to be remotely monitored. Normally open contacts shall be supplied at the converter for each alarm for this purpose. The contacts shall close under an alarm condition.

6. VENTILATION

All equipment racks shall be positioned in logical fashion on the floor in a configuration, which will ensure proper ventilation

Each cubicle containing heat-generating equipment (thyristors, transformers electronic circuitry, filters, etc) shall, where necessary, have extraction ventilation fans mounted on the top of the cubicle to assist air circulation. These fans shall be fed from the output distribution panel of the uninterrupted power supply.

7. QUALITY ASSURANCE

The manufacturer shall be responsible for the performance as specified herein and to prove such performances to the satisfaction of the engineer. Except as otherwise specified, the supplier must utilise facilities acceptable to the engineer.

8. DRAWINGS

As soon as possible after the awarding of the contract, the successful tenderer shall at his expense submit to the engineer for approval, three prints of:

(1) All general arrangement drawings.

(2) Detailed dimensioned drawings of all plant and equipment.

(3) Complete wiring diagrams and block schematic diagrams.

At the same time a list of all equipment designations, labels, etc. in both official languages shall be submitted for approval.

The approval of drawings shall not relieve the successful tenderer of his liability to carry out work in accordance with the terms of the contract.

On completion of the contract, a complete set of transparencies of all drawings of a quality acceptable to the engineer shall be handed to the engineer at the expense of the successful tenderer. These final drawings shall include:

(1) A proper and accurate as-made wiring diagram of the complete installation showing circuit numbers, terminal strip numbers and conductor colours.

(2) A schematic diagram clearly showing functions and component values. A material list showing make, model and characteristics of all components of the control equipment and switchgear is to be included.

(3) Fully dimensioned as-made physical layout drawing of the equipment, batteries and ventilation equipment.

(4) A detailed **schedule** of all wiring.

The contract shall be deemed incomplete until all drawings have been received by the client.

9. INSTRUCTION OF OPERATOR AND MANUALS

After completion of the installation, and when the plant is in running order, the successful tenderer will be required to instruct an attendant in the operation of the plant, until he is fully conversant with the equipment and handling thereof.

Three (3) copies of maintenance, fault-localising and operating manuals together with the drawings required shall be handed over to the engineer.

10. TESTS

The complete testing including the provision of test facilities, instruments, dummy loads and switchgear at the manufacturer's premises in the Republic of South Africa shall form part of this contract. If the factory tests cannot be performed in the RSA, the client may, at his discretion and own cost, decide to attend tests at the supplier's overseas factory. Tenderers shall not allow for this.

For the test in the manufacture's premises the client shall be notified four weeks in advance in order that a representative can be sent to witness these tests.

10.1 Battery tests

(1) The output voltage of the battery unit (i.e. all the cells making up one battery) shall be tested with the incoming supply removed.

(2) The full rated load for the battery shall then be connected to it. The voltage shall be measured at 5 minute intervals for the duration discharge period.

(3) The batteries shall be left to recharge. The voltage shall be checked after 14 hours with the load and incoming supply removed as well as with the load connected but incoming supply removed.

(4) When fully recharged, the voltage and specific gravity of every cell shall be measured with the incoming supply removed.

(5) The circulating A.C. current through and the A.C. voltage across the batteries shall be measured when the rectifiers are on with the battery discharged and fully charged.

10.2 <u>Oscillator tests</u>

(1) Frequency within tolerances at all loads.

(2) Parallel redundancy.

(3) Auto automatic synchronisation for connection of the synchronous motor/alternator to mains via the thyristor switch.

An electronic frequency counter shall be used to measure the frequency.

10.3 <u>Rectifier tests</u>

(1) Output voltage of rectifiers at no load and full load with batteries charged and not charged.

(2) Current limit, both for mains failure and return to mains.

(3) Switch off value mains input monitor.

(4) Sequential switch on for return to mains.

(5) Soft start circuits.

10.4 <u>General</u>

Ammeters will not be acceptable to prove the above items. A wave analyser and a recording oscilloscope will be required. Photographs shall be taken of the oscillograms by the contractor in the presence of the engineer.

The overall efficiency of the complete uninterrupted power supply shall be proved to be within the specified limit at full load and at no load.

The overcurrent protection mechanisms of the A.C.B. shall be proved by current injection (either primary or secondary)

The bypass and detour circuits shall be proved.

All alarms, indications and control functions shall be proved.

The test instruments provided shall in all cases be of high quality and suitable to be able to adequately assess the quantities being measured and the equipment being tested. All instruments shall be calibrated by a testing laboratory approved by the National Calibration Service of the CSIR. The test equipment remains the property of the successful tenderer.

At the completion of the tests, a full test report shall be submitted by the contractor to the engineer in triplicate.

Continuously adjustable dummy loads of a rating suitable to comprehensively test the UPS shall be provided by the contractor as well as any temporary cables required for the connection of the dummy load to the UPS on site.

11. CABINET

The contractor shall supply and install a metal cabinet with lockable doors of sufficient size to house all operating and maintenance instructions, drawings, spares, tools, etc.

12. SCHEMATIC DIAGRAM

A schematic diagram of the complete system shall be mounted in a suitable place and shall be resin encapsulated.

13. AUXILIARY EQUIPMENT

Tenderers shall make all allowances for plant required (i.e. hoists, cranes, trolleys, etc.) ensuring positioning of the equipment in the UPS room.

14. UPS POWER PLUG OUTLET

All UPS power plug outlets must be of the red non-standard 3-pin type with the earth pin not earthed to the plug baseplate to facilitate the installation of a single earth connection earthing system. Each socket outlet must be provided with a red plug top.

Each socket outlet must be labelled with an engraved label indicating the power circuit number to which it is connected.

15. DISTRIBUTION WIRING

All sub-distribution wiring circuits must be wired as follows:

15.1 Mains power plug circuits

4 mm^2 PVC/copper in red and black conductors and a 2,5mm^2 bare copper earth.

15.2 UPS power plug circuit

4 mm^2 PVC/copper in blue and black and a green PVC insulated 2,5mm^2 earth wire.

The black neutral conductors must be clearly labelled at each end as follows: "UPS" or "OKT”

15.3 UPS Earthing

The main earth bar must be connected to the insulated earth bar of the UPS via a removable copper link bar.

All UPS boards must have insulated earth bars, separately earthed to a clean 1,2m earth spike be means of 70mm^2 insulated earth to obtain at least one ohm at the UPS board.

SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

SECTION 3 – SCHEDULES OF TECHNICAL INFORMATION

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SECTION 3 – SCHEDULES OF TECHNICAL INFORMATION

The following schedules shall be completed by the Tenderer in conjunction with Section 2 of the specification. They therefore provide an opportunity for the Tenderer to confirm whether their offered equipment complies with the specification. Failing to complete these schedules could invalidate the bidder.

1. SYSTEM PARAMETERS

1.	Net output power of inverter system	kVA
2.	Power factor for which the system is rated	Lagging
3.	Nominal input voltage	Volts
4.	Maximum input voltage tolerated	Volts
5.	Minimum input voltage tolerated	Volts
6.	Maximum input frequency deviation tolerated	Hz
7.	Maximum and minimum input power factor at rated KVA	kVA
8	Maximum harmonic input tolerated for successful operation	%
9	Nominal output voltage	Volts
10	Steady state output voltage regulation	Volts
11	Dynamic output voltage regulation:	
(a)	Step load of 25% between 10% and 100% of full load	%
(b)	150% overload for 1 sec	%
(c)	Input voltage step variation of ± 15%	%
12	Time for voltage recovery to steady state:	
(a)	25% step load	ms
(b)	100% step load	ms

(c)	150% step load for 1 sec and then returned to 100%	ms
13.	Relative output phase angles at 100% unbalanced load (in degrees)	Degrees
14.	Maximum harmonic content of output voltage	%
15.	Overload capacity	
(a)	One hour	%
(b)	One minute	%
(c)	Ten seconds	%
(d)	One second	%
(e)	Five msec	%
(f)	One msec	%
16.	Total input required with batteries charged for rated full load	KVA
17.	Total input required at full load and and battery discharged	KVA
18.	Allowable temperature rise across equipment at input air temperature of:	
(a)	25 °C	°C
(b)	30 °C	°C
(c)	32 °C	°C
(d)	35 °C	°C
(e)	40 °C	°C
19.	Heat dissipation under normal full load Running conditions:	

(a)	Converter		KW
(b)	Battery		KW
20.	Efficiency of the complete UPS system	**1,0p.f.**	**0.8p.f**
(a)	Full load	%	%
(b)	80% load	%	%
(c)	75% load	%	%
(d)	65% load	%	%
(e)	50% load	%	%
(f)	40% load	%	%
21.	R.M.S. value of the A.C. **current** component through the batteries for:		
(a)	Discharged battery		Amp
(b)	Charged battery		Amp
22.	R.M.S. value of the A.C. **voltage** component through the batteries for:		
(a)	Discharged battery		Volts
(b)	Charged battery		Volts
23.	Total number of cubicles		
24.	Total floor space required		m^2
25.	Dimensions of cubicle in mm		W
			H
			L

2. BATTERY CHARGER

1.	Type	
2.	Output voltage for trickle charge	Volts
3.	Steady state regulation of output voltage trickle to full load	± %
4.	Output voltage for input voltage fluctuation	
(a)	± 10%	%
(b)	± 15%	%
5.	Ripple content (%)	%
6.	Current limit value	Amp
7.	Input voltage at which battery charger switches off	
(a)	Maximum	Volts
(b)	Minimum	Volts
8.	Maximum switch on inrush current	Ampere
9.	Battery charger overload protection (type)	
10.	Efficiency	%
11.	How is the effect of harmonics on input voltage minimised ?	

3. OSCILLATOR

1.	Type of oscillator (RC, crystal, etc.)	
2.	Stability:	
(a)	With oscillator supply fluctuation	± %
(b)	Temperature variation	± °C
(c)	Number of power supplies in parallel redundancy	
3.	Number of batteries from which oscillator is fed	
4.	Minimum time synchronise to mains frequency	sec

4. INVERTER

1.	Maximum continuous power output (kVA)	KVA
2.	Nominal output voltage	Volts
3.	Maximum harmonic content	%
4.	Nominal input voltage:	
(a)	Maximum	Volts
(b)	Nominal	Volts
(c)	Minimum	Volts
5.	Input current at full load	Ampere
6.	Input power factor at full load	Lagging
7.	Efficiency at full load	%

8.	Overload protection	

5. STATIC SWITCH

	Does switch comply to clause 3.2.2.12	
1.	Describe electronic switch	
2.	Minimum power factor at which switches will operate satisfactorily	
3.	How does switch derive operating signal ?	
4.	Maximum break time for switchover	ms

6. BATTERIES

1.	Manufacturer	
2.	Country of origin	
3.	Type	
4.	Type No	
5.	Total number of cells	
6.	Number of cells per inverter	
7.	Battery voltage (float conditions)	Volts
8.	Battery voltage (Boost charge)	Volts
9.	Capacity (rated for time required)	Ah at
		Hrs

10.	Battery time offered under load conditions specified in Clause 2.17 Part 2) and (Clause 3.2.2.5 (Part 3)	Minutes
11.	Maximum output current	Ampere
12.	Cell voltage under float conditions	Volts
13.	Cell conditions under boost conditions	Volts
14.	Cell voltage at start of discharge and full inverter load	Volts
15.	Cell voltage at end of discharge period	Volts
16.	Expected lifetime of batteries	Years
17.	Time to charge to 90% capacity	Hrs
18.	Total time to charge to 100% capacity	Hrs
19.	Material of supporting framework	
20.	Finish of framework	
21.	Dimensions of each cell	W
		H
		L
22.	Design of positive plate of cell	
23.	Rating of fused isolator	Ampere
24.	Cell configuration	

7. SYSTEMS ABOVE 200kVA

1.	No of shelves	
2.	No of rows/shelves	
3.	No of tiers/shelves	

4.	Shelf length	
5.	Shelf height (incl. Batteries)	

NOTE : ALL BATTERY CALCULATIONS INCLUDING CURVES SHALL BE INCLUDED IN THE TENDER

8. DETAILS OF MANUFACTURE OF UPS

1.	Manufacturer	
2.	Address	
3.	Country of origin	
4.	Make or trade name of equipment	
5.	Manufacture's type no.	
6.	Is tenderer an accredited agent?	YES/NO
7.	Furnish details of maintenance and repair service facilities which can be rendered.	

SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY
SECTION 4 – PRICE SCHEDULES

TABLE OF CONTENTS

SECTION 4 – PRICE SCHEDULES

1. General

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

1.2 The descriptions in this Price Schedule shall be read in conjunction with the specification.

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

1.4 The Price Schedules shall not be used for ordering purposes. The Contractor shall check the lengths of cables and overhead conductors on site before ordering any of the cables. Any allowance for off-cuts shall be made in the unit rates.

1.5 The rates shall exclude Value Added Tax and the total carried over to the final summary in PART A.

1.6 All material covered by this **Specification** shall, wherever possible, be of South African manufacture.

ANNEXURE A WCS_____

SCHEDULE OF IMPORTED MATERIALS AND EQUIPMENT TO BE COMPLETED BY TENDERER

Items	Material / Equipment	Rand (R) (Excluding VAT)
1		
2		
3		
4		
5		
6		

The Contractor shall list imported items, materials and/or equipment which shall be excluded from the Contact Price Adjustment Provisions (if applicable) and shall be adjusted in terms of currency fluctuations only. Copies of the supplier's quotations for the items, materials or equipment (not higher than the Contract rate as listed below) should be lodged with the Representative/Agent of the Department of Public works within 60 (sixty) days from the date of acceptance of the tenders. No adjustment of the contractor's profit, local VAT amount, discount, mark-up, handling costs, etc. shall be allowed.

The net amounts will be adjusted as follows

FORMULA:

The net amount to be added to or deducted from the contract sum:

$$A = V\left(\frac{Z}{Y} - 1\right)$$

A = the amount (R) of adjustment

V = the net amount (R) (Supplier's Quotation) of the imported item (Material or Equipment)

Y = exchange rate at the closing date of tender submission

Z = exchange rate on the date of payment

CONTRACTOR

_____

SIGNED _____

DATE _____

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic Specification (This Document)
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	**Security Fence Specification (This Document)**
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification
Part 12:	ICT Specification

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:
ELECTRONIC INSTALLATIONS

PART 10: SECURITY FENCE SPECIFICATION

CONTENTS

FUNCTIONAL SPECIFICATION

1 TESTS

The contractor shall inspect, complete and present a certificate, certifying that:

- The installation meets the Client approved requirements in terms of design and installed location and standard.

- Cabinets are earthed and correctly in accordance with the requirements of Earthing, Bonding, Surge and Lightning protection specifications.

- Source of electrical supply has been identified and clearly marked.

- All data and electrical infrastructure installed has been tested and meets the standards.

- The installation documentation has been compiled and is available for inspection.

2 MAINTENANCE OF INSTALLATIONS

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

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

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

This specification covers the supply, installation and commissioning and guarantee for twelve months of the complete Inner Taut Wire Fence Installation.

A further 36-month maintenance and repair contract shall be allowed for, as detailed under Clause 2 above.

3 OMMISIONS AND DISCREPANCIES

The Tenderer shall, at the time of tendering, draw the Engineer's attention to any omissions or discrepancy between the specification and the drawings and request from his clarification of details or responsibilities.

If a limited allowance or special conditions are made for the Tender Sum for the supply or erection of any item of the installation, the limit or special conditions shall be defined at the time of tendering.

It is the sole responsibility of the Contractor to ensure that all quotations obtained from manufactures and suppliers are complete in their entirety and must include all equipment and accessories necessary for compliance with current practice and the efficient and proper functioning of the installation.

If any such items of equipment, brackets and accessories, etc., have been omitted from a supplier's quotation, or incidental work is necessary, the Contractor must include for all such items and work in the tender.

Bidders are requested to adhere to the requirements of the specification as closely as possible. Should a bidder find that he cannot comply with certain requirements of the specification without deviating from his standard range of products, he may offer his standard product, providing all deviations from the specification are clearly documented in a covering letter accompanying his bid offer. All the relevant paragraphs and sub-paragraphs in the specification must be referred to in the covering letter.

4 REGULATIONS

The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in the scope of works. It is the contractor's responsibility to ensure that the system installed adheres to the *Department Of Public Works Security Standard Technical Specification For An Integrated Security System For A Correctional Facility,* herein after to be termed GENERAL SPECIFICATION.

5 NOTICES AND FEES

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

6 SCOPE OF WORKS - GENERAL

Bidders to note that this specification is to be read in conjunction with the specifications listed above and specifically the Electronic Specification.

In terms of this contract bidders must include the following in their bid offers:

1. De-installation and Re-installation of the parts and/or portions of the existing Inner taut wire fence installation and Outer Bowed Fence electronic sensory and detection system(s), in order to bring the entire fence installation to correct working order, as guided by this specification and other regulations as stated in Section 3 of this specification.

2. The complete supply, delivery, installation, testing and commissioning of the Inner Taut Wire and Bowed Fence Kinematic Security fence, including use of the existing hardware, as detailed in Annexure A - MOS schedule.

3. The supply, installation and connection of equipment shall be done by an accredited supplier and installer who is to be subcontracted by the electrical contractor. They should be aware and adhere to all requirements, including site safety, to that of the electrical contractor.

4. Supply and installation of conduit and ducting access shall be done by the Electrical Contractor.

6.1 INNER TAUT WIRE SCOPE OF WORKS

a) Security electronic equipment and cabinets.

b) Taut wire perimeter detection system.

c) Field Fibre-optic communication equipment.

d) Perimeter Controller.

e) Report printer.

f) Surge protectors.

g) Power supplies.

h) Training. *See Section 11 of this specification.*

i) Spare Parts.

6.2 KINEMATIC FENCE DETECTION SYSTEM

The contractor shall ensure the supply, installation, commissioning and testing of the Kinematic Fence Detection System, and consider the following parameters.

The purpose of the Kinematic detection system on the bowed outer fence is to protect it from tampering, and to detect individuals attempting to assist an escape from the outside. The system provides reaction teams with sufficient time to react and reach the point of intrusion in the case of tampering on the fence.

The physical fence acts as a delay system once a detection alarm is received to allow sufficient time for the reaction force to reach the point of intrusion.
This delay functions of the outer fence need to be protected to ensure that it fulfils its purpose. Detection is required to detect the cutting or removing of the structure and attempts thereof.

The required detection is based on direct measurement of the causes of cutting and removing of the structure and not derivatives thereof such as short circuit detection or volumetric detection not measuring fence behaviour.

Detection shall be based on the measurement of the kinematical behaviour of the structure during intrusion attempts.

The system shall be applied in order to ensure maximum coverage in the detection area.

Where applicable, the scope of works shall entail:

- Disconnection of existing Fibre Optic cabling, power cabling and sensor connectors from field nodes mounted within the field cabinet.
- Stripping out of all existing wiring, field nodes, energisers, converters etc.
- Removal of Taut-wire sensors from sensor posts.
- Removal of Master control equipment including processor.

7 QUALITY OF MATERIALS

Only materials of first-class quality shall be used.

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

Materials wherever possible, must be of South African manufacture.

Note: Material on Site Schedule has been provided, and it is required that the contractor familiarise himself with the schedule.

8 DRAWINGS

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

The position of the Inner Taut Wire fence installations are marked on drawing number E21/2107/SA/100.

9 TIME SYNCHRONISATION

The successful bidder is expected to configure each subcomponent device of the taut wire and kinematic fence detection system installation to ensure compliance to this specification as well as the DPW Standard Security Installation Specification.

10 CABLING

All cables and ports should be properly labelled and documented.

Cable dressing should be as per the standard norms. All the cables must be neatly tied together at each and every location.

11 TRAINING DELIVERY

The successful bidder is expected to conduct staff trainings on the usage and operation of the Taut Wire and Outer Kinematic Fence Detection System, including inter-operability with the Security Management System software.

The following information is to be provided in the technical proposal:

- Details of course content to be provided;
- Number of training sessions per type of users (for example more training sessions may be required for middle management);
- Duration of each training session; and
- Relative experience of trainer.

12 INTEGRATION

The Systems listed above shall be fully integrated with the Security Management System provided in accordance with the SMS specification as contained in the Electronic Specification.

13 INNER 2.7M TAUT WIRE DETECTION FENCE

13.1 Detection Fence

1. The taut wire fence and alarm system shall act as an electronic barrier to detect and alarm escape attempts.

2. The taut wire system shall be installed as a stand-alone system located on the facility side of the outer perimeter fence.

3. The electronic barrier shall consist of the following:

a. A protective 2700 mm high barrier with 27 taut barbed wires, stretched between anchor posts, (wire tension shall be such that when a 2kg weight is applied between two slider posts the wire deflection shall be between 50mm and 75mm. All wires shall be of the same tension) and supported by a number of slider posts and detection sensors.

4. The taut wire sensors shall be mounted on a sensor post constructed of galvanized steel. The sensors shall be spaced according to the wire spacing specification. (Bottom 18 wires 90mm, then 9 wires at 120mm spacing)

5. Movement transfer wires

    a. High, tensile, double-braided barbed wire.

    b. Minimum breaking strength of 439 Kg

    c. Barbed 4 points.

    d. Average spacing of the barbs is not to exceed 125 mm

    e. Galvanized steel.

6. Tensioners

    a. Tensioners shall be galvanized, ratchet wheel type.

    b. At one end of the zone, each taut wire strand shall be attached to an individual tensioner.

7. Slider Post accessories: Slider mechanism with accessories that serve to support the wire system, converting vertical force into horizontal movement.

All Slider post accessories shall be constructed of stainless steel.

8. Sensor Post Accessories: Sensor post shall be designed to contain the sensors.

At a minimum, the sensor post accessories shall be constructed of galvanized steel as per detail in the drawings.

9. Sensor, anchor and slider posts: All sections shall be at least 2750 mm in height.

10. Zones: The system shall be configured as shown on the drawings.

11. All wires shall be stored on the factory shipping reel until the wire is installed on the sensors.

14 POWER AND COMMUNICATION CABLE

All cables must comply with the manufacturer recommendations.

Exterior wire and cables shall be installed in schedule 50 PVC conduit and rated for direct burial use. The conduit shall be installed in the inner fence sidewalk.

Power distribution wire from the main equipment room to remote processors, transponders, microwave units, or other remote electronics on the site perimeter shall be minimum 2.5 mm2 copper and shall be increased in size asnecessary to ensure no more than 5% (AC or DC) voltage drop from the mainequipment room to the remote equipment. Power voltage drop calculations shall be submitted for all field located perimeter equipment.

Provide a two core multimode fibre optic cable, direct bury type cable between all perimeter system enclosures and the head end to create a loop around the perimeter system. Provide 1500mm of spare cable for each cable in each perimeter system enclosure.

All cables that will be directly buried shall be, rated for direct burial andapproved for wet locations.

All conductors shall be rated for direct burial and approved for wet locations in accordance with SABS.

Signal and power cables shall be separate cables and not combined as part ofthe same cabling jacket.

15 DETECTION MEASURES

Taut Wire

Each sensor shall contain a dedicated microprocessor enabling a unique detection algorithm to be assigned as required.

The horizontal wires shall be attached to the sensors. The taut wire sensor shall be capable of producing an alarm when a wire is deflected by no more than 75mm. The taut wire sensor shall also respond to a cut in the wire.

The above system configuration shall have the capability to detect any attempt to penetrate the perimeter by climbing, cutting or spreading the fence wires apart.

1. The sensor detection parameters and detection performance should be accessible from the master controller on an individual sensor basis.

2. The taut wire detection performance should comply with the following minimum criteria:

   a. Nuisance alarm rate: Maximum 1 Alarm per zone per month

   b. Probability of detection: Minimum 95%.

3. The TWFDS shall annunciate an alarm condition in the event of one or combination of the following:

   a. Climbing the taut wire fence.

   b. Cutting the taut wire fence.

   c. Spreading the taut wire fence wires no further that the adjacent wire.

   d. Tampering with the processor enclosure.

   e. Attempting to remove the sensor post.

   f. Attempting to cut the power or communications of the processor to the perimeter security system.

4. Processing algorithms shall be provided as part of the TWFDS to process alarm events. Each individual wire shall be monitored for alarm conditions.

5. Subsequent attempts to climb, cut or spread the fence even after a tamper alarm condition is detected and annunciated, shall cause the processor to activate a new intrusion alarm.

6. The TWFDS shall have the ability to automatically adjust the centre of alarm detection range for gradual changes in sensor position caused by the environment, casual contact or ageing thus significantly lowering periodic maintenance.

16 MONITORING AND CONTROL

The perimeter controller shall contain the status map off all field detection and status devices. These devices shall include the following:

a) Taut wire sensor alarm status

b) Taut wire sensor maintenance status

c) Outer fence detection alarm

d) Outer fence detection maintenance

e) Field cabinet tamper

f) Auxiliary inputs including gate area detection devices and gate status contacts at sally port.

g) Field communication status for each field controller

Alarm and Event Printing

Alarms and selected events shall be printed on a suitable continuous paper printer

Alarm and Event Recording

The following shall be recorded on the alarm or event log:

a) All changes in the state of field devices. This includes alarm and maintenance conditions. These events shall be logged per zone and per device.

b) Operator master accept actions.

c) Field reset actions.

Log entries shall be date and time stamped to the nearest second.

17 EXTERNAL INTERFACES

The perimeter controller shall provide the following data interfaces:

TCP/IP Socket interface

All perimeter or system devices shall be included in this interface mechanism.The external system shall initialize on selected devices and events shall be posted when any change occurs in the status of such devices. Events shall also be sent to the perimeter controller. Messages shall be in clear text.

Perimeter Controller Interface

Devices shall be mapped in a set of holding registers for access by an externalSCADA system

These external data interfaces shall be used to integrate the perimeter system with a Security Management System or CCTV system.

Where a Security Management System is in operation the Perimeter system shall be fully integrated with the SMS and CCTV systems for annunciation, print recording, and logging of alarms and initiation of CCTV system functions upon an alarm condition.

All perimeter alarms shall be logged, annunciated, recorded and managed by the SMS alarm terminal in Central Control. Fence Alarms, trouble and tamperconditions shall be separately annunciated by individual zone designations.

The interface definition shall be documented and delivered with the system aspart of the deliverable of this project. (Proof of the operability of the interfacemust be given.)

Wide Area Networking

The Perimeter Controller shall be Internet Protocol (IP) enabled so as to be networked over a Wide Area Network (WAN) for the purposes of remote monitoring, control and viewing of historical information. This shall facilitatethe performance assessment of both operator and equipment from anywhere on the client's network.

Diagnostic Tools

A diagnostic screen shall be included at the master indicating the following:

On/off line status of field processors

The alarm and maintenance status of all individual sensors

The alarm and maintenance status of any other equipment attachedto the system as required.

The diagnostic software shall include a data recording facility to record all thedigital and analogue signals from any selected field processor unit and any selected detection device.

18 RETRUNABLE MATERIALS SCHEDULE

PART 10:

FIRE DETECTION AND EVACUATION ALARM INSTALLATION

PROJECT SPECIFICATION

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic Specification
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	**Fire Detection Specification (This Document)**
Part 11:	Fire Protection Specification

Part 10 PROJECT SPECIFICATION

SUPPLEMENTARY SPECIFICATION FOR THE SUPPLY, INSTALLATION & COMMISSIONING OF THE FIRE DETECTION AND EVACUATION ALARM INSTALLATION

1. GENERAL

This supplementary specification is for the supply, installation and commissioning of Fire Detection Installation.

The works carried out under this Section of the subcontract shall be governed by the following specifications:

- Department of Public Works Standard Specifications:

PW 371	Specification of Materials and Methods to be used
STS 5	The Electrical Installations and Electrical Equipment pertaining to Mechanical Services : Issue IXa : December 1999
STS 9	Fire Security: Standard Technical Specification for an Inert Gas Agent Extinguishing System : FPO 4E (PW 335): January 1999
STS 10	Fire Security: Standard Technical Specification for an Automatic Fire Alarm Installation : FPO 5E (PW 336) : June 1994
STS 17	Standard Technical Specification for the Preventive Maintenance, Servicing and Repair of Fire Security Installations (PW 341) : November 2000

- SANS Standard Specifications:

SANS 369	-	Code of practice for the operation of fire protection measures
SANS 530	-	Fire detection and fire alarm systems for buildings
SANS 728	-	Automatic fire detection and alarm systems
SANS 7240	-	Fire detection and alarm systems
SANS 8201	-	Audible emergency evacuation signal
SANS 10139	-	Fire detection and alarm systems for buildings - System design, installation and servicing
SANS 10142	-	The wiring of premises
SANS 10400	-	The Application of the National Building Regulations
SANS 50054	-	Fire detection and fire alarm systems
ISO 8421	-	Fire protection – Vocabulary
ISO/IEC 29341	-	Information technology - UPnP Device Architecture

- Detailed Specification
- Tender Drawings
- Any relevant SANS Standard, local by-law, corporate specification and any national regulation promulgated by Act of Parliament such as the OHS Act 85 of 1993, whether specifically mentioned or referred to hereafter or not.

The Standard Specifications are not bound in this document. Standard Specifications may be obtained from the offices of the Consulting Mechanical Engineers on request provided they are not subject to copyright. Standards or Codes such as SANS, ISO, DIN, BS, EN may be obtained from the offices of SANS

Where reference is made in this specification and any drawings and documents mentioned therein to the Factories, Machinery and Building Works Act of 1941 this shall be deemed to be replaced by the Occupational Health and Safety Act, 1993.

Where reference is made in the Specifications and any drawings and documents mentioned therein to "Secretary for Public Works" or "Department of Public Works" or "Director General: Community

Development" and "Department of Community Development", this shall be replaced by "Director General: Public Works" and "Department of Public Works" respectively

Tenders shall only be considered if the following requirements are strictly adhered to during the tender process:

- The main tender shall comply with the specification in all respects and no changes will be allowed in the Price Schedule or in the information schedules.
- The Schedules of the tender document must be completed fully and in detail for the tender. Any incomplete section will be regarded as not to specification and may lead to disqualification of the tender.
- Contractors may hand in alternative tenders together with the main tender. Alternative tenders will be considered if the main tender is acceptable. Alternatives shall be presented on separate pages but in the same format and details per the Specification. It shall be clearly shown what the differences are between the main offer and the alternative offers.
- When the total tender price of the installation is carried over to the price schedule form, it must include the first 12 months maintenance as specified.
- Bidders must ensure that the bid document is studied in full and that all the conditions are complied with during the bid process.

2. DRAWINGS AND APPROVAL (Refer to Standard Specification where applicable)

The bid drawings must be returned with the tender. Any proposed alterations to the layout shall be indicated on these drawings in red ink and may only be submitted as an alternative bid.

Not later than three weeks after signing the contract, or receiving verbal instruction, the successful bidder shall submit to the Engineer either four copies of his detailed working drawings, or written confirmation that the tender drawings will be used.

Approval by the Engineer of drawings submitted by the Contractor shall not relieve the Contractor of his liability to carry out the work in accordance with the requirements of the contract documents.

3. SCOPE OF WORK

The standard specification shall apply unless otherwise indicated in this section.

The drawings issued herewith and listed in the relevant section are to be read in conjunction with the specification and all items mentioned, together with all ancillary equipment necessary for the correct installation, operation and full compliance with the Standards and codes must be provided, notwithstanding the fact that they may not have been included in detail in these documents.

The work performed shall comprise the supply, delivery, offloading, interim storage, installation, testing, commissioning and leaving in good working order of the complete Fire Detection Installation inclusive of all guarantees as specified herein and the supply of 'AS IS' installation record drawings, Maintenance and Operating Manuals, Sign-Off Forms and documentation in accordance with the specifications and requirements for:

(i) Supply and installation of Analogue Addressable Fire Detection and alarm Systems in Sally Port 2, Sally Port 5, Sally Port 6 & Sally Port 7

(ii) Programing of all sensors, line devices and alarm devices

(iii) Testing and commissioning of the Analogue Addressable Fire Detection and alarm System as required and specified.

(iv) Liaising with a Principal Contractor and all other Subcontractors on site

(v) Provision of all O&M Manuals and As Built drawings as specified

The tenderer shall take cognisance and make due allowance for the fact that continuity and sequence of work is unlikely to occur and as such cannot and will not be guaranteed; claims arising from such instances will not be entertained.

Where or if tenderers have made specific or special allowances in this respect these shall be clearly indicated in a programme submitted with their tender offer.

Tenders must submit a programme showing what specific allowances have been made for working on each specialist installation.

Should a claim arise for extra time or overtime work due to out of sequence work or having to make programme changes to accommodate the Employer, the onus will be on the tenderer to prove that at the time of tender he could not have reasonably contemplated that such extra time or overtime would have been required nor that such instances would have occasioned.

It is the sole responsibility of the tenderer to ensure that all quotations obtained from manufactures and suppliers are complete in their entirety and must include all equipment and accessories necessary for compliance with current practice and the efficient and proper functioning of the installation.

If any such items of equipment, brackets and accessories, etc., have been omitted from a supplier's quotation, or incidental work is necessary, the tenderer must include for all such items and work in the tender.

All equipment offered by the tenderer shall be to the approval of the Engineer, prior to installation. This standard specification and the supplementary specification with drawings shall be carefully adhered. Equipment installed without the approval of the Engineer will have to be removed at the tenderer's expense and be replaced with officially approved listed items.

4. DESIGN CONDITIONS

Location: Port Elisabeth

Altitude: 250 m. above mean sea level

External: Summer Max. Average : 32,0 DB : 23,0 WB
Winter Min. Average : 2,0 DB : 95% RH

Internal: 23,0 deg C + 1,0 deg C 50 % RH + 5 % RH

NOTE: All equipment capacities in the drawings are given at room conditions. Tenderers offering equipment that is rated at different conditions must ensure that the equipment they offer is capable of meeting the specified capacities at room conditions.

5. SYSTEM DESCRIPTION

5.1. General Information and Preferred Equipment

This tender is for the supply, installation and commissioning of a complete, Fire Detection and Fire Alarm system and all ancillary components as specified and shown in the drawings

Although the system design is not based on any specific make of equipment and components. The St Albans Correctional Facility have existing Analogue Addressable Fire Alarm equipment, that are supplied by Messes Gulf Security Technology Co, Ltd a subsidiary of Carrier (Carrier Global Corporation) under the trade name GST200N Series Intelligent Fire Alarm Control Panels and GST DI-9000E systems. All equipment supplied under this contract must be fully compatible with the existing equipment

5.2. Analogue Addressable Fire Detection Installation

The fire detection system is an addressable system and is designed and programmed for early fire detection and warning, initialising specific safety sequences in the equipment when required and monitor that such sequences can be initiated when required.

Fire Control Panel (GST200N)

The Analogue Addressable Fire Control Panels, located in the Control Room at each of the Sally Ports 2,5,6,7 (4 off) as shown on the drawings, shall consist of a two loop, wall mounted semi-flush panel complete with, a built in battery charger, batteries, all interfaces, and accessory boards needed to communicate/ operate all devices/sensors described in this document.

A 240V supply to the panel shall be provided. The Fire Control Panel's built in standby power supply system, shall be capable of supplying sufficient standby power for all the devices connected to the Fire Control Panel for a minimum duration of 24 hours in normal condition and then an additional 0,5 hours in Alarm Condition.

The Fire Control Panel and fire detection and alarm system shall be protected against any Electrical Spikes, Drops, EMF (Lighting strikes)

The front of the panel comprises function buttons, indicator LEDs, and an alpha numeric display unit.

The alpha numeric display unit must display the Alarm Type, Zone Number, Sensor/ Device Number and provide a user-defined message for each Sensor/Device.

The Fire Control Panel shall be fully field-programmable via a keypad, or via a PC with the suitable proprietary programming software installed

All panel wiring connections for both power and loop cabling must be provided with surge and spike arresting devices discharging all surges to earth. If more than one earth point is used all earths are to be equalised i.e. be at the same earth potential.

All wiring must be daisy chained; wiring spurs to devices will not be used.

System Operation

The system operates in two modes, Night/Building Empty and Day/Building Occupied, the modes selectable via the key switch on the Fire Control Panel only.

Day/Building Occupied Mode

Sensors in public areas operate at normal or low sensitivity.

All fire signals received by a sensor are to be confirmed by a second sensor in the same zone or any break glass unit; all confirmed signals will be automatically relayed to the Fire Control Panel, if not cancelled (reset) within a specified time (less than four minutes). All signals which are not responded to will be considered a confirmed signal.

The person attending to the alarm can call for more time by pressing the "ACK/MUTE" push button, on Fire Control panel, in which instance the clock will be reset to zero and a new programmable cycle will be initiate. During such cycle the attendant/s must be capable of investigating the source of the alarm and cancel it at the panel (by pushing the reset button) in the event of a false alarm or confirm it at the panel (by pushing the accept button) or by breaking the glass of any break glass unit.

The alarm may only be cancelling from the Fire Control panel

It must be noted that operation of the "ACK/MUTE" push button shall be overridden by the triggering of a second sensor/device in the same zone or via a break glass unit.

Night/Building Empty Mode

Sensors in public areas operate at normal or high sensitivity.

All fire signals received by a sensor are automatically relayed to the Fire Control Panel and sounding the local evacuation sounders/sirens

Operation of Fire Detection System in the Event of a Fire

In the event of a confirmed fire condition, the fire Detection system is to automatically:

- Shut down any ventilation fans (if applicable)
- De-activate the access controlled magnetic locks on fire escape doors
- Sound the evacuation sounders/siren.

These functions will be grouped differently depending on where the signal originates from.

All manual call points (break glass units) will only activate the evacuation alarms.

Sensors

All sensors shall comply with the standard specification; the type and location of sensors shall be as indicated on the drawings.

Addressable Optical Detector (GST DI-9102E)

Addressable Heat Detector (GST DI-9103E)

All sensors must be clearly labelled with the sensor number on both the base and sensor head to prevent incorrect location of sensors.

Addressable Break Glass Units/Manual Call Points (GST DI-9204E)

All manual call units shall comply with the standard specification; the location of which shall be as indicated on the drawings. The units shall be supplied with hinged clear cover and re-settable element.

All manual call units must be clearly labelled for ease of location of manual call units.

Line Devices

All line devices shall comply with the standard specification. The type and location of line devices are shown on the drawings.

Addressable Control Unit/ Line Relays (GST DI-9302E)

The Contractor will provide the line relay and connect to a 24 V contactor coil. The contactor and wiring to its contacts to be carried out under this contract.

Addressable Monitor Units/Interface Units (GST DI-9300E)

The interface units used shall be with Normally Open contacts either of the 'sprinkler' or 'non-fire' types; an end of line resistors shall be provided with each interface unit.

The Contractor will be expected to provide the interface units and connect to voltage free contacts which are to be monitored as follows:

- Contact open Normal
- Contact closed Alarm
- Wiring open Fault
- Wiring shorted Fault

Addressable Line Isolators (GST DC-9503E/DC-9504E)

Line isolators are to be used to protect against short circuits and are to be positioned no further than 20 detectors apart, or on entering a new zone (i.e. no more than 20 detectors or one zone will be isolated in the event of a short circuit).

Addressable Sounder with Visual Indicator GST DI-9403E

All sounders shall comply with the standard specification; they shall be located in positions as indicated on the drawings. The Sounders shall operate in zones or in the event of a general alarm all together. The supply shall be monitored for open circuits, short circuits and any supply faults, and any anomalies/faults shall be reported to the Fire Control Panel as a fault.

All sounders should be an addressable line device requiring no extra wiring either than the 2 wire looped cable used for wiring detectors, they may however be wired on a separate loop.

Zones

It must be possible to randomly allocate, by software, any device, or sensor, from any line, to any zone. The zoning of devices shall be finalised by the consulting engineer only prior to the programming of the Fire Control Panels.

Fire Brigade/Alarm Signalling

No direct connection to the Fire Brigade will be required.

A SMS modem shall be connected to the fire Control panel and will SMS a minimum of three (3) Cell phone numbers when the Fire Control Panel is in a fire alarm condition. The SIM card and cell phone numbers, will be provided by the Client

Labelling / addressing of all devices

Each devise shall have its own address that will include both loop number and panel number, to be clearly indicated on each device and device base.

This address shall be obtained from the Consulting Engineer prior to installation / programme of the devices.

Fire Alarm Electrical Work

Wiring

The fire alarm installation shall be wired as a 2 wire looped systems, so that it will be possible to access a zone from either end. Each looped system shall have a maximum of 235 detectors/devices wired with a 2 core screened twisted pair cable and shall have a fire rating of no less than 2 hours (PH120)

All systems controlled/ switched by the fire alarm installation that are not wired in a fail-safe configuration (open circuit in alarm condition) shall have a fire rating of no less than 1/2 hour.

The fire alarm wiring must comply with the manufacturer's specification.

The contractor will be responsible for all wiring required by the fire alarm system to operate any of its integral components. All PVC wiring shall be 1000 V grade. All wiring shall comply with SANS 10142 and the standard specification.

Conduits and Wire-ways

Galvanised trunking wire-ways and/or wiring baskets are to be to run on the surface of roof/floor slabs and walls. Conduit is to be chased into brick and run in inaccessible roof or floor voids. All surface mounted PVC conduits shall be saddled every one (1) metre.

All detector bases shall be fixed to thin wall galvanised round conduit box. Where bases are used in movable or fixed ceiling tiles the box will be connected with a length of flexible conduit to a conduit box fixed to the slab soffit.

No PVC saddles or fixing/ mounting clamps may be used

All conduits and conduit accessories shall bear the SANS mark.

Maintained Electrical Power Supply

Each Fire Control Panel will include a power supply and a built in battery charger. However some components that form part of this contract will require independent power supplies. These power supplies shall consist of a 220Vac/24Vdc converter with a 5 amp dc output rating. The power supply shall be capable of supplying sufficient standby power for all the connected components for a minimum duration of 24 hours in normal condition and then an additional 0,5 hours in Alarm condition.

The power supply, battery charger and battery/s, shall all be housed in proprietary named wall mounted lockable metal housing

6. RECORD KEEPING AND LABELLING

6.1. Labels

All equipment shall have a unique number inscribed on a label and fixed to the equipment. These numbers shall correspond with that on the drawings and in the manuals.

6.2. Design Information

The following information shall be indicated on a label:

- The battery type and size. (next to the batteries)
- The quiescent load and alarm load in amps of the system. (next to the batteries)
- The sizes of all the fuses. (next to the fuses)
- The dates that the batteries were installed. (on the batteries)
- The number of each detector, break glass unit, interface, relay, or other activation or initiating devices. (on or next to the unit)

6.3. Record Keeping

A record shall be kept of each inspection and test in a book next to the fire panel.

The record book shall state at least the following:

- List of all fire detection panels, alarms, sensors and devices.
- The date and name of the person and company carrying out the services / tests / inspections.
- Comments on the tests or inspections.
- The voltages measured for the battery tests.

The date on which batteries were installed shall be clearly marked on the batteries and also indicated in the record book.

6.4. Blocked / Reference Plans

All framed drawings fixed to the wall next to the fire panel shall be kept up to date with changed information on the fire detection system. The drawing shall contain at least the following:

- The building name as shown outside the building otherwise as known by the users of the building.
- The panel number shall also be shown.
- All the initiating devices and their numbers and types shall be shown.
- A symbol list of all the symbols used on the drawing.
- The positions and numbers of all the battery chargers and gas cylinders shall be shown.
- Detection and gas zones must be indicated.
- The drawing shall be at least A3 size but large enough to contain all the required information.
- The drawing shall be mounted behind glass with a hard wood frame.

7. ELECTRICAL WORK

Three phase 400 volt 4 wire plus earth supplies or 230 volt 2 wire plus earth supplies shall be provided and will terminate in the control panel. The Subcontractor will be required to allow for the fixing of a white on black engraved traffolite label identifying the supply origin, and whether the panel or part of it is on emergency/standby power, as well as a white on red engraved traffolite label with the words "FIRE ALARM" in the Distribution board identifying each circuit supplying the fire alarm installation

Final connections from the isolators or panels to the various systems or units inclusive of all switch gear, inter-connecting cable, wiring channels, instrumentation, and controls etc. will form part of the Contract. The Contractor shall make an allowance for the isolators to be located in position visible from the unit or system or panel to be isolated and on average at a distance of not exceeding three metres.

8. DAMAGE CAUSED BY VOLTAGE SURGES

All damage caused by lightning or power surges must be fixed under this contract. No such claims will be considered.

The Contractor must note that the Bhisho area is prone to lightning and voltage surges must therefore be expected.

The contractor is advised to install surge protection equipment on the systems and to regularly check the surge protection equipment for proper operation. The Contractor is advised to contact a specialised lightning protection specialist to assist with the design of the surge protection.

9. TEST EQUIPMENT

The contractor shall ensure that the following equipment is available on site for the engineer's use.

- A digital multimeter.
- Smoke and heat detector testers suitable to reach heights of 6 meter.
- Testers to test batteries.
- Test equipment to test flame detectors, etc, if applicable.

10. BUILDER'S WORK

All builders' work will be detailed and such information will be supplied to the Engineer for approval prior to it being implemented.

In general, where pipe work must be built in, as work progresses on site the Contractor will be required to ensure timeous installation of such items.

Dimensions and positions will be the responsibility of the tenderer.

11. ALTERNATIVE OFFER

The tenderer must quote strictly in accordance with the Engineer's specification and drawings, and alternative offers requested in the documentation but should the tenderer wish to propose further alternative offers to the specification, then the tenderer must provide complete technical details on the alternative equipment proposed and list amounts ("ADD" or "OMIT"), in the Schedule of Alternative Offers.

Unless all the relevant information is provided, full assessment of the alternative offer cannot be made and such offers shall not be considered

No changes to the design or equipment specified will be considered after adjudication and appointment of the Contractor for this Contract.

12. TESTS AND COMMISSIONING

If required, the methods and standards used in ISO R859 or any other acceptable means of testing approved by the Engineer shall be used to determine the following rated capacities of the system as specified:

12.1. Analogue Addressable Fire Alarm Installation

Each component (detector head, line relay, interface unit, interlock, door closer etc.) comprising the installation will be tested for operation as an individual component (e.g. smoke test, continuity test etc.) and under simulated fire conditions. The Contractor shall allow for simulating fire conditions at least once per fire zone. The software will also be tested in a similar manner.

The Contractor shall allow for conducting a range of tests under simulated fire conditions with the Employers representatives and satisfy himself and the Consulting Engineer that they are sufficiently conversant with the system operation to distinguish false alarms from true alarms and act accordingly. Training of the Employer's representatives will form part of the system commissioning.

The Contractor must note that he is expected to have tested the entire installation in accordance with what stipulated above and to have rectified all defects and malfunctions prior to him calling the engineer to site to witness the First Delivery test.

All defects which affect the operational safety of the system will prevent acceptance of First Delivery of the system until they are rectified and the defective installation retested in its entirety. Every failed test must be repeated in its entirety. All costs for abortive trips to site and Engineer's time where these are incurred because of the Contractor's negligence will be paid for by the Contractor.

The following inspections and tests will be carried out at the time of handover. Minor omissions or defects will be noted and are to be rectified within 7 days. Major omissions will result in the cancellation of the handover, and a new date set for the handover. All testing equipment is to be provided by the contractor at no additional cost.

Documentation

All documentation, i.e. Operation instructions, maintenance instructions, manuals installation drawings, wiring and circuit drawings, programme printout etc., as called for by the tender documents, are to be presented.

Documents are to be complete in all respects and properly bound or mounted, as required.

Equipment

All installed equipment will be inspected for compliance with the following:

Equipment is to be fully in accordance with the specification attached to the tender documents.

Equipment is to be new and free from scratches and marks.

All labels and instructions are to be bilingual (English and second language to be advised) and permanently marked or affixed. Labelling of the "Dymo-Tape" type will not be accepted.

All installed equipment will be examined for workmanlike assembly and finish. Particular attention will be paid to secure mounting of components, neat and secure installation of wiring, and proper labelling of all components and terminals.

All installed equipment must have a detailed non fading circuit drawing (preferably schematic) showing all components (with values, part, and terminal numbers) permanently affixed inside the equipment, or framed and mounted on the wall adjacent to the equipment.

Installation

Installation will be expected for secureness, neatness, and workmanlike finish.

Equipment is to be mounted in a secure manner, in the correct position, with the base parallel to the floor.

All conduits, MICC, cabling etc, must be securely and neatly fastened as described in the tender documents. Ends and terminations must be properly executed.

Wiring and terminations will be inspected for neatness, proper saddling and stripping, and correct colour coding and numerical labelling in accordance with the drawings.

Particular attention will be paid to neatness of wiring inside panels and junction boxes. Wiring runs must be either parallel or at 90˚C to each other. Wiring must not be run across the front of any components or equipment in such a manner as to prevent easy observation, testing, servicing, or replacing of any item of equipment. Untidy wiring inside panels or boxes will not be accepted.

Operational Tests

The following operation tests will be carried out on the system to ensure compliance with the tender documents.

Detectors:

All detectors will be tested by means of applying smoke and/or heat to the detector (all functions must be tested on multi sensor heads).

Break Glass Units:

All break glass units will be tested.

Zones:

All zones will be checked to ensure that when a detector or break glass unit is activated the correct zone lamp lights up and the correct message is displayed.

One detector chosen at random in each zone is to be disconnected, and the panel checked to ensure that a “fault” signal has been received and the correct message is displayed.

All alarms, bells, beepers, sirens, hooters, or other audible alarms are to be tested.

If the audible alarm circuits are monitored, then one audible alarm unit chosen at random, in each zone, is to be disconnected, and the panel checked to ensure that a “fault” has been received and the correct message is displayed.

The Fire Control Panel: (is to be tested as follows)

Correct lamps light-up when alarm or fault is initiated from zone.

Audible alarm silences when “silence” button is pressed.

Audible alarms must re-start after being silenced when an alarm is initiated from another zone.

An alarm is to be initiated from a break glass unit. The break glass unit is then to be returned to its normal position. The panel is to be checked to see that it is still displaying an alarm, i.e. that it is “latched” into the alarm condition.

The panel is to reset when the “re-set” button is pressed.

The LED’s entire are to light-up when the “lamp-test” button is pressed.

The correct message is displayed, including zone and device identification.

Battery Operation:

The following tests will be done to ensure proper operation on the standby power supply batteries (if provided):

The mains supply to the panel is to be disconnected:

- The system must change over to the standby batteries.
- The panel must give a “fault” signal and indicate a “Mains Failure” condition.
- One detector or break glass unit in each zone must be activated and all alarms, lamps, etc., must work normally, and at full level.

The system must be left, in a standby, normal condition, operating on its batteries for the full duration of the standby battery period as specified in the tender documents.

At the end of this period the following tests will be done:

a) Battery voltage is to be re-measured and recorded.

b) The battery voltage must be above the minimum required by the control panel, as specified by the manufacturer.

c) One detector in each zone is to be tested.

d) The panel is to be checked for correct functioning.

e) The audible alarms are to be checked for adequate volume.

Detector Voltage:

The voltage at the last detector in each zone is to be measured, with a voltmeter, and recorded, under the following conditions:

- With the mains on.
- With the mains off, immediately after switching off.

Under all these conditions, the voltage at the detector must be within the voltage range required by the detector, as specified by the manufacturer of the detector.

Simulation Test

Smoke Detectors

A fire consisting of two crumpled sheets of full-size newspaper is to be made in a suitable container of wire mesh or similar. This fire is to be made at floor level at the most furthers distance away from a detector, in the room or area being tested.

The detector must initiate the alarm within 2 minutes of the newspaper being lit.

Heat Detectors

All heat detectors shall be performance tested with a hair drier.

Audible Alarms

The system is to be activated into alarm, with the audible alarms operating. These must be heard with adequate volume in all areas where this is required as specified.

Interface Units and Line Relays

All interface units and line relays must be checked individually and collectively as correctly operational with mains power and with battery power. All display LED's must indicate corrects operation of all such units individually and collectively.

13. MAINTENANCE AND SERVICE CONTRACT

The tenderer shall include in the tender price for carrying out at least two inspections of the installation during the first year from the date of practical completion.

The tenderer shall compile a full report within two weeks of having completed each inspection and forward the same to the Consulting Engineer for record.

14. DOCUMENTATION, DRAWINGS AND AS BUILT DRAWINGS

The tenderer shall in addition to documentation specified in the Standard Specification furnish the Engineer with three sets of documents and drawings related to the approved concept, design, installation, commissioning, operation, and maintenance of the entire system and its components, on or before the Practical Completion date.

All documentation is to be submitted in both hard copy and digital format.

The following drawings are required:

- Layout drawings (plans, sections, elevations, isometric diagrams, 3-D drawings etc.) identifying each component (hard copies and electronic copies)
- The Contractor shall note that acceptable drawing formats are AutoCAD

The following documents are required:

- Full description of the system/s
- Operating instructions
- Installation instructions
- Commissioning instructions
- systems programme printouts
- Maintenance instructions, maintenance schedule and troubleshooting guide

The tenderer will include all suppliers' information that is available in electronic format in both hard copies and in electronic format neatly catalogued for easy reference.

The tenderer shall include in the tender price the cost year for servicing and maintaining the installation on behalf of the client for one year after one year from the date of Practical Completion.

A full and detailed description, listing the extent of the service/ maintenance work to be carried out at each service, is to be shown separately and included with this document.

The number of services included per year to be clearly stated and will consist of at least (but not limited to) four quarterly inspections of the complete installation at intervals not exceeding three (3) months after practical completion.

The tenderer shall compile a full report within two weeks of having completed each inspection and forward the same to the Consulting Engineer and Employer for record.

15. GUARANTEE OF THE INSTALLATION

The equipment will be subject to twelve (12) months guarantee against breakdown or failure due to inferior design, material or workmanship shall be replaced free of charge, including cost of labour and travelling, on such an occurrence by the tenderer.

The guarantee period will commence from the date of Practical Completion of the project. The successful tenderer will be responsible for all the repairs and/or replacement of equipment during the guarantee period. The guarantee shall not apply to replacements or repairs made necessary by misuse of negligence on the part of persons other than those in the employ of the successful tenderer

16. OPERATING & MAINTENANCE MANUALS

Operating Manuals

The tenderer shall supply as part of the contract three (3) copies of the Operation Manual and "As Built" drawings for Fire Alarm and Fire Extinguishing Systems

At least one month before commissioning, one draft copy shall be submitted to the Engineer (and if required the Client) for comment and approval.

Although the manuals contain information of a technical nature wherever possible and practicable manuals must be compiled in layman's language.

Operating manuals shall give a clear description of and the purpose of the installation.

a) Paper copies of all approved drawings and diagrams.

b) Detailed description of the different components used in the installation.

c) On- and off switching procedures.

d) Guidelines for routine-test to be carried out by the User Department inclusive of the periods during which tests are to be undertaken.

e) Detailed instructions for procedures to be followed during a fault

The tenderer shall in addition to documentation specified above and/or in the Standard Specifications furnish the Engineer with two sets of documents and drawings related to the concept, design, installation, commissioning, operation, and maintenance of the entire system and its components, on or before the date for Practical Completion.

The following drawings are required:

- Layout drawings
- Schematic circuit drawings
- Internal circuit drawings of all panels, etc.
- **Wiring drawings showing wire colour codes and numbers as well as all connections onto terminal strips (markers to be approved by the Engineer)**.

The following documents are required:

- Full description of the system.
- **Operating instructions**.
- Installation instructions.
- Commissioning instructions.
- Maintenance instructions, maintenance schedule, and troubleshooting guide.
- Programme printout

Maintenance Manuals

Three complete sets of maintenance manuals (Technical) prepared in English shall be supplied by the Contractor.

At least one month before commissioning a draft copy shall be submitted to the Engineer for comments and approval.

Maintenance manuals shall consist of the following:

a) A general description of the system.

b) A general description of the controls.

c) Schedule of equipment, model numbers, optional extras, modifications, electrical power requirements, etc.

d) Detailed monthly, quarterly, semi-annually, and annual preventative maintenance procedures.

e) Manufacturer's catalogues clearly indicating type, size and model of equipment supplied.

f) Tabulated commissioning data of all equipment and systems, indicating- as measured and according to specification - requirements.

g) List of suppliers, addresses, and telephone numbers.

h) List of spare parts for all equipment.

i) Fault tracing/finding procedures.

Manuals shall be bound in a firm hard cover.

The information shall be clear and readable and supplied with an index.

The above mentioned manuals shall be available at Practical Completion; Practical Completion of the installation will not be accepted without the manuals.

17. TRAINING OF STAFF

The Subcontractor shall allow for instructing Department appointed responsible persons in the correct maintenance of the installation. The Subcontractor shall use only competent staff to carry out training and where a company has been specified to carry out commissioning the same company must be used by the Contractor to carry out Operation and Maintenance Training. In broad terms training must cover the same subject contents in the Operating and Maintenance Manuals in sufficient detail for the staff to be able to perform all the required adjustments and operations without third party assistance

TENDER DRAWING LIST

Drawing No.	Drawing Title
E21/2107/SA/201	SALLY PORT 02: ICT & FIRE DETECTION
E21/2107/SA/204	SALLY PORT 05: ICT & FIRE DETECTION
E21/2107/SA/205	SALLY PORT 06: ICT & FIRE DETECTION
E21/2107/SA/206	SALLY PORT 07: ICT & FIRE DETECTION

SCHEDULES OF EQUIPMENT OFFERED

The tenderer shall supply a complete schedule of all equipment in the Main or any alternative offer in the format indicated below.

FIRE DETECTION SYSTEM

Item of Equipment	Rating/ Capacity	Manufacturer	Model No	Remarks
Fire Control Panel				
Multi Sensor Detector				
Line Relay				
Interface Unit				
Line Isolator				
Manual Call Point				
Sounder				
Sounder Beacon				
Wiring (fire signal)				
Wiring (24 V)				
Conduit				
Galvanised wiring baskets				
Standby Power Pack				
Battery Charger				
Batteries				

PART 11:

FIRE PROTECTION

PROJECT SPECIFICATION

Part 11 PROJECT SPECIFICATION

SUPPLEMENTARY SPECIFICATION FOR THE SUPPLY, INSTALLATION OF FIRE FIGHTING EQUIPMENT AND FIRE FIGHTING INFORMATION SIGNS

1. GENERAL

This supplementary specification is for the supply, installation and commissioning of Firefighting Equipment Installation.

The Conditions of Contract Form **GCC 2010** and the Department of Public Works Standard Conditions in respect of the Supply, Delivery and Installation of Electrical and Mechanical Equipment, Plant and Materials Form PW 379 and bid Form attached SHALL APPLY TO THIS CONTRACT as well as STS 5 - Standard Specification for the Electrical equipment and Installation Mechanical Services Issue IXa December 1999.

The works carried out under this subcontract shall be governed by the following standard specifications, SANS and STS specifications:

- Department of Public Works Standard Specifications:
  - PW 371 Specification of Materials and Methods to be used.
  - STS 5 Standard Specification for the Electrical equipment and Installation Mechanical Services Issue IXa December 1999

- SANS Standard Specifications:
  - SANS 810 - Firefighting equipment, powder fire extinguishers, portable, rechargeable
  - SANS 889 - Firefighting equipment, water fire extinguishers, portable, rechargeable
  - SANS 1186 - Symbolic safety signs
  - SANS 1522 - Fire extinguishers, powders
  - SANS 1567 - Fire extinguishers, portable, rechargeable, carbon dioxide
  - SANS 1910 - Portable refillable fire extinguishers
  - SANS 10105-1 - The use and control of fire-fighting equipment
  - SANS 14788 - Continuous hot-dip zinc-5 % aluminium alloy coated steel sheet
  - SANS 10400 - The Application of the National Building Regulations
  - SANS SM 1172 - Fire extinguishers, classification system, fire ratings
  - ISO 965 - ISO general purpose metric screw threads
  - ISO 1461 - Hot dip galvanized coatings on fabricated iron and steel articles
  - ISO 3575 - Continuous hot-dip zinc-coated carbon steel sheet of commercial and drawing qualities
  - ISO 14617 - Graphical symbols for diagrams
  - ISO 14713 - Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures

- Detailed Specification

- Tender Drawings

- Any relevant SANS Standard, local by-law, corporate specification and any national regulation promulgated by Act of Parliament such as the OHS Act 85 of 1993, whether specifically mentioned or referred to hereafter or not.

The Standard Specifications are not bound in this document. Standard Specifications may be obtained from the offices of the Consulting Mechanical Engineers on request provided they are not subject to copyright. Standards or Codes such as SANS, ISO, DIN, BS, EN may be obtained from the offices of SANS

The Detailed Specification for the works is bound in this document together with all the Tender Drawings indicating the extent of the works to be tendered for and completed

Where reference is made in this specification and any drawings and documents mentioned therein to the Factories, Machinery and Building Works Act of 1941 this shall be deemed to be replaced by the Occupational Health and Safety Act, 1993.

Where reference is made in the Specifications and any drawings and documents mentioned therein to "Secretary for Public Works" or "Department of Public Works" or "Director General: Community Development" and "Department of Community Development", this shall be replaced by "Director General: Public Works" and "Department of Public Works" respectively

Tenders shall only be considered if the following requirements are strictly adhered to during the tender process:

- The main tender shall comply with the specification in all respects and no changes will be allowed in the Price Schedule or in the information schedules.

- The Schedules of the tender document must be completed fully and in detail for the tender. Any incomplete section will be regarded as not to specification and may lead to disqualification of the tender.

- Tenderers may hand in alternative tenders together with the main tender. Alternative tenders will be considered if the main tender is acceptable. Alternatives shall be presented on separate pages but in the same format and details per the Specification. It shall be clearly shown what the differences are between the main offer and the alternative offers.

- When the total tender price of the installation is carried over to the price schedule form, it must include the first 12 months maintenance as specified.

- Bidders must ensure that the bid document is studied in full and that all the conditions are complied with during the bid process.

2. DRAWINGS AND APPROVAL (Refer to Standard Specification where applicable)

The bid drawings must be returned with the tender. Any proposed alterations to the layout shall be indicated on these drawings in red ink and may only be submitted as an alternative bid.

Not later than three weeks after signing the contract, or receiving verbal instruction, the successful bidder shall submit to the Engineer either four copies of his detailed working drawings, or written confirmation that the tender drawings will be used.

Approval by the Engineer of drawings submitted by the Contractor shall not relieve the Contractor of his liability to carry out the work in accordance with the requirements of the contract documents.

3. SCOPE OF WORK

The standard specification shall apply unless otherwise indicated in this section.

The drawings issued herewith and listed in the relevant section are to be read in conjunction with the specification and all items mentioned, together with all ancillary equipment necessary for the correct installation, operation and full compliance with the Standards and codes must be provided, notwithstanding the fact that they may not have been included in detail in these documents.

The work performed shall comprise the supply, delivery, off-loading, interim storage, installation, testing, commissioning and leaving in good working order of the firefighting equipment Installation inclusive of all guarantees as specified herein and the supply of 'AS IS' installation record drawings, Maintenance and Operating Manuals, Sign-Off Forms and documentation in accordance with the DPW specifications and requirements for:

(i) The supply and installation of 9 kg DP fire extinguishers inside wall mounted enclosures

(ii) The supply and installation of 5 kg CO^2 fire extinguishers c/w wall mounted brackets on timber backing plate or enclosures.

(iii) The supply and installation of Photo luminescent firefighting information signs

(iv) The supply and installation of Reflective firefighting information signs

(v) Provision of all O&M Manuals and As Built drawings as specified

The Tenderer shall, at the time of tendering, draw the Engineer's attention to any omissions or discrepancy between the specification and the drawings and request from him clarification of details or responsibilities.

If a limited allowance or special conditions are made for the Tender Sum for the supply or erection of any item of the installation, the limit or special conditions shall be defined at the time of tendering.

It is the sole responsibility of the Tenderer to ensure that all quotations obtained from manufactures and suppliers are complete in their entirety and must include all equipment and accessories necessary for compliance with current practice and the efficient and proper functioning of the installation.

If any such items of equipment, brackets and accessories, etc., have been omitted from a supplier's quotation, or incidental work is necessary, the Tenderer must include for all such items and work in the tender.

All equipment offered by the Tenderer shall be to the approval of the Engineer, prior to installation. This standard specification and the supplementary specification with drawings shall be carefully adhered to by the Tenderer. Equipment installed without the approval of the Engineer will have to be removed at the Tenderer's expense and be replaced with officially approved listed items.

The Tenderer shall employ only skilled artisans and technicians approved by the Engineer who are competent in this type of work. The work shall be carried out in accordance with the standards laid down by the Engineer.

The whole installation shall be in accordance with the latest edition of the Occupational Health and Safety Act: No. 85 of 1993. All regulations framed therein and shall be carried out to the satisfaction of the Engineer.

The contracting firm shall be a recognised firefighting equipment Installation specialising in this field and approved by the Engineer.

4. DESIGN CONDITIONS

Location:	Port Elisabeth
Altitude:	250 m. above mean sea level
External:	Summer Max. Average: 32,0 DB : 23,0 WB Winter Min. Average: 2,0 DB : 95% RH
Internal:	23,0 deg C + 1,0 deg C 50 % RH + 5 % RH

Design conditions and performance specifications for individual plant components are in accordance with what listed hereafter.

The Tenderer shall take due cognizance of the climatic conditions likely to be experienced both in summer in winter months and allow for these in the selection of materials.

5. SYSTEM DESCRIPTION

5.1. General Information

This tender is for the supply of the fire fighting equipment Installation as shown in the drawings.

All equipment used for the fire fighting equipment Installation shall bear the SANS.

5.2. Fire Extinguishers

Portable Dry Powder Extinguishers

4.5 Kg canisters c/w safety seal wall or column mounted brackets on timber backing plate or inside fibreglass or poly carbonate enclosures.

9 Kg canisters c/w safety seal wall or column mounted brackets on timber backing plate or inside fibreglass or poly carbonate enclosures.

Portable CO_2 Extinguishers

5 kg canisters c/w safety seal wall or column mounted brackets on timber backing plate or inside fibreglass or poly carbonate enclosures.

10 kg canisters c/w safety seal wall or column mounted brackets on timber backing plate or inside fibreglass or poly carbonate enclosures.

Portable Water Expelled Foam Extinguishers

9 Kg canisters c/w safety seal wall or column mounted brackets on timber backing plate or inside fibreglass or poly carbonate cabinet enclosures.

Backing Plate for mounting of Extinguishers

Extinguisher J or Universal brackets must be mounted on a timber backing plate secured to wall or column. Backing plate painted post office red shall be of solid timber 700 x 105 x 22 mm.

Fire Cabinets Enclosures

Weather proof UV resistant fibreglass or poly carbonate wall or column mounted enclosures including clear cover for mounting of canisters, padlocks and key holders.

5.3. Fire Hose Reels

Hose Reels

Galvanised fire hose reels and galvanised wall mounting brackets c/w holder bracket on chain with wheel for hose nozzle with safety seal.

Hoses

Semi-rigid 30 meter hoses.

Nozzles

Combined nozzles with shut off ball valve and adjustable spray control nozzle.

Glycerine Pressure Gauges

66 mm diameter 0-2500 kPa glycerine pressure gauges c/w stainless steel body and bezel, copper pigtail and shut off gauge cock.

Fire Cabinets Enclosures

Weather proof UV resistant fibreglass or poly carbonate wall or column mounted enclosures including cover for mounting of hose reel c/w safety seals, padlocks and key holders.

5.4. Pipe Work

All pipe work shall be manufactured from SANS Medium grade mild steel pipe work hot dip galvanised after manufacture.

Pipe work supports shall be hot dip galvanised. Exposed piping threads shall be primed with one coat of aluminium paint.

All pipe work will be colour coded with bands at intervals not exceeding 3 metres; all valves will be provided with one colour coding band on either side of the valve.

Cast–in Items

All cast in items will be hot dip galvanised after manufacture and will be supplied in good time by the Contractor to the Contractor for building in position.

The Contractor will be responsible for verifying that all builders' work has been completed in accordance with the Contractor's specifications and requirements and that all cast-in items have been correctly positioned and built in.

Protection of Pipe Work below Ground and to be Cast-in

All hot dip galvanised pipe work below ground and pipe work to be cast in will be protected by applying two layers of "Denso Wrap' with sufficient overlay to ensure protection from contact with soil and/or moisture (a minimum of 50% overlay will be required).

Colour Coding of Pipe Work

All pipe work above ground will be colour coded as follows:

Fire hose reel pipe work	:	signal red
Hydrants pipe work	:	signal red bands
Domestic water pipe work	:	brilliant green bands

Colour coding bands shall be provided at each valve on either side of the valve flange.

Ball Valves

All ball valves will be PN16 valves nickel plated brass valves with stainless steel balls and PTFE seats

5.5. Fire Fighting Information Signs

All Fire Fighting Information **s**ignage shall be installed according to sans 0400 part t, sans 10114, sans 1186-1 and the local authority.

External Fire Fighting Information signage shall be of the reflective type and comply with sans 1186-4, and the minimum size signage shall be 580mm x 290mm.

Internal Fire Fighting Information signage shall be of the photoluminescence type and comply with sans 1186-5.

All Fire Fighting Information signs shall have a visible SANS stamp on it and fitted in an aluminium framed. Wall mounted and/or Suspended Fire Fighting Information signage shall be positioned so that the bass of the sign is between 2m and 2.5m above finished floor level. Suspended signs shall be hung with proper lugs and steel cabling and must be double sided. [Hand twisted wires are not acceptable]The signs shall be fixed to the walls with screws rated for the type of wall construction the sign is being fixed to. [Double sided tap or any form of adhesive shall not be permitted]. Only hot dip galvanised or stainless steel anchors and anchor bolts are permitted for the fixing of external Fire Fighting Information signage.
The signs shall be positioned so that the bass of the sign is between 2m and 2.5m above finished floor level.

- Photo-luminescent 190 x 190 mm single sided sign to SANS 1186-5 indicating a Directional Arrow (SANS 1186-1 code FB1)

- Photo-luminescent 190 x 190 mm single sided sign to SANS 1186-5 indicating a Fire Extinguisher (SANS 1186-1 code FB2)

- Reflective 290 x 290 mm single sided sign to SANS 1186-4 indicating a Directional Arrow (SANS 1186-1 code FB1).

- Reflective 290 x 290 mm single sided sign to SANS 1186-4 indicating a Fire Extinguisher (SANS 1186-1 code FB2)

6. BUILDER'S WORK

The Contractor will be responsible for submitting to the Engineer all Builder's Work drawings for approval prior to them being issued to site. No Builder's Work is allowed to proceed without the Engineer's approval. If necessary the Engineer may submit the details for further approval to the Structural or Civil Engineers. The Contractor shall allow adequate time for this process to take place.

All holes in beams irrespective of size shall not be drilled without prior permission from the resident engineer / architect or the structural engineer (a record shall be entered into the site instruction book). In principle holes in beams will not be provided other than at the neutral axis and in positions where the risk of damage to reinforcing bars or stirrups is negligible.

7. TESTS AND COMMISSIONING

Before Practical Completion the Contractor shall allow for in his tender amount and provide the Engineer with a complete commissioning schedule indicating actual tests and test results and measurement of all the design or specified data/variables.

MAINTENANCE AND SERVICE CONTRACT

The tenderer shall include the cost for the first year of servicing and maintaining the installation on a three monthly basis on behalf of the Client from the date of Practical Completion.

The Contractor shall compile a full report within two weeks of having completed each inspection and forward the same to the Engineer for record.

This information, as well as a full and detailed description, listing the extent of the service/ maintenance work to be carried out at each service, is to be shown separately attached to the tender document.

8. DOCUMENTATION, DRAWINGS AND AS BUILT DRAWINGS

The Contractor shall in addition to documentation specified in the Standard Specification furnish the Engineer with three sets of documents and drawings related to the approved concept, design, installation, commissioning, operation and maintenance of the entire system and its components, on or before the Practical Completion date. All documentation is to be submitted in both hard copy and digital format.

The following drawings are required:

- Layout drawings (plans, sections, elevations, etc.) identifying each component (hard copies and electronic copies)
- The Contractor shall note that acceptable drawing formats are dwg and dxf formats.

The following documents are required:

- Full description of the system
- Cleaning instructions
- Maintenance instructions, maintenance schedule and troubleshooting guide

The Contractor will include all supplier's information that is available in electronic format in both hard copies and in electronic format neatly catalogued for easy reference.

9. GUARANTEE OF THE INSTALLATION

Every component supplied and installed under this Contract shall be guaranteed for at least one (1) year from the date of Practical Completion against breakdown and/or faulty workmanship and shall be replaced free of charge, by the Contractor irrespective of the manufacturer's or supplier's guarantees. All repair and reinstatement costs shall be borne by the Contractor (parts, labour, travelling, special despatch arrangements, and any consequential damage if any).

10. OPERATING AND MAINTENANCE MANUALS

At least one month before commissioning, one draft copy of the Manual shall be submitted to the Engineer for comment and approval.

Although the manuals contain information of a technical nature wherever possible and practicable manuals must be compiled in layman's language. All maintenance schedules and spare parts lists shall be compiled and structured in such a manner as to allow understanding by an operator with little or no technical knowledge.

Once approved the Tenderer shall supply three sets of Operating and Maintenance Manuals to the Engineer for forwarding to User client.

The Manuals must give a clear description of and the purpose of the installation, its components and its controls and shall comply with any standard Specifications listed beforehand.

Maintenance manuals shall consist inter alia of the following:

(a) A general description of the system
(b) A general description of the components
(c) Schedule of components, model numbers, etc.
(d) Detailed monthly, quarterly, semi-annual and annual preventative maintenance procedures
(e) Manufacturer's catalogues clearly indicating type, size and model of components supplied
(f) Tabulated commissioning data of all equipment and the system, indicating- as measured and according to specification - requirements.
(g) List of suppliers, addresses and telephone numbers
(h) List of spare parts for all components
(i) Fault tracing/finding procedures.
(j)

Manuals shall be bound in a firm hard cover.

The information shall be clear and readable and supplied with an index.

All manuals are to be supplied in both hard copy and electronic format.

11. TRAINING OF STAFF

The Tenderer shall allow for instructing User client appointed responsible persons in the correct operation and maintenance of the installation. The Tenderer shall use only competent staff to carry out training and where a company has been specified to carry out commissioning the same company must be used by the Tenderer to carry out Operation and Maintenance Training.

In broad terms training must cover the same subject contents in the Operating and Maintenance Manuals in sufficient detail for the staff to be able to perform all the required adjustments and operations without third party assistance

TENDER DRAWING LIST

Drawing No.	Drawing Title
E21/2107/FP/100	FIRE PROTECTION - SITE PLAN
E21/2107/FP/101	FIRE PROTECTION - SALLY PORT 1, 5 & 6
E21/2107/FP/102	FIRE PROTECTION - SALLY PORT 7, 8 & 9
E21/2107/FP/103	FIRE PROTECTIONSALLY PORT 2, 3,4 & 10

SCHEDULES OF EQUIPMENT OFFERED

The tenderer shall supply a complete schedule of all equipment in the Main or any alternative offer in the format indicated below.. The tenderer shall also supply full pictorial and technical manufacturer's brochures of all equipment offered in the Main or any Alternative Offer.

Item of Equipment	**Rating/ Capacity**	**Manufacturer**	**Model No**	**Remarks**
Fire Hose Reel				
Hose				
Hose Nozzle				
Fire Hose Reel Enclosure				
Dry Powder Fire Extinguishers				
Carbon Dioxide Fire Extinguishers				
Fire Extinguisher Enclosures				

PART 1

THE SUPPLY, INSTALLATION AND COMMISSIONING OF AN INTEGRATED SECURITY FENCE INSTALLATION

INCLUDING INNER TAUT-WIRE DETECTION FENCE SYSTEM, PLC CORRECTIONAL CENTRE CONTROL SYSTEM, ICT BACKBONE, ACCESS CONTROL SYSTEM (BIOMETRIC), C.C.T.V. SYSTEM, EVENT LOGGING SYSTEM, DIGITAL INTERCOM AND RECORDING SYSTEM, X-RAY MACHINES, METAL DETECTORS, OUTER PERIMETER FENCE KINEMATIC DETECTION SYSTEM, DIESEL BACK GENERATOR SYSTEM, UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM

SPECIFICATION FOR THE SECURITY FENCE INSTALLATION AT ST ALBANS CORRECTIONAL FACILITY:

WORK PACKAGE 1 – ELECTRONIC WORKS

Part 1:	Integrated Electronic Specification (This Document)
Part 2:	Access Control and Intercom Specification
Part 3:	Distributed Control System Specification
Part 4:	CCTV Surveillance Specification
Part 5:	Electrical Works Specification
Part 6:	X-Ray and Walk-Through Metal Detector Specification
Part 7:	Standby Generator Set Specification
Part 8:	Uninterruptible Power Supply Specification
Part 9:	Security Fence Specification
Part 10:	Fire Detection Specification
Part 11:	Fire Protection Specification
Part 12:	**ICT Specification (This Document)**

PART 12

SPECIFICATION FOR ICT WORK

CONTENTS

PART 1 – GENERAL SPECIFICATION

1 TESTS

The contractor shall inspect, complete and present a certificate, certifying that:

- The installation meets the Client approved requirements in terms of design and installed location and standard.
- Cabinets are earthed and correctly in accordance with the requirements of Earthing, Bonding, Surge and Lightning protection specifications.
- Source of electrical supply has been identified and clearly marked.
- All data and electrical infrastructure installed has been tested and meets the standards.
- The installation's documentation has been compiled and is available for inspection.

The department and / or DCS shall be responsible for the final quality checks as per the site sign off documentation.

2 MAINTENANCE OF INSTALLATIONS

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

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

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

This specification covers the supply, installation and commissioning and guarantee for twelve months of the complete ICT installation.

3 OMMISIONS AND DISCREPANCIES

The Tenderer shall, at the time of tendering, draw the Engineer's attention to any omissions or discrepancy between the specification and the drawings and request from his clarification of details or responsibilities.

If a limited allowance or special conditions are made for the Tender Sum for the supply or erection of any item of the installation, the limit or special conditions shall be defined at the time of tendering.
It is the sole responsibility of the Contractor to ensure that all quotations obtained from manufactures and suppliers are complete in their entirety and must include all equipment and accessories necessary for compliance with current practice and the efficient and proper functioning of the installation.

If any such items of equipment, brackets and accessories, etc., have been omitted from a supplier's quotation, or incidental work is necessary, the Contractor must include for all such items and work in the tender.

Bidders are requested to adhere to the requirements of the specification as closely as possible. Should a bidder find that he cannot comply with certain requirements of the specification without deviating from his standard range of products, he may offer his standard product, providing all deviations from the specification are clearly documented in a covering letter accompanying his bid offer. All the relevant paragraphs and sub-paragraphs in the specification must be referred to in the covering letter.

4 REGULATIONS

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

5 NOTICES AND FEES

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

6 SCOPE OF WORK

In terms of this contract bidders must include the following in their bid offers:

1. The supply, delivery, installation, testing and commissioning of an ICT Infrastructure to provide IT Data to various areas shown on the drawings and as described.

2. The supply, installation and connection of equipment and **all UTP CAT 6 wiring** should be done by an IT network specialist who is to be subcontracted by the electrical contractor. They should be aware and adhere to all requirements, including site safety, to that of the electrical contractor.

3. Supply and installation of conduit and ducting access shall be done by the Electrical Contractor.

7 QUALITY OF MATERIALS

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

The contractor shall submit samples of cabinets (complete with doors, power ducts, fans, etc) and labels to be installed for approval.

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

Materials wherever possible, must be of South African manufacture.

8 REDUNDANT INFRASTRUCTURE

All redundant cables, poles, connection hardware and pathways, that no longer in use, shall be identified and discarded by the contractor at contract rates. The removal of such infrastructure shall only be allowed once the appointed User representative approves the removal in writing. Infrastructure that is not removed shall be stored on site as determined by the User.

9 GENERAL PRINCIPLES

The Voice, Data and Power Network shall be built to guarantee a high availability, through reliable and maintainable communication services and products, at optimum Life Cycle Cost (LCC).

Unless otherwise specified, a RING network topology will be followed and can include redundant links. The following guidelines shall be followed in the voice and data networks:

- The design shall allow for all Data outlets to be within 90m of the floor distributor or multiples of floor distributors.

- The floor distributor will not serve more than one floor. More than one floor distributors may be planned per floor.

10 WIRED LOCAL AREA NETWORK (LAN)

UTP:

- All cables shall be stamped with the following:
  - Name of manufacturer.
  - Specification it has been tested to (SIO/IEC 1801, etc).
  - Name of testing laboratory that verified conformance to specification.
  - Cable rating (Cat 5e or 6 or 7)
  - Length marking.
- All copper cabling to be installed shall be UTP Category 5e Cable for all new sites as the minimum standard. All new sites shall be certified with the manufacturer's products system warranty and Installation warranty.
- On existing sites where extensions need to be done, the extensions shall match the original installation (Molex, Krone or Modnet). If the site is a certified site, the extensions shall also be certified.
- On existing sites where the current installation does not conform to Category 5e, all the points and cables shall be replaced with minimum Category 5e UTP and certification should be obtained.
- The maximum cable length shall not extend 90m.
- Unless otherwise specified, a 3m fly-lead and 1m patch-lead shall be supplied with each point. The maximum patch-lead and fly-lead length shall not exceed 10m.
- All patch-leads for normal data shall be grey in colour.
- All ends shall be terminated correctly according to CAT 5e standards.
- Only termination tools as specified by the specific manufacturer shall be used.
- All cables must be tested with a network cable tester to confirm connections are all properly made.
- The cable bend radius should be no less than 4 times the outer diameter of the cable.
- When installing, the maximum pull-force for 4-pair horizontal balanced twisted pair cables is 12kg.
- Cables installed in swing frame cabinets shall be secured in such a manner to allow the cabinet swing to open completely without adding any strain on the cables.
- Cables shall preferably be enclosed at all times and shall not be attached to ceiling suspension wires, frames or structures.
- All labels to be 8mm black text on white PVC. Each cable to be individually numbered on both ends and on the patch panel
- Suspended cable (also referred to as "Lashed Cable") shall under no circumstances be deployed, unless for a very specific reason and no alternatives are available.

Patch Panels:

- Only termination tools as specified by the specific manufacturer shall be used.

- There shall be 1 patch panel per switch. The number of patch panel ports must be the same as the correlating switch. (e.g. 24 port switch will have a 24 port patch panel)

- A brush panel shall be fitted for each patch panel (fibre and UTP) and switch, i.e. 2 brush panels for each 24 points.

- All labelling shall be printed on permanent ink PVC labels. All printed labels shall be black on white with a fonts size of at least 8mm. Labelling on patch panels shall be done as follows: A, B, C etc: from the top to bottom of the cabinet. The label will be on the left side of the Patch Panel.

- The cable will be labelled with the same number at the back of the Data Outlet not more than 50mm from the termination point/end by means of an approved method. Oval grip labels will be accepted.

Data Outlets:

- Preferably outlets shall be flush-mounted and shall be installed in a pre-punched skirting cover plate, punched with two 37mm x 22mm holes. The data outlet shall be fitted in the left hole.

- Each data outlet must have a corresponding power outlet.

- Data and voice outlets shall not be placed directly under power sockets.

- Only termination tools as specified by the specific manufacturer shall be used.

- The outlets will be installed with blanks in either power skirting or floor boxes.

- All labelling shall be printed on permanent ink PVC labels. All printed labels shall be black on white with a fonts size of at least 6mm. Labelling on Data Outlets shall be done as follows: GABnn where:

    - G indicates the floor on which the cabinet is situated.

    - A indicates the cabinet number.

    - B indicates the patch panel number.

    - nn indicates the port on the patch panel.

- The cable will be labelled with the same number at the back of the Data Outlet not more than 50mm from the termination point/end by means of an approved method. Oval grip labels will be accepted.

Wire Channels:

- Where power skirting is utilized as the cable pathways, outlets shall be flush mounted and shall be installed in a pre-punched skirting cover plate. Where voice points need to be installed, provision shall be made for such voice point by installing a dual punch plate. The data point shall be installed on the left punch out. Unused punch outs shall be blanked-off.

- Channel skirting should be a minimum of 2 x 100mm channels.

- Only horizontal cabling channel will be accepted, having the effects that both the fly-lead and patch-lead are moulded factory manufactured leads and are tested.

11 WIRELESS LOCAL AREA NETWORK (WLAN)

Wireless Access Point

- Shall support these Wireless standards: IEEE 802.11a, 802.11b, 802.11g, 802.11d, 802.11h,

802.11n

- Shall support these Wired/Switching/Routing standards: IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX specification, and IEEE 802.1Q VLAN tagging
- Shall support these security standards:
  - Wi-Fi Protected Access (WPA)
  - IEEE 802.11i (WPA2, RSN)
  - RFC 1321 MD5 Message-Digest Algorithm
  - RFC 2104 HMAC: Keyed Hashing for Message Authentication
  - RFC 2246 TLS Protocol Version 1.0
  - RFC 3280 X.509 PKI Certificate and CRL Profile
- Shall support the following encryption: WEP, SSL, TSL, AES
- Shall support RADIUS authentication, extensions and tunnel accounting.
- Wireless Access Point Controller size shall be determined by allowing 2 free ports available after all required access points in the designated area have been added.
- All Access Point Controller ports shall have at least dual Power over Ethernet Plus (PoE+) Functionality providing a minimum of 25.5 W of power. The PoE+ ports shall be for electrical needs and added failover capability. One port can be a normal Ethernet port for uploading purposes.
- Shall have operating temperatures in the 0º to 40ºC bracket
- Operating humidity must be between 10% to 95% noncondensing
- Shall have a guaranteed 150 000 hours mean time between failures.
- Shall support 2.4 GHz (802.11b/g; 802.11n) and 5 GHz (802.11a; 802.11n)
- The following antenna standards may be installed:
  - 6/9 dbi dual band omni-directional
  - ¾ dbi dual band ceiling mount
  - 4/6 dbi dual band hallway
  - 8/10 dual band panel
- Shall support data minimum data rate of 54Mbps
- Interfaces shall include minimum one 10/100/1000 Gigabit Ethernet autosensing RJ-45
- Shall be powered by either 802.3af (PoE) Ethernet switch/wireless controller or Local Power Supply. PoE supplied shall be minimum 15.4W.

12 DISTRIBUTION CABINETS

Only 19” floor standing distribution cabinets may be used. Wall mounted cabinets are to be used in Sally ports as detailed in the drawings provided for each sally port.

Technical Specifications

Floor standing cabinets shall conform to the following:

- Dimensions 15U to 47U (H) x 600mm (W) x 800mm or 1000 (D).
- Have a rust resistant frame.
- Fitted with a set of four adjustable metal feet.
- Fitted with blank floor plates.
- Fitted with a 150mm light duty cable tray.
- Fitted with sufficient high performance ball bearing low noise fans fitted on the cabinet. At least one fan shall expel air from the cabinet and the other impels air into the cabinet, air flow should be from bottom to top.
- Shall be fitted with a 3 or 5 Way metal power duct with a circuit breaker.
- Each module has a front panel that is 19 inches (482.6 mm) wide, including edges or ears that protrude on each side which allow the module to be fastened to the rack frame with screws.
- Must be fitted with a set of either two or four punched posts. Four-posts shall be used for mounting equipment that requires support at the front and the rear.
- Fitted with a lockable tinted safety flexi glass door. All doors shall be removable without the use of tools. The frame and the door shall be lockable with the same key. Two keys shall be supplied for each cabinet.
- Fitted with a metal power duct with a circuit breaker. 5 way power duct for up to 25U cabinets and 10 way power duct for above 25U cabinets.
- The cabinet shall be powder coated.
- Shall have cable entries at the top of the wall box
- All open panels to be closed off with blanking panels.
- Install one patch panel and two brush panels per switch.

Wall mounted cabinets shall conform to the following:

- Dimensions 9U to 12U (H) x 600mm (W) x 400mm (D).
- Shall be of the swing frame type.
- Shall be reversible. (Swing in both directions)
- Shall have a weight carrying support between the cabinet housing and the frame to ensure that the cabinet lock does not carry any weight in the locked position.
- Fitted with sufficient high performance ball bearing low noise fans fitted on the cabinet. At least one fan shall expel air from the cabinet and the other impels air into the cabinet, air flow should be from bottom to top.
- Fitted with a lockable tinted safety flexi glass door. The frame and the door shall be lockable with the same key. Two keys shall be supplied for each cabinet.
- The cabinet shall be powder coated.
- Shall have cable entries at the bottom and top of the wall box

- All open panels to be closed off with blanking panels.

- Install one patch panel and two brush panels per switch.

- Shall be fitted with a 5 Way metal power duct with a circuit breaker.

- Each module has a front panel that is 19 inches (482.6 mm) wide, including edges or ears that protrude on each side which allow the module to be fastened to the rack frame with screws.

- Must be fitted with a set of either two or four punched posts. Four-posts shall be used for mounting equipment that requires support at the front and the rear.

Cabinet Installation Standards

The contractor shall preferably place distribution cabinets in rooms nearby an outside wall and near the centre of a building to minimize cable lengths and optimize performance. The placement of cabinets is a joint decision between ST ALBANS CORRECTIONAL FACILITY and the DCS.

Wall mount cabinets shall not be fitted to temporary structures such as dry walls.

Two keys shall be provided for each cabinet installed.

Floor Standing Cabinets

- The cabinet must be located in a position where at least three doors can open entirely except where cabinets are placed alongside each other. Where two or more cabinets are placed next to each other on a solid floor, **slack cabinets** shall be installed between the cabinets. Cabinets should be at least a cabinet side door width apart.

- The cabinet shall stand securely and level on all four feet.

- Dedicated power supply should be terminated within the cabinet.

- A 350mm front mount tray shall be installed in the main cabinet, housing the NTU.

Wall Mount Cabinets

- Cabinets shall be secured with 4x M8 Rawl bolts and not fixed to any temporary walls.

- Cabinets are to be installed as high as the ceiling allows with at least 100mm between the top of the cabinet and the ceiling for ventilation.

- The frame and the door shall be able to open at least 90 degrees.

- Dedicated power supply should be terminated within the cabinet.

Cabinets Labelling

- All cabinets shall be marked with a label with a unique number for that cabinet in the building it is situated in.

- All labels shall be permanent and printed black on white with a font size of at least 12mm.

- The label will be fitted in the middle on the top of the cabinet, not on the glass door.

The label on the cabinets will be: “Cabinet X/Y” where:

- X – Indicates the floor on which the cabinet is situated as designated by the building owner (E.g.: -2, -1, G, 1, 2,).

- Y – Indicates the cabinet number, which will be numbered A, B, C etc. for more than one cabinet per floor.

- The keys shall be supplied to the ST ALBANS CORRECTIONAL FACILITY and the DCS with tags and labels indicating the cabinet number. One key per cabinet (controlled by a register) must be kept on site.

13 SWITCH

Core Switch (24 Port Fibre Switch)

The core switch shall be capable of the following:

Max raw fabric capacity (Aggregated)	: 960 Gb/s
Switching capacity (Aggregated)	: 728 Gb/s
Throughput	: 541.7 Mpps
File system flash	: 16 GB
DRAM	: 4 GB
VLANs	: 4,000
MAC addresses	: 64 K
Max IPv4 routes	: 144 K
Max IPv6 routes	: 72 K
Jumbo frames	: 9216 bytes
VFL ports capacity	: 200 Gb/s or 400 Gb/s aggregate
Maximum number of units in a virtual chassis	: 8

Layer-3 routing and multicast

IPv4 routing
- Multiple VRF
- Static routing
- Routing Information Protocol (RIP) v1 and v2
- Open Shortest Path First (OSPF) v2 with Graceful Restart
- Intermediate System to Intermediate System (IS-IS) with Graceful Restart
- Border Gateway Protocol (BGP) v4 with Graceful Restart
- Generic Routing Encapsulation (GRE) and IP/IP tunnelling
- Virtual Router Redundancy Protocol (VRRPv2)
- DHCP relay (including generic UDP relay)
- Address Resolution Protocol (ARP)
- Policy-based routing and server load balancing
- DHCPv4 server

IPv6 routing

- Multiple VRF
- Internet Control Message Protocol version 6 (ICMPv6)
- Static routing
- Routing Information Protocol Next Generation (RIPng)
- Open Shortest Path First (OSPF) v3 with Graceful Restart
- Intermediate System to Intermediate System (IS-IS) with Graceful Restart
- Multi-Topology IS-IS
- BGP v4 multiprotocol extensions for IPv6 routing (MP-BGP)
- Graceful Restart extensions for OSPF and BGP
- Virtual Router Redundancy Protocol version 3 (VRRPv3)
- Neighbour Discovery Protocol (NDP)
- Policy-based routing and server load balancing
- DHCPv6 server
- DHCPv6 relay & UDPv6 relay

IPv4/IPv6 multicast

- Internet Group Management Protocol (IGMP) v1/v2/v3 snooping
- Protocol Independent Multicast–Sparse-Mode (PIM-SM), Source Specific Multicast (PIM-SSM)
- Protocol Independent Multicast–Dense-Mode (PIM-DM), Bidirectional Protocol Independent Multicast (PIM-BiDir)
- Distance Vector Multicast Routing Protocol (DVMRP)
- Multicast Listener Discovery (MLD) v1/v2 snooping
- PIM to DVMRP gateway support

Layer 2 Switch

- Shall be able to stack the switches, where all the switches in a stack act as a single switch unit with unified configuration, and single IP address management for the group of switches.

- 100% of all switch ports shall have Power over Ethernet Plus (PoE+) Functionality providing a minimum of 25.5 W of power.

- Auto-Negotiation on all ports to automatically select half- or full-duplex transmission mode to optimize bandwidth.

- Shall support the following layer 2 services:

    - IEEE 802.1Q static VLAN (1024)

    - IEEE 802.1p Class of Service (CoS)

    - IEEE 802.1D Spanning Tree Protocol

    - IEEE 802.1v Protocol VLAN & Port VLAN and MAC-based VLAN

    - Voice VLAN

    - Guest VLAN

    - IP subnet-based VLAN

    - IEEE 802.1 Q-in-Q

    - IEEE 802.1w Rapid Spanning Tree

    - IEEE 802.1s Multiple Spanning Tree

    - IEEE 802.3ad Link Aggregation (LACP)

    - IEEE 802.1x port access authentication

    - IEEE 802.3af (Power-over-Ethernet)

    - IEEE 802.3at (Power-over-Ethernet)

    - IEEE 802.3bt (Power-over-Ethernet)

    - IEEE 802.3az (Energy Efficient Ethernet)

    - IEEE 802.3ae (10 Gigabit Ethernet)

    - IGMP v1, v2, v3 snooping support

    - IGMP querier

    - Static multicast filtering

- Shall have Dynamic Host Configuration Protocol (DHCP) for easier switch deployment.
- Shall have Automatic Media-Dependent Interface Crossover (MDIX) to automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed.
- Shall have Address Resolution Protocol (ARP) to minimize broadcasts and maximize available bandwidth.
- Shall support Port-Based ACLs for Layer 2 interfaces to allow security policies to be applied on individual switch ports.
- Shall support a form of Quality of service (QoS) to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.
- Shall support MAC filtering
- Shall support Denial of Service (DoS)
- Shall support RADIUS (RFC 2865) and TACACS+.
- Shall support both IPv4 and IPv6.
- Switch size shall be determined by allowing 6 free ports available per switch.
- Shall have minimum forwarding bandwidth of 88 Gbps and 20 Gbps for stacked switches.
- Shall have a minimum switching bandwidth of 176 Gbps
- Shall have minimum 255 VLANS
- Shall have minimum 255 VLAN IDs
- Shall have operating temperatures in the -5º to 45ºC bracket
- Operating humidity must be between 10% to 95% noncondensing
- Shall have a guaranteed 150 000 hours mean time between failures.
- Shall have at least 2 10 Gigabit Ethernet or 2 1 Gigabit Ethernet SFP+ uplink ports.

Layer 3 Switch

- Shall have Dynamic Host Configuration Protocol (DHCP) for easier switch deployment.
- Shall have Automatic Media-Dependent Interface Crossover (MDIX) to automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed.
- Shall have Address Resolution Protocol (ARP) to minimize broadcasts and maximize available bandwidth.
- Shall support Port-Based ACLs for Layer 2 interfaces to allow security policies to be applied on individual switch ports.
- Shall support a form of Quality of service (QoS) to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.
- Shall support MAC filtering
- Shall support Denial of Service (DoS)

- Shall support RADIUS (RFC 2865) and TACACS+.
- Switch size shall be determined by allowing 6 ports available per switch.
- Shall have at least 2 10 Gigabit Ethernet or 2 1 Gigabit Ethernet SFP+ uplink ports
- Shall support both IPv4 and IPv6 static routing
- Up to 64 IPv4 and 4 IPv6 static routes
- Up to 64 IPv4 and 4 IPv6 static routes
- Shall have a minimum switching fabric of 144 Gbps.
- Shall have minimum 255 VLANS
- Shall have minimum 255 VLAN IDs
- Shall have operating temperatures in the -5º to 45ºC bracket
- Operating humidity must be between 10% to 95% noncondensing
- Shall have a guaranteed 150 000 hours mean time between failures.

Layer-2, Layer-3 routing and multicast

Layer-2 switching

- Up to 16k MAC addresses
- Up to 4000 VLANs
- Up to 1.5k total system policies
- Latency: < 4 µs
- Max frame: 9216 bytes (jumbo)
- IGMPv1/v2/v3 snooping to optimize multicast traffic
- Multicast Listener Discovery (MLD) v1/v2 snooping
- Up to 1000 multicast groups

Network protocols

- DHCP relay (including generic UDP relay)
- ARP
- Generic User Datagram Protocol (UDP) relay per VLAN
- DHCP Option 82 - configurable relay agent information

Indicators

System LEDs
- System (OK) (chassis HW/SW status)
- PWR (primary power supply status)
- VC (virtual chassis primary)

Per-port LEDs
- 10/100/1000: PoE, link/activity
- 100/1000/2.5GE: link/activity/PoE status
- SFP: Link/activity
- Virtual Chassis (VFL): Link/activity

IETF RFCs

IP Multicast

- RFC 2236/2933 IGMP v2 and MIB
- RFC 2365 Multicast
- RFC 3376 IGMPv3 for IPv6

Compliance and certifications

Commercial EMI/EMC

- 47 CRF FCC Part 15: 2015 Subpart B (Class A)
- VCCI (Class A limits. Note: Class A with UTP cables)
- ICES–003: 2012 Issue 5, Class A
- AS/NZS 3548 (Class A) - C-Tick
- AS/NZS 3548 (Class A limits. Note: Class A with UTP cables)
- CE-Mark: Marking for European countries (Class A limits. Note: Class A with UTP cables)
- CE emission consists of:
- ¬ EN 50581: Standard for technical documentation for Restriction on Hazardous Substances (RoHS) recast
- ¬ EN 55022 (EMI and EMC requirement)
- ¬ EN 55024: 2010 (ITE immunity characteristics)
- ¬ EN 61000-3-2 (Limits for harmonic current emissions)
- ¬ EN 61000-3-3
- ¬ EN 61000-4-2
- ¬ EN 61000-4-3
- ¬ EN 61000-4-4
- ¬ EN 61000-4-5
- ¬ EN 61000-4-6
- ¬ EN 61000-4-8
- ¬ EN 61000-4-11
- ¬ IEEE802.3: Hi-Pot Test (2250 V DC on all Ethernet ports)

14 ROUTER

- Auto-Negotiation on all ports to automatically select half- or full-duplex transmission mode to optimize bandwidth.

- Shall have Automatic Media-Dependent Interface Crossover (MDIX) to automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed.

- If the router is a modular platform, the necessary module slots shall be added for the network requirements.

- Shall be powered by a high-performance multi-core processor.

- Shall be embedded with WAN link security and VPN services (both IPSec and SSL necessary)

- All onboard WAN ports shall be 10/100/1000 Gigabit Ethernet WAN routed ports.

- For every Two 10/100/1000 Gigabit Ethernet WAN ports there shall be SFP-based connectivity in lieu of a RJ-45 port and enabling fibre connectivity.

- Shall support integrated LAN switching

- Shall support the following protocols:

  - IPv4

  - IPv6

  - static routes

  - Open Shortest Path First (OSPF)

- Border Gateway Protocol (BGP)
- BGP Router Reflector
- Intermediate System-to-Intermediate System (IS-IS)
- Multicast Internet Group Management Protocol (IGMPv3)
- Protocol Independent Multicast sparse mode (PIM SM)
- PIM Source Specific Multicast (SSM)
- Distance Vector Multicast Routing Protocol (DVMRP)
- IPSec
- Bi-Directional Forwarding Detection (BVD)
- IPv4-to-IPv6 Multicast
- Multiprotocol Label Switching (MPLS)
- L2TPv3
- 802.1ag
- 802.3ah
- L2 and L3 VPN
- LACP

- Shall Support the following encapsulations:
  - Ethernet
  - 802.1q VLAN
  - Point-to-Point Protocol (PPP)
  - Multilink Point-to-Point Protocol (MLPPP)
  - Frame Relay
  - Multilink Frame Relay (MLFR) (FR.15 and FR.16)
  - High-Level Data Link Control (HDLC)
  - Serial (RS-232, RS-449, X.21, V.35, and EIA-530)
  - Point-to-Point Protocol over Ethernet (PPPoE)
  - ATM
- Shall support a form of Quality of service (QoS) to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.
- Total number of WAN ports shall allow for 1 free WAN port.
- Minimum DDR4 memory shall be 1024 MB.

- Shall have operating temperatures in the 0º to 40ºC bracket

- Operating humidity must be between 10% to 85% noncondensing
- Shall have a guaranteed 150 000 hours mean time between failures.-

PART 2 – INSTALLATION DETAILS

1 WIRED LOCAL AREA NETWORK (LAN)

Data Outlets:

The installation of data outlets must conform to clause 10 of Part 1 of this specification.

Data outlets shall be placed as indicated by the Electrical Engineer on drawing numbers, **E21/2107/SA/200, E21/2107/SA/201, E21/2107/SA/202, E21/2107/SA/203, E21/2107/SA/204, E21/2107/SA/205, E21/2107/SA/206, E21/2107/SA/207, E21/2107/SA/208, E21/2107/SA/209, E21/2107/SA/300.**

UTP:

The installation of UTP cable and cableways must conform to clause 10 of Part 1 of this specification.

Cabling shall be laid in conduits, power skirting and cable trays as provided by the Electrical Contractor. Each Data Outlet shall be connected directly to the relevant floor distribution room with UTP cable as specified.

2 WIRELESS LOCAL AREA NETWORK (WLAN)

The installation of access points must conform to clause 11 of Part 1 of this specification.

ST Albans Server Room:

- Access Point(s) shall be installed in the above mentioned area to provide sufficient WLAN connectivity to the National Command Centre, per the discretion of the DCS IT team.

- The Access Point(s) shall be placed on site, as determined by the DCS and Engineer.

3 DISTRIBUTION CABINETS

The installation of distribution cabinets must conform to clause 12 of Part 1 of this specification.

Existing Distribution cabinets on each floor shall be used.

4 SWITCH

New Switches implemented shall offer full integration with existing systems or programs.

The installation of switches must conform to clause 13 of Part 1 of this specification.

The installation of patch panels must conform to clause 10 of Part 1 of this specification.

SALLY PORTS 6:

- New Layer 4/7, 24 port fibre switch(s) shall be installed in the rack in the ground floor distribution room to supply sufficient network points for sally port to facilitate adequate connectivity to peripheral devices.

- Switch size shall be determined by allowing at least 6 ports available per switch. E.g. If 23 ports are required, a 24 port switch shall not be installed; instead a 48 port switch shall be installed.

- Per Switch layout shall be as follows:

    - Brush Panel

- Patch Panel
- Brush Panel
- Layer 4 Switch (Core Switch)

- All Switches shall be labelled as specified.

SALLY PORTS 2, 5, and 7:

- New Layer 2/3 Switch(s) shall be installed in the rack in the ground floor distribution room to supply sufficient network points for Sally ports 2, 5, and 7.

- Switch size shall be determined by allowing at least 6 ports available per switch. E.g. If 23 ports are required, a 24 port switch shall not be installed; instead a 48 port switch shall be installed.

- Per Switch layout shall be as follows:

  - Brush Panel
  - Patch Panel
  - Brush Panel
  - Layer 2 Switch

- All Switches shall be labelled as specified.

5 NOTICES

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

6 DRAWINGS

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

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

7 EXTENT OF WORK

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

Delimitation of the project – Sally Ports 1 – 10.

8 RETURNABLE MATERIALS SCHEDULE

NB: **Only one manufacturer's name to be inserted for each item.**

Item	Material	Make or trade name	Country of origin
1.	19U Cabinets		
2.	24 Port Switch		
3.	24 Port Fibre Switch (Core)		
4.			
5			
6			
7			
8			
9			
10			
11			

END OF ICT SPECIFICATION

SA GENERAL MAINTENANCE

CONTENTS

SA 01 SCOPE

Maintenance of the specified systems, services and/or parts of buildings and infrastructure shall all be referred to as "Maintenance of a Sub-Installation". Maintenance of all completed Sub-Installations shall ensure reliable functioning and optimum service life thereof. Monthly maintenance responsibilities for each Sub-installation, including all units and components as specified shall commence within Sections or portions of the Sub-installation which have achieved practical completion.

The maintenance shall be undertaken during the following stages:

- After Sectional Completion and before Certificate of Completion for a Sub-Installation or Section
- 12-Month Defects Liability Period with Maintenance
- 36-Month Fixed-term Maintenance Period

Maintenance of a Sub-Installation shall be performed in accordance with the Technical and Particular Specifications, the Operating and Maintenance Manuals (where applicable) and the Maintenance Control Plan.

Remuneration for maintaining "Sub-installations" (systems, services and/or buildings and parts of the infrastructure) in good functional condition is provided for in the Schedules of Quantities by means of monthly payment items.

This Additional Specification covers maintenance requirements, development of a maintenance control plan, identification of equipment, site maintenance administration, maintenance performance measurement, as well as the items for measurement of the Contractor’s service level and resulting payment.

SA 01.01 Maintenance during Defects Liability Period prior to Completion of theSub-Installation

Where Sectional Completion has been granted, the Section completed shall be under Defects Liability Period prior to issuance of the Certificate of Completion commencing from the date of Sectional Completion to the date of Completion for the Installation.

The Contractor shall guarantee all works undertaken for the period between Sectional Completion and Certificate of Completion for the Sub-Installation or Section. The maintenance shall be conducted in strict compliance with the manufacturer’s or Original Equipment Manufacturer (OEM) maintenance plan.

If during this period the Installation, or any part thereof, is not in working order, or not working satisfactorily owing to faulty material, design or workmanship, the Contractor will be notified and immediate steps shall be taken by the Contractor to rectify the defects and/or replace the affected parts on site at his own expense.

The Contractor shall maintain the works or Installation(s) in good working condition for the full period.

The Contractor is obliged to rectify all defects occurring within this period prior to transitioning into the 12-Month Defects Liability and Maintenance Period.

Should breakdowns be frequent, or should the Installation otherwise prove unsatisfactory during the said period, the Contractor shall, if called upon by the Engineer or the Employer's Representative, at his own expense replace the whole installation or such parts as the Engineer or the Employer may deem necessary.

SA 01.02 12-Month Defects Liability Period with Maintenance

The Contractor shall guarantee all works undertaken for a period of twelve months after the Certificate of Completion has been issued for the Installation. The maintenance is to be conducted in strict compliance with the manufacturer's or OEM maintenance plan.

If during this period the Installation, or any part thereof, is not in working order, or not working satisfactorily owing to faulty material, design or workmanship, the Contractor will be notified and immediate steps shall be taken by the Contractor to rectify the defects and/or replace the affected parts on site at his own expense.

The Contractor shall maintain the works or Installation(s) in good working condition for the full twelve-month period.

The Contractor is obliged to fix all defects occurring within the 12-Month Defects Liability Period with Maintenance prior to transitioning into the 36-Month Fixed-term Maintenance Period.

Should the Contractor fail to transition with the installations in good working order on the expiry of the specified twelve months, the Engineer shall note all such defects in the snagging report.

All snags shall be fixed or rectified under the terms of the 12-Month Defects Liability Period with Maintenance and should be concluded within the first month of the 36-month Fixed-term Maintenance Period.

Should breakdowns be frequent, or should the Installation otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Engineer or the Employer's Representative, at his own expense replace the whole installation or such parts as the Engineer or the Employer may deem necessary.

SA 01.03 36-Month Fixed-Term Maintenance Period

The maintenance is to be conducted in strict compliance with the manufacturer's or OEM maintenance plan.

If during this period the installation, or any part thereof, is not in working order, or not working satisfactorily the Contractor will be notified and immediate steps shall be taken by the Contractor to bring the installation to its original functional state as at Final Approval of the repair and upgrade phase.

If replacement of parts or components of the installation be involved, tendered rates shall be used in all cases.

The contractor is obliged to hand over the entire installation in good working order at the end of the 36-month Fixed-term Maintenance Period. Should the Contractor fail to hand over the works in good working order on the expiry of the specified 36 months, the Contractor shall be responsible for further monthly maintenance, at their own expense, until final delivery is taken.

SA 02 MAINTENANCE REQUIREMENTS

SA 02.01 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall maintain the complete Sub-Installation(s) for the full duration between issuance of Certificate of Sectional Completion or Certificate of Completion up to the issuance of Certificate of Final Completion, at the end of the 36-Month Fixed-Term Maintenance Period.

Maintenance implies and shall include monthly preventative maintenance, corrective maintenance, as well as breakdown maintenance on all components of the specified Sub-Installations.

The maintenance control plan (specified in Clause SA 04) will be developed by the Contractor, to schedule the frequency of routine inspections and format of reports. The Contractor shall carry out inspections on the equipment as detailed in the Technical and Particular Specifications and the maintenance control plan. Each inspection, test or breakdown shall be recorded in an approved format and listed in a quarterly report (part of the maintenance control plan).

As part of the repair, upgrade and/or new installation work of each sub-installation, the Contractor shall submit a set of Operating and Maintenance Manuals where applicable. The Contractor shall ensure thorough training to ensure that the operating and maintenance personnel are conversant with the instructions as presented in the Operating and Maintenance Manuals. Continued training shall be included in the scope of maintenance work for the duration of the Contract, in accordance with Additional Specification SD: General Training.

The Operating and Maintenance Manuals, as approved by the Engineer, shall be used as a basis of preventative maintenance. The Contractor shall perform all preventative and corrective maintenance as described in the Operating and Maintenance Manuals. This shall be in accordance with the Original Equipment Manufacturer (OEM), Technical and Particular Specifications.

The Contractor shall, as part of his maintenance responsibilities repair or replace faulty equipment upon logging of a breakdown, within the down-time as defined in Clause SA 05.02 at the Contractor's cost, except in the event of replacement being labelled as exceeding liability as specified in Clause SA 02.03, in which case the Department will bear part of the costs.

The Contractor shall not claim additional establishment costs where repair, upgrade and/or new installation work is to be carried out during the maintenance phase.

The Contractor shall rectify any faulty condition of which he becomes aware of, even if it has not been logged. Such rectification shall also be logged and listed in the quarterly report.

SA 02.02 **CONDITIONS FOR EXCEEDING THE CONTRACTOR'S LIABILITY DUE TO OPERATIONAL DAMAGE BREAKDOWNS**

Operational damage shall be defined for the purpose of this clause as being any damage caused on purpose, by accident or through negligence by the User Client's employees, inmates (where applicable), suppliers, subcontractors, etc for any reason whatsoever. Where repair work is necessitated during the contract as a result of operational damage caused by User Clients or their associates, the Contractor will be requested to:

(a) perform work, using rates bid for the supply, delivery and installation of material forming part of the repair work schedule, within the maximum down-time allowed for operational damage, where the Engineer rules that the damage has been caused by incorrect operation;

(b) submit one (1) quotation for repair and/or replacement of the damaged unit, where tender rates are not available and where the Engineer rules that the damage caused is operational;

(c) perform the work on receipt of an order from the Engineer, within the time offered as part of the quotation,

(d) notify the Engineer well in advance of completion of the repair work in order to enable inspection, and

(e) refrain from claiming additional establishment costs for such work.

The responsibility of determining whether damage to the installation was caused by people other than employees or associates of the Contractor shall rest with the Engineer.

Operational damage caused by the employees, suppliers, subcontractors, etc of the Contractor, shall be repaired by the Contractor at his own cost.

SA 02.03 **CONDITIONS FOR EXCEEDING THE CONTRACTOR'S LIABILITY ABOVE MARGINAL BREAKDOWN COST**

In the event where the cost for the repair or replacement of any single component/subassembly where a breakdown has occurred due to a single failure, or where the cost for replacing a single item of equipment completely, exceeds the value of R30 000,00 (transport, accommodation and travelling cost excluded), the liability of the Contractor is limited to the value of R30 000,00. The additional cost above the value of R30 000,00 will be paid for by the Employer provided that conditions 1, 2 and 3 below have been met.

1. The defective part/component/subassembly or machine must be identifiable as a single subassembly or component and not the total of a number of small defects or breakdowns on subassemblies/components on any one or more machines.

Examples of subassemblies/components are the following:

(a) Should the wiring or bearings on an electric motor fail, the complete motor must be removed for repairs and the cost for the repairs on the complete motor will be regarded as repairs on a single subassembly/component.

(b) A starter motor, for example, is a subassembly, which can be removed from the machine for repairs. The repairs on the starter motor together with the repairs on the main bearings will not be regarded as a repair on a single subassembly/component. If the complete diesel engine is replaced with its associated subassemblies the replacement of the complete unit will be regarded as a single component.

(c) A pump as a whole is regarded as a single component. The pump and driving machine on long coupled pumps are regarded as separate subassemblies. Pumps and motors on close-coupled equipment are regarded as a single component. The pump and motor of a sump pump are therefore regarded as a single component.

(d) Control equipment for the control of a single item, with the sensing device, the controller itself and the final controlled variable are regarded as a single component of the system. The repairs on any one item on a controller have an influence on the rest of the control equipment and must after the replacement be commissioned again as a unit.

2. The Contractor shall submit a written report to the Engineer for approval. This report shall contain the following information:

(a) The make and model number of the machine serviced/inspected/ repaired/replaced;

(b) The identification number of the machine;

(c) A description or name and part number of the defective part/component or subassembly;

(d) A statement on whether the component could be repaired, together with a cost estimate;

(e) A quotation valid for a minimum period of 60 days if the component/part/subassembly has to be replaced or repaired by an outside firm. If the subassembly/machine is to be repaired or replaced by an outside company, the Contractor shall supply one (1) quotation for such parts/repairs or a quotation from any sole supplier. Only an original quotation will be accepted. The mark-up on such work shall be a percentage as bid and shall be applicable to the total cost (VAT excluded) of repair work by outside companies;

(f) The expected urgency for the replacement or repairs, and

(g) The delivery time of a new component/subassembly/machine or delivery times on spares required to repair the defective component/ subassembly.

3. A written approval to proceed with the work must be issued by the Department. Copies of the original VAT invoices from outside companies for all repairs or spare parts supplied must be attached to the Contractor's invoice.

SA 02.04 **COMPONENTS INCLUDED IN MAINTENANCE SCOPE**

Maintenance, as specified, will be applicable to all of these Sub-Installations:

- CCTV Surveillance System
- Access Control System
- Cell phone Detection, Intercom and Public Address Systems
- Security Electrical Services
- Sally Port
- Dividing Fence System
- Outer and Inner Security Fencing Systems
- Smoke Detection

SA 02.05 **COMMENCEMENT OF MAINTENANCE PERIOD**

- **Maintenance during Defects Liability Period prior to Completion of the Installation**

  The period shall commence on the date indicated on the Sectional Completion Certificate up to the date of Certificate of Completion of the Installation.

- **12-Month Defects Liability Period with Maintenance**

  Duration shall commence from the Completion Date of an Installation

- **36-Month Fixed Term Maintenance Work**

  Duration shall commence from the end of the 12-month Defects Liability Period for an Installation.

The Contractor shall accept full maintenance responsibilities for each completed Sub-Installation upon issue of a Certificate of Sectional Completion for the work of that installation.

NOTE:

The onus is incumbent upon the Contractor to ensure that all equipment and components of the system installed are covered by the relevant warranties and guarantees up to twelve months after the issue of a Certificate of Completion for entire repair work. The Contractor should obtain and include the necessary warranty extensions in the tender pricing.

SA 02.06 **DEFINITIONS**

(a) **Routine preventative maintenance**

This entails the rendering of services and servicing of equipment according to a predetermined maintenance control plan to:

(i) replace and service components of equipment, units or parts thereof for each installation at prescheduled moments regardless of condition;

(ii) readjust, reset, clean, corrosion protect all components of equipment, units or parts thereof for each installation, and

(iii) carry out all implied actions to maintain installations in their present functional condition.

Preventative maintenance shall be aimed at minimization of breakdowns.

(b) **Corrective maintenance**

This entails regular observation of the equipment, identifying pending breakdowns, maladjustment or anomalies of equipment, units or parts of installations and subsequent action to restore installations to the functional condition as before the breakdown.

(c) **Breakdown maintenance**

This entails repair and/or replacement of defective equipment, units or parts of installations following a breakdown that leaves the installation inoperable or unsafe, and subsequent action to restore installations to their normal functional condition, within the maximum down-time allowed.

(d) **Immediate response repairs**

These repairs are defined as repair work required where no breakdowns are allowed at any time in terms of the Technical Specifications.

(e) **Emergency maintenance repairs**

These repairs are defined as any work required to rectify an emergency breakdown that disables a complete installation and prevents it from functioning to its designed service level.

(f) **Ordinary maintenance repairs**

These repairs are defined as all maintenance work required other than emergency maintenance repairs.

(g) **Fatal breakdown**

Fatal breakdown is defined as an occurrence when an installation / sub-installation or a specified part thereof fails to operate for any period of time other than during the execution of routine preventative and corrective maintenance activities.

SA 02.07 SITE MAINTENANCE RECORD KEEPING

The Contractor shall provide and maintain hard-cover A4 maintenance files for each installation for the duration of the Contract. All schedules, checklists, breakdown reports, preventative maintenance records, component replacement records and quarterly reports shall be filed, together with information regarding repairs exceeding the Contractor's liability, as set out in SA 02.02 and SA 02.03.

Site maintenance records shall be submitted at each monthly meeting.

SA 02.08 SUPPLY OF LABOUR, EQUIPMENT AND MATERIAL

(a) Labour

Competent personnel that have been trained by the Contractor, in accordance with Additional Specification SD: General Training shall execute all maintenance work.

(b) Equipment

All tools and equipment and consumables required for maintenance work shall be supplied by the Contractor at his cost (except where otherwise provided).

(c) Material

All material, spare parts, components, equipment and appurtenances necessary for the complete maintenance of each installation shall be supplied and installed by the Contractor at his cost, to a maximum value per part/subassembly as specified in Subclause SA 02.03 for exceeding Contractor's Liability.

Materials as provided for in the Bill of Quantities, shall be supplied and delivered by the Contractor at the rates bid upon order of the Engineer only, and shall be free-issued to the User Client for own use. The Contractor shall inform the Engineer of all scheduled deliveries to arrange official hand-over with the User Client.

The Contractor shall cede any supplier's or factory guarantee of repaired or replaced components to the Employer to ensure that such guarantees are not jeopardised in any way. All workmanship, materials and components used for breakdown repair shall be guaranteed for twelve (12) months.

SA 02.09 IDENTIFICATION OF EQUIPMENT

A unique identification number will be allocated only to each mechanical equipment item forming part of the installation. This identification number will be allocated and administered in collaboration with the User Client and must be described in the maintenance control plan.

Reference shall be made to identification numbers in the maintenance control plan, operating and maintenance manuals and during all maintenance activities, including the logging of breakdowns and other correspondence. Identification numbers shall also be indicated on as-built drawings.

SA 03 MAINTENANCE CONTROL

SA 03.01 SCOPE

Maintenance quality control shall be the responsibility of the Contractor who shall introduce a maintenance control plan to assist him in ensuring that preventative, corrective and breakdown maintenance are performed as described in the operating and maintenance manuals and Technical and Particular Specifications.

SA 03.02 PRELIMINARY MAINTENANCE CONTROL PLAN

A preliminary version of the maintenance control plan shall be submitted with the programme and the framework of the preliminary version shall be as close as possible to that of the final maintenance control plan as specified in SA 03.03 below. Detail contained in this preliminary maintenance control plan shall include:

(a) Actual time that a representative of the Contractor will be present on Site for the duration of the maintenance period;

(b) the scope and frequency of routine inspections

(c) repair methodology

(d) details of training plan to be implemented in accordance with Additional Specification SD

SA 03.03 MAINTENANCE CONTROL PLAN

(a) The maintenance control plan shall be based on the Contractor's preliminary maintenance control plan, and shall be bound in a neat, A4-sized, ring-bound document with a cover page and back cover. The contents of the document shall be indexed.

In drawing up the document, the Contractor may reproduce relevant paragraphs and clauses from any of the specifications forming part of the Contract documents, but should there be any discrepancies between such clauses and paragraphs in the maintenance control plan and those in the Contract documents, those in the Contract documents shall be regarded as being correct and shall apply.

(b) To ensure that the Engineer is satisfied that the Contractor understands the purpose and advantage of carrying out maintenance work according to a maintenance control plan he shall, as an introduction to the control plan document, set out his views as to what he believes the implementation of a maintenance control plan will achieve.

(c) The maintenance control plan shall also contain the following:

(i) A summary of the repair and maintenance work to be carried out under the Contract giving details of the conditions of the various installations at the facility(ies) affected by the activities under the Contract. The Contractor shall bear in mind that maintenance work may have to be carried out before the repair phase of the installation has been entirely completed and the summary mentioned above shall therefore differentiate between maintenance work before and after the repair phase has been completed.

(ii) Details of how the Contractor intends to carry out the various types of maintenance work especially breakdown maintenance should breakdowns occur.

(iii) Details of how the call centre works, as specified in clause SA 05 as well as all statistics of breakdowns, leakages, blockages, etc. available from the call centre for the installation and the age of the installation that has been taken into account in compiling the contents of the maintenance control plan.

(iv) A list of organisations and persons directly involved with the Contract or whose requirements have to be taken into account during the entire Contract Period such as the IDT, Department of Public Works, the User Client, the Consulting Engineer, the Contractor, the Local Authority, etc. Each person's position within his organisation as well as the applicable phone numbers shall be given.

(v) Details of monthly meetings to be held with the Independent Development Trust (IDT), the User Client, Contractor and Engineer;

(vi) Reports to be submitted after every routine inspection (all reports, checklists, breakdown records, score card results, etc. for each system of an installation shall be kept on the site in a hard cover file);

(vii) Procedures to address complaints and logged breakdowns;

(viii) Details of quarterly reports, summarising all inspections, together with inspection data such as nature of test, names of persons carrying out tests and inspection results. Detail of repairs and replacements, together with testing of repaired equipment shall also be reflected in this report, and

(ix) Assistance to be given by the Engineer with decisions regarding material, equipment and other recommendations.

d) The codes of practice as set out in ISO 10006 and ISO 9004 for quality systems and management shall be used as a guideline for compiling a maintenance control plan. ISO accreditation is not a requirement in terms of this Contract.

(e) The maintenance control plan shall be upgraded when its contents are no longer representative of actual conditions.

(f) The Contractor shall check the contents of existing Operating and Maintenance Manuals (if available) and shall update or modify them and then incorporate applicable data into his own manuals. Where no manuals exist, the Contractor shall draw up his own Operating and Maintenance Manuals.

Pertinent data contained in the Operating and Maintenance Manual may be transferred to the Maintenance control plan to make it a document which can be used as an independent handbook for maintenance work.

The Contractor is referred to the contents of paragraph (a) above regarding the reproduction of data, as this shall also be applicable to data reproduced from Operating and Maintenance Manuals.

SA 04 COMMUNICATION

The maintenance control plan (Clause SA 03) will provide, after agreement between the Contractor and the Engineer, for the following communication and complaint logging procedure:

(a) The Contractor shall establish a fixed telephone line, data services and a cellular telephone connection to ensure that he can be reached at any time.

(b) The Contractor shall primarily be responsible for determining the items requiring preventative, corrective and breakdown maintenance, and shall communicate this information directly to his maintenance workforce.

(c) Should the Engineer or operating personnel of the User Client determine or suspect that preventative, corrective or breakdown maintenance is required, a call shall be logged through the call centre to reach the Contractor as soon as possible.

(d) Reaction times will be as described in Clause SA 05.02.

(e) All complaints of the User Client shall be reported to the Engineer via the call centre, as set out in the maintenance control plan, and the Engineer shall issue instructions to the Contractor. The breakdown registration form will be completed and faxed to the Contractor. After the Contractor has attended to the complaint, the Engineer will provide feedback to the call centre both telephonically and via email. The breakdown close-out form shall be completed by the Contractor and faxed to the Engineer as soon as the breakdown is repair by the Contractor.

The call centre logs the details of the Engineer's call and provides feedback to the complainant.

Reference shall also be made to Clause PS 7.12 of Portion 1 of the Project Specifications as well as to Additional Specifications SG regarding the Call Centre.

SA 05 PERFORMANCE MEASUREMENT

The Contractor's performance shall be measured against the following parameters:

SA 05.01 SPECIAL TESTING OF AN INSTALLATION

The Engineer may at any time inspect any part of the entire installation. During Maintenance work, the Engineer shall at his discretion order special tests to be carried out on complete installations at intervals of not less than four months, to verify the satisfactory functional condition of the installation.

The Engineer reserves the right to select at random component equipment and trade practices to be tested by independent authorities for compliance with specifications as specified in this Contract document.

The Contractor shall provide all equipment, tools and instruments required for testing.

SA 05.02 MAXIMUM MAINTENANCE DOWN-TIME

After a complaint has been logged and forwarded to the Contractor, the Contractor shall be expected to minimise the maintenance down-time until the system component is fully operational to the satisfaction of the Engineer. Should the

Contractor not respond within the maximum down-time, the Engineer may arrange, at the cost of the Contractor, for the necessary repair work to be done by others.

The Contractor shall respond to a breakdown registration by travelling to Site to evaluate the breakdown (scope of repair work), estimate the realistic downtime and provide feedback to the Engineer.

Should the Contractor not be able to complete the required repair work within the maximum down-time period allowed, it shall be his responsibility to obtain extension of down-time from the Engineer. The written report shall clearly state the reasons for the extension, as well as the actual extension required.

Extension of down-time will only be granted by the Engineer if:

(a) the maximum down-time is unreasonable in relation to the scope of the repair work required;

(b) the delivery time of a new component/subassembly/machine or spares required for the repair of the defective component/subassembly does not enable the Contractor to successfully complete the repair work within the maximum breakdown down-time allowed.

Should the actual down-time exceed the maximum down-time the Contractor shall be liable to a payment reduction for the difference between actual down-time and maximum down-time. This is reflected in the table below:

REQUIRED MAINTENANCE	MAXIMUM DOWNTIME ALLOWED	PAYMENT REDUCTION IF EXCEEDED
Fatal breakdown	Zero (immediate response)	R3 300/hour
Emergency Breakdown - General Emergency Breakdown - MCDC	48 hours 12 hours	R2 500/day R5 000/day
Ordinary Breakdown	3 days	R1 000/day
Operational damage repair	3 days	R1 000/day

"Maximum down-time" shall mean the period of time allowed to repair a breakdown, and "actual down-time" shall mean the measured period from the instant when the breakdown was logged with the Contractor until the installation has been repaired to its functional specification.

SA 05.03 PERFORMANCE-BASED PAYMENT

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly maintenance payments for the various installations.

Remuneration for maintaining "installations" (systems, services and/or buildings and parts of the infrastructure) in good functional condition is provided for in the Bills of Quantities by means of monthly payment items.

A difference shall be made in the monthly variable Contractor remuneration during the 12-Month Defects Liability and Maintenance Period and the 36-Months Fixed-term Maintenance.

This Additional Specification covers maintenance requirements, development of a maintenance control plan, identification of equipment, site maintenance administration, maintenance performance measurement, as well as the items for measurement of the Contractor’s service level and resulting payment.

SA 05.03.01 **Score-card**

The Engineer will inspect each installation monthly after Sectional Completion and/or Completion of the Installation. The Engineer will use a score-card to measure the quality of preventative and corrective maintenance rendered by the Contractor during the preceding month, on all components that form part of the installation, in accordance with the maintenance specifications. The Engineer will record his inspection directly onto the score-card. The score-card shall serve to evaluate ten performance indicators each month in the manner set out below.

The Contractor shall always have the opportunity to score the maximum points, provided that his preventative and corrective maintenance work comply with the Specifications. The Employer will therefore be protected against a reduced or unsatisfactory service level and may refuse payment on such points.

SA 05.03.02 **Performance indicators**

Performance indicators shall be selected to measure the Contractor's service level of preventative and corrective maintenance.

The Contractor and the Engineer shall each have the opportunity to select five (5) performance indicators each month, which shall focus on the measurement of maintenance quality against the relevant specifications for the ensuing month. All ten (10) performance indicators are known to both the Engineer and the Contractor.

The Contractor shall aim to perform satisfactorily on all ten performance indicators. All indicators shall be selected from the scope of his normal preventative and corrective maintenance work and shall be based on the maintenance control plan and operating and maintenance manuals. The work shall either be satisfactory, or unsatisfactory, and the Contractor shall score one (1) or zero (0) respectively per indicator.

Performance indicators shall be used to focus on certain key aspects of the work and shall in no way limit the Contractor's responsibility to do all the required work.

SA 05.03.03 **Satisfactory performance**

The Engineer shall inspect the site on an arbitrary day to measure the quality of maintenance against the ten selected performance indicators. Should the Contractor score the maximum points (10) he shall receive his full maintenance payment for the installation. Should the quality of preventative maintenance, or components requiring persistent corrective maintenance be unsatisfactory according to the score-card, the Contractor may fail to achieve full payment due to a reduced service level. Each monthly payment for maintenance shall be subject to evaluation based on the score-card.

A copy of the score-card including a guideline for the use thereof is included in this Specification.

SA 06 MEASUREMENT AND PAYMENT

SA 06.01 MAINTENANCE OF COMPLETED SECTION OF A SUB-INSTALLATION OR EQUIPMENT PRIOR TO CERTIFICATE OF COMPLETION……Unit: point

The unit of measurement shall be a point. Each month shall represent a maximum of ten points and a minimum of zero points, depending on the performance and quality of maintenance. Ten points per month, determined by using the rate bid per point, shall include full compensation for all liabilities and obligations described or implied in the Contract document and deemed by the Contractor to be applicable to the maintenance phase of the Contract, for the complete monthly maintenance of a Section of the Sub-Installation or equipment after Sectional Completion of Repair and Upgrade Work, and all appurtenant works deemed to form part thereof, as defined in the relevant Technical or Particular Specifications.

The combined rate bid for ten points (which shall not be less than 10% of the total Bid Sum) shall also include full compensation for complete preventative, corrective and breakdown maintenance (as defined in this General Maintenance Specification), including full compensation for all costs related to resetting, repair, procurement, supply, delivery, replacement, protecting, furnishing, installing, testing and commissioning of all items and material required to maintain the complete installation in a perfect functional condition. The only items not to be included in the rate for monthly maintenance points are:

1. Supply, delivery, installation and testing of special equipment/materials that will be measured elsewhere, and

2. Special testing of a Sub-Installation.

Although ten points per month shall include full compensation for preventative, corrective and breakdown maintenance, the Contractor might fail to achieve all points applicable in the event of unsatisfactory performance, in which case he shall still perform all maintenance requirements according to specification, but at his own cost where a reduction in points awarded is insufficient to cover his cost.

The total number of points for maintenance of a completed Section or Equipment under usage shall be 60 points.

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly maintenance payments for the various Sub-Installations.

SA 06.02 MAINTENANCE OF A SUB-INSTALLATION DURING THE DURING 12-MONTH DEFECTS LIABILITY PERIOD WITH MAINTENANCE..... Unit: point

The unit of measurement shall be a point. Each month shall represent a maximum of ten points and a minimum of zero points, depending on the quality of maintenance. Ten points per month determined by using the rate bid per point, shall include full compensation for the monthly maintenance of an incomplete installation until practical completion of the repair work thereof.

The combined rate bid for ten points (which shall not be less than 10% of the total Bid Sum) shall include full compensation for preventative, corrective and breakdown maintenance (as defined in this General Maintenance Specification) of all units, equipment and/or components thereof that require no initial repair work in terms of the complete installation. As repair work progresses, maintenance responsibilities shall be extended to include those units, equipment or parts thereof that have been serviced, repaired or reconditioned.

The total number of points for maintenance of a completed installation during the 12-Month Defects Liability period with Maintenance shall be 120 points.

Although ten points per month shall include full compensation for preventative corrective and breakdown maintenance, the Contractor might in the event of unsatisfactory performance fail to achieve all points applicable, in which case he shall still perform all maintenance requirements according to specification, but at his own cost where a reduction in points awarded is insufficient to cover his cost.

SA 06.03 **MAINTENANCE OF A COMPLETED SUB-INSTALLATION DURING THE36-MONTH FIXED-TERM MAINTENANCE PERIOD** ..... Unit: point

The unit of measurement shall be a point. Each month shall represent a maximum of ten points and a minimum of zero points, depending on the performance and quality of maintenance. Ten points per month, determined by using the rate bid per point, shall include full compensation for all liabilities and obligations described or implied in the Contract document and deemed by the Contractor to be applicable to the maintenance phase of the Contract, for the complete monthly maintenance of an entire Sub-Installation after Certificate of Completion of the Repair and Upgrade Work, and all appurtenant works deemed to form part thereof, as defined in the relevant Technical or Particular Specifications.

The combined rate bid for ten points (which shall not be less than 10% of the total Bid Sum) shall also include full compensation for complete preventative, corrective and breakdown maintenance (as defined in this General Maintenance Specification), including full compensation for all costs related to resetting, repair, procurement, supply, delivery, replacement, protecting, furnishing, installing, testing and commissioning of all items and material required to maintain the complete Sub-Installation in a perfect functional condition. The only items not to be included in the rate for monthly maintenance points are:

3. Supply, delivery, installation and testing of special equipment/materials that will be measured elsewhere, and

4. Special testing of a Sub-Installation.

The total number of points for maintenance of a completed installation shall be 360.

Although ten points per month shall include full compensation for preventative, corrective and breakdown maintenance, the Contractor might fail to achieve all points applicable in the event of unsatisfactory performance, in which case he shall still perform all maintenance requirements according to specification, but at his own cost where a reduction in points awarded is insufficient to cover his cost.

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly maintenance payments for the various installations.

SA 06.04 **DEFECTS LIABILITY PERIOD PRIOR TO COMPLETION** ..... Unit: month

Where Sectional Completion has been achieved, the Section completed shall be under Defects Liability Period prior to Completion commencing from the date of Sectional Completion to the date of Completion for the Installation.

Remuneration for Defects Liability Period prior to Completion of an Installation per month for portions of the Installation which have achieved Sectional Completion shall be calculated as follows:

$$MDS = \frac{\text{CWS}}{\text{TWSI}} \; x \; MDSI$$

MDS = Monthly Defects Liability amount for the portion of Sub-Installation in the particular Section
CWS = Certified Value of the completed works of the Sub-Installation in the Section
TWSI = Tendered amount for completing all works for the entire Sub-Installation
MDSI = Tendered Monthly Defects Liability amount for the entire Sub-Installation during Defects Liability Period prior to Completion of an Installation.

SA 06.05 **WARRANTY EXTENSION** ..... Unit: month

Where the Engineer or Employer requests early installation or usage of equipment (e.g. X-ray Machines, Walk-through Metal Detectors), the Contractor shall extend the warranty and Defects Liability Period for the equipment from the date of operational usage to the date of Completion of Certificate.

SA 06.06 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING FATAL BREAKDOWN** ..... Unit: hours

The unit of measurement shall be the number of hours during which a component of an installation was in a dysfunctional condition and required immediate response repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of hours measured, shall be deducted from the certified amount due to the Contractor.

SA 06.07 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING A GENERAL EMERGENCY BREAKDOWN** ..... Unit: hours

The unit of measurement shall be the number of days, in excess of 48 hours, during which a component of an installation was in a dysfunctional condition that required emergency repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA 06.08 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING EMERGENCY BREAKDOWN RELATED TO MODULAR CONTAINERISED DATA CENTRE (MCDC) AND HYPER-CONVERGED INFRASTRUCTURE (HCI) SUB-INSTALLATION** ..... Unit: hours

The unit of measurement shall be the number of days, in excess of 24 hours, during which a component of an installation was in a dysfunctional condition that required emergency repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA 06.09 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING ORDINARY BREAKDOWN** ..... Unit: days

The unit of measurement shall be the number of days, in excess of 3 days, during which a component of an installation was in a dysfunctional condition that required ordinary repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA 06.10 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING OPERATIONAL DAMAGE BREAKDOWN**..... Unit: days

The unit of measurement shall be the number of days, in excess of 3 days, during which a component of an installation was in a dysfunctional condition that required ordinary repairs.

The negative fixed rate shall include full compensation for the Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA.08 **UPDATING EXISTING OPERATING AND MAINTENANCE MANUALS:**

SA.08.01 **Description of installation**..... Unit: sum

SA.08.02 **etc. for other installations**

The unit of measurement shall be the sum of money needed to update the manuals for each Sub-Installation. The rate bid shall include full compensation for checking the information in the manuals of each installation, for the necessary research, for drawings and diagrams, for all instructions or procedures that have to be drawn up and editing that has to be performed and for all else necessary to provide seven copies (one set) of the updated manuals all in accordance with additional specification SB.

MAINTENANCE SCORE-CARD PROFORMA

CONTRACT NUMBER: .....

CONTRACT: .....

CONTRACTOR: .....

ENGINEER: .....

SUB-INSTALLATION: _____ **MONTH NO**: ☐☐

The following components of the sub-installation were selected by the contractor at the Monthly Maintenance Meeting no. ☐☐ as performance indicators to be tested according to specification:

1. CONTRACTOR'S SELECTION	**0**	**1**
1.1		
1.2		
1.3		
1.4		
1.5		
SUBTOTAL:		

The following components of the sub-installation were selected by the Engineer as performance indicators to be tested
According to specification:

2. ENGINEER'S SELECTION		
2.1		
2.2		
2.3		
2.4		
2.5		
SUBTOTAL:		

TOTAL SCORE: | | |

D D / M M / Y Y

Engineer's Representative **Signature** **Date**

GUIDELINE FOR THE USE OF THE MAINTENANCE SCORE-CARD

The score-card and performance indicators must be used as a maintenance management tool. The aim with each score-card is to ensure that:

(a) the project focuses on key aspects of maintenance per month;
(b) the Contractor receives payment for his work, and
(c) the Employer receives value for money and a sustained high level of service.

Performance indicators must be selected to measure the Contractor's service level of preventative and corrective maintenance that will be based on the Maintenance Control Plan and the Operating and Maintenance Manuals (containing information specified in the Contract documentation).

For each specific Sub-Installation, different performance indicators must be defined each month based on the content of the maintenance in relation to the scope of maintenance work per Sub-Installation and must be based on the Contractor's service level record on preventative and corrective maintenance.

Breakdowns must be dealt with if and when necessary by logging of the breakdown and monitoring the downtime.

The Contractor and the Engineer must agree on all performance indicators at an occasion prior to the month during which the Contractor's performance (service level of maintenance) will be measured.

ADDITIONAL SPECIFICATION

SB OPERATING AND MAINTENANCE MANUALS

CONTENTS

SB 01 SCOPE

The Contractor shall be responsible for the compilation of complete sets of Operating and Maintenance Manuals. A separate Operating and Maintenance Manual shall be supplied for each Sub-Installation where required and as defined in the Additional Specification SA: General Maintenance.

SB 02 PROCEDURE FOR SUBMISSION OF MANUALS

SB 02.01 SUBMISSION OF DRAFT MANUALS

A draft copy of each Operating and Maintenance Manual shall be submitted to the Engineer prior to safety inspection of the installation. Approval of the draft Operating and Maintenance Manuals shall be a prerequisite for commencement of the safety inspection in terms of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)

Where and installation/ sub-installation has an existing Operating and Maintenance Manual, the Contractor shall check whether its contents are still applicable and accurate. When drawing up his own Operating and Maintenance Manual for the installation/ sub-installation, the Contractor shall incorporate there in all such existing applicable data. The existing Operating and Maintenance Manual shall then be disposed of provided written permission to do so has been obtained from the Engineer.

The manuals will be reviewed and checked by the Engineer and returned to the Contractor with comments, where necessary. The Contractor shall make the necessary changes and amendments to the manuals to incorporate the Engineer's comments.

SB 02.02 DEVELOPMENT OF FINAL MANUALS

A final draft copy of each Operating and Maintenance Manual shall be submitted to the Engineer at least one week prior to commencement of Day 1 tests on commissioning. This set of manuals will not be accepted without the Contractor's

verification of the information contained in the manuals and the professional language editing thereof. The Engineer shall return the manuals to the Contractor, who shall make the final corrections. The Engineer will, however, not be responsible for the quality control on manuals. Approval of final Operating and Maintenance Manuals shall be a prerequisite for issuing of a Certificate of Practical Completion for Repair, Upgrade and/or New Work of the Installation/ Sub-Installation.

After the Engineer has approved the final Operating and Maintenance Manuals, the Contractor shall provide the Engineer with seven (7) sets of the manuals. Approval of the final Operating and Maintenance Manuals shall be a prerequisite for issuing of a Certificate of Completion.

SB 03 FORMAT OF OPERATING AND MAINTENANCE MANUALS

(a) Manuals shall be bound in hardcover lever-arch files with plastic coatings. The files shall be clearly labelled on the front cover, as well as on the back band, with the following information:

(i) The title "Operating and Maintenance Manuals"

(ii) Name of the installation/ sub-installation (as defined in Additional Specification SA: General Maintenance)

(iii) Name of the contract and contract number

(iv) The Contractor's name, address and contact telephone number and fax (logo optional)

(v) Month and year in which the manuals are finally handed over to the Employer

(vi) Name of the User Client

(b) Pamphlets and bound leaflets/booklets from suppliers or manufacturers shall be placed in plastic pockets.

(c) Drawings and diagrams larger than A3 shall be folded and placed in plastic pockets to be easily removed or stored.

(d) The sections of the manuals specified below shall be clearly partitioned.

(e) Cross-referencing between drawings/diagrams and text shall be in a clear and consequent format.

(f) The Operating and Maintenance Manuals shall be supplied in English.

(g) An electronic copy of the final manual shall be handed to the engineer upon approval of the operation and maintenance manual.

SB 04 CONTENTS

SB 04.01 TABLE OF CONTENTS

The table of contents shall appear on the second page and shall consist of the headings of the various sections in the manual and the relevant page numbers.

The table of contents shall essentially contain at least the following:

1. Introduction
   - 1.1 Scope of the manual
   - 1.2 General arrangement of the manual
   - 1.3 Description of installation
   - 1.4 Specifications

2. List of drawings and diagrams

3. Parts and components

4. Operating procedures

5. Maintenance
   - 5.1 Purpose of maintenance
   - 5.2 Preventative maintenance
   - 5.3 Trouble-shooting

6. Breakdown maintenance and repair

7. List of Appendices.

SB 04.02 INTRODUCTION

The introduction shall contain at least the following:

SB 04.02.01 Scope of the manual

A summary shall explain the scope of the contents.

SB 04.02.02 General arrangement of the manual

A brief description shall explain the way in which the manual is arranged.

SB 04.02.03 Description of Installation/ Sub-Installation

This section shall give a functional description of the complete installation/ sub-installation covered by the manual, including all systems and/or functional units deemed to form part thereof, as defined in Additional Specification SA: General Maintenance.

SB 04.02.04 Specifications

A summary shall be given of the specifications applicable to the particular part of the Contract.

SB 04.03 DRAWINGS AND DIAGRAMS

SB 04.03.01 Mechanical flow diagrams (MFDs) and single line diagrams

Mechanical flow diagrams (for mechanical systems) or single line diagrams (for electrical systems) of the system and/or functional unit shall be included in the Operating and Maintenance Manuals for easy reference by the operators of the installation. Diagrams shall be drawn not only for parts of an installation that have been repaired, but also for the complete installation, including all the components.

SB 04.04 PARTS AND COMPONENTS

SB 04.04.01 Equipment data sheets

A data sheet shall be drawn up for each piece of equipment and/or machine forming part of the installation and shall contain the following information:

(a) Equipment tag number
(b) Equipment description
(c) Model/make/manufacturer
(d) Supplier/Reconditioning details
(e) Ordering details
(f) Details of fixed components
(g) Details of lubrication
(h) Maintenance references (refer to supplier/reconditioning technical manual).

SB 04.04.02 Technical equipment manuals

For each piece of equipment and/or machine forming part of the installation/ sub-installation the following information shall be included in this section of the Operating and Maintenance Manuals:

(a) the supplier or reconditioning manual and/or standards of operating and maintenance instructions;

(b) illustrated parts breakdown and/or group assembly drawings as agreed with the Engineer;

(c) parts lists and data sheets, including all characteristic curves for machines indicating operation point, efficiency, power consumption, etc;

(d) calibration charts, and

(e) test certificates for hydraulic pressure tests, flame-proof grading, materials, non-destructive examinations, coating and lining details, etc.

Each detailed description shall be accompanied by a set of engineering drawings. From the drawings the functionality of each part or component used, as well as the special characteristics associated with the part or component shall be very clear.

SB 04.04.03 Parts and components list

A detailed description shall specify all the parts and components used for the duration of the Contract. This description shall include new parts and components, as well as existing parts and components that have either been reconditioned or used as specified in the Contract.

The description shall state at least the part or component number, part or component name, the size of the part or component, an explanatory description, the quantity used, the material of which the part or component is made, the coating (if any), date of purchase, as well as any relevant remarks as to the application thereof.

Details of the manufacturer of the part or component shall also be listed. This shall at least state the name, address, telephone number, fax number and name of a contact person.

The supplier of the part or component shall also be stated and shall include at least the name, address, telephone number, fax number, name of a contact person and an alternative supplier (if available).

SB 04.04.04 Drawings

Drawings shall contain a descriptive heading, an explanatory key and relevant comments. Drawings shall be done on a computer-aided design package approved by the Engineer.

A compound drawing for all subassemblies shall clearly indicate how and where the various parts fit in the subassembly. The compound drawing shall be linked to the equipment data sheets and parts and components list and shall clearly specify the parts or components used, their model numbers, their sizes and the quantities used. The compound drawings shall also be accompanied by a short description explaining the workings of the subassembly, as well as the assembly of the parts or components to complete the subassembly.

SB 04.05 OPERATING PROCEDURES

The operating instructions shall be a step-by-step description of the manual start-up and shut-down procedure for every piece of equipment and/or process reconditioned, repaired or supplied with references to the MFDs. For automatic operation the operators shall be referred to the automatic control manual (if applicable).

The functioning of the installation shall be clearly described, using a flow diagram depicting the interrelationships among the various subassemblies. The subassemblies shall be described by descriptive drawings.

Each mechanical or process flow diagram shall contain at least a heading, relevant comments and a key.

Every subassembly shall also have its own flow diagram explaining the operation of the subassembly, as well as the application of each part and component. The application of the subassembly shall also be very clear. The flow diagram shall consist of at least a heading, relevant comments and an explanatory key.

A detailed description shall be given of all operational systems forming part of the installation, explaining the operation and functioning of the system and the number of operations personnel required for performing the operation successfully.

The preparations, which are required before the system can be operational, shall be clearly stated and explained.

The operation tasks shall be clearly explained with reference to dangerous situations that might occur. Hazardous operations shall be explained in great detail and cover all the applicable safety precautions.

SB 04.06 MAINTENANCE

SB 04.06.01 Purpose of maintenance

The maintenance process shall be explained and the main responsibilities described.

SB 04.06.02 Preventative maintenance

A preventative maintenance and lubrication schedule shall be included in this section. This schedule shall be in table format and shall include a summary of all the maintenance actions required for each different system and/or functional unit covered by this manual, in order to give a single summary of all routine preventative maintenance actions required for the complete installation.

The schedule shall indicate daily, weekly, fortnightly, monthly and yearly maintenance actions. A lubrication schedule summary shall also be included under this section.

The frequency of routine preventative maintenance actions shall be indicated very clearly.

The Contractor shall provide the maintenance requirements as prescribed by the manufacturer. The type of maintenance shall be clearly indicated. The description of the maintenance to be performed shall include at least the part name, location of the part in either the assembly or subassembly, the model number, the quantity of the particular part or component to be maintained, the type of maintenance, and notes on the maintenance procedure.

A brief description shall accompany the maintenance schedule, indicating special tools to be used, maintenance and test equipment required for the test procedures. Any special tools necessary for maintenance shall be specified in terms of name, model, size, manufacturer, supplier (name, telephone number, fax number, contact person), coating (if any) and notes on the use of the equipment.

Remarks on the system readiness checks of each subassembly shall be explained in detail. Routine inspection and maintenance processes shall be described. It shall be

very clear what needs to be done, how to perform the necessary task and any dangers that are present.

SB 04.06.03 **Trouble-shooting**

An explanation shall be given to assist the maintenance personnel in analysing and resolving malfunctions that might occur. Various scenarios with possible causes and rectification procedures shall be explained.

The scenarios shall be accompanied by drawings indicating the position of the part that is faulty. Each of these drawings shall have a heading, comments and an explanatory key.

SB 04.07 **BREAKDOWN MAINTENANCE AND REPAIR**

The Contractor shall describe the complete procedure to be followed in the event of a breakdown. It shall be very clear what the operating personnel should look for, how to eliminate any dangers due to the breakdown (eg electricity must be shut off in the event of problems with the wiring) and who should be contacted. The Contractor shall supply the names and telephone numbers of at least two contact persons who may be contacted in the event of a breakdown.

The Contractor shall refer to Additional Specification SA: General Maintenance, to determine the reaction time for the repair to the breakdown.

Repair instructions shall provide the maintenance personnel with detailed instructions for the removal and/or replacement of any item requiring replacement due to malfunctioning. Contact numbers shall also be given to assist maintenance personnel, should a breakdown occur.

The Contractor shall specify the actions expected of maintenance personnel in the event of a breakdown.

The Contractor shall also specify the testing procedures to be followed before the system can be put into operation again. Every procedure shall be described clearly and all the potential dangers pointed out, as well as the precautions that have to be taken.

The testing procedures shall be accompanied by drawings illustrating the process to be performed. Every drawing shall have a heading, comments and an explanatory key.

SB 05 **MEASUREMENT AND PAYMENT**

SB.01 **COMPILE AND SUPPLY A COMPLETE SET OF OPERATING AND MAINTENANCE MANUALS** .....Unit : sum

The unit of measurement shall be a sum for each complete set (seven copies) of Operating and Maintenance Manuals. Operating and Maintenance Manuals for different installations/ sub-installations shall be measured separately in the Schedule of Quantities.

The tendered sum shall include full compensation for all technical research, gathering of information, compilation of manufacturer's instructions, compilation of drawings and diagrams, and for writing of all the descriptions, instructions and functional procedures, as well as language editing, in order to provide a clear and correct set of Operating and Maintenance Manuals.

The tendered sum shall also include full compensation for all expenses such as paper, copy work, binding and printing necessary for the completion of the manuals.

The tendered sum shall also include full compensation for the compilation of draft sets of operating and maintenance manuals in accordance with the specification, and for incorporation of all comments and corrective requirements.

SB.02 **COMPILE AND SUPPLY A COMPLETE KEY PLAN** .....Unit : sum

The unit of measurement shall be a sum for each complete set (three A0-size copies) of the key plan(s).

The tendered sum shall include full compensation for all expenses such as paper, copy work and printing required for the completion of the key plan.

The key plan shall include and comply with the following:

(a) Detail ground survey

All services must be shown on a complete key plan as required by the Engineer, including roads, fences, paving, transmission and telephone lines, etc. For sewerage reticulation and stormwater drainage systems the pipe sizes, as well as invert heights must be provided. An effort must be made to trace the routes of these services.

(b) Survey of buildings

The "footprint" of all the buildings and structures must be surveyed.

(c) General

All survey data shall be captured in electronic format (DXF).

SB.03 **UPDATE AND REVISE THE EXISTING SET OF OPERATING AND MAINTENANCE MANUALS** .....Unit : sum

The unit of measurement shall be a sum for each complete set (seven copies) of Operating and Maintenance Manuals updated, revised and compiled. Operating and Maintenance Manuals for different installations shall be measured separately in the Schedule of Quantities.

The Contractor shall note that existing manuals may not be to an acceptable standard or may not be available. All manuals that exist will be available to view at the compulsory site inspection.

The Contractor shall also note that manuals may not necessarily be available in an electronic format.

The tendered sum shall include full compensation for all technical research, gathering of information, compilation of manufacturer's instructions, compilation of drawings and diagrams, and for writing of all the descriptions, instructions and functional procedures, as well as language editing, in order to provide a clear and correct set of Operating and Maintenance Manuals.

The manuals shall also include all new equipment installed under this contract.

The tendered sum shall also include full compensation for all expenses such as paper, copy work, binding and printing necessary for the completion of the manuals.

The tendered sum shall also include full compensation for the compilation of draft sets of operating and maintenance manuals in accordance with the specification, and for incorporation of all comments and corrective requirements.

ADDITIONAL SPECIFICATION

SC GENERAL DECOMMISSIONING, TESTING AND COMMISSIONING PROCEDURES

CONTENTS

SC 01 SCOPE

This specification encompasses all aspects of the repairs/upgrade of systems and services that form part of an installation/ sub-installation, including the factory and on-site testing, decommissioning, installation and commissioning of all equipment, instrumentation and materials reconditioned, supplied and installed as part of an installation as defined in Additional Specification SA: General Maintenance.

The specified procedures are the minimum requirements to be supplemented by various technical and particular specifications in this document. These requirements shall apply to all commissioning work scheduled as part of the initial repair, upgrade and/or new installation work on installations/ sub-installations, as well as commissioning work that is part of the routine preventive and corrective maintenance.

SC 02 PHASED REPAIRS AND UPGRADING OF THE INSTALLATION/ SUB-INSTALLATION

When an installation/ sub-installation consists of parallel systems or components, the complete installation/ sub-installation and all its components shall be repaired and/or upgraded without taking the complete installation/sub-installation out of commission at any time, unless otherwise specified in the Technical Specifications.

In order to schedule the repairs/upgrade of an installation/ sub-installation, all work shall be done in phases as specified in the Technical Specifications and illustrated in detail on the Drawings. Repairs/ upgrade of each part shall terminate with the successful reconditioning of that part.

Each part of the system shall be decommissioned and recommissioned in the sequence specified in the Technical Specifications and on the Drawings.

The Contractor shall install all the necessary temporary specials, spool pieces, supporting frames and brackets to provide a functional link between each repaired and upgraded part of the system and the part of the installation that has not yet been repaired and upgraded during recommissioning. Electrical and instrumentation Contractors and subcontractors shall ensure that the system remains operational as specified, using either existing or newly installed instruments, cables and controls.

Payment is based on the successful recommissioning of a specific part of the installation.

SC 03 DETAILED COMMISSIONING PROGRAMME

No work of any kind on any part of the installation shall take place prior to the Engineer's approval of a detailed commissioning programme. This programme shall be submitted in addition to the general programme for planning and monitoring contract progress, at least two weeks prior to any programmed shutdown. The programme shall be the coordinated product of the Engineer and the User Client. Commissioning programmes shall take all process requirements into account. The detailed commissioning programme shall indicate all actions necessary for:

(a) Decommissioning

(b) Recommissioning of parts of the installation

(c) Commissioning of the installation as a whole.

All work deemed necessary for practical completion of the installation shall be indicated on the commissioning programme.

The programme shall indicate the milestones to be achieved before shutdown and decommissioning as activities of zero duration, all of which shall be prerequisites linked to the "start" of decommissioning.

The following specific actions shall be included in the programme, clearly indicating the time allowed for:

(a) Communication, including the time for confirmation of the official shutdown;

(b) Draining parts of the installation to sumps, where available, or to other storage facilities provided by the Contractor;

(c) Installation of temporary blanked flanges or other means of isolation where necessary;

(d) Partial decommissioning and removal of existing material and equipment to perform work, including protection of pipework against hot work, cutting into pipework, loosening bolts, flanges and all other work necessary for recommissioning;

(e) Installation of temporary functional links (pipe specials) between any two parts of the installation;

(f) Each individual field weld, subject to the Engineer's approval;

(g) Non-destructive testing of materials, for manufacturing/construction quality and for producing test results;

(h) Installation of all instruments and their connection to SCADA systems;

(i) Installation and connection of all power cables;

(j) De-aeration of all pipe sections;

(k) Communication between the Contractor, the Engineer, the Employer and the User Client;

(l) Start-up of the complete system, indicating start-up procedures.

Inspection of the prefabricated installation, testing of all equipment prior to final commissioning, pressure testing and non-destructive testing shall be clearly scheduled in the project progress programme.

Day 30 tests and instruction/training sessions with the User Client shall be scheduled in the project progress programme.

SC 04 COMMISSIONING COMMUNICATION CHANNELS

The Contractor shall communicate with the User Client's operating and maintenance managers via the Engineer to finalise start-up after decommissioning in accordance with the specified procedures.

The following key parties shall be involved before and during shutdown and decommissioning of any part of the system:

Contractor:	Site Agent
Engineer:	Resident Engineer
Employer:	Representative of Area Manager
User Client:	Operating and Maintenance Manager.

SC 05 COMMISSIONING RISK CONTROL AND PENALTIES

(a) The safety instructions stipulated by the Occupational Health and Safety Act, 1993 (Act 85 of 1993) shall be adhered to at all times.

(b) The Contractor shall not be allowed to work on any part of the installation without obtaining a commissioning check permit on the day of shutdown. A typical example of a commissioning check permit is included in this document, referring to the minimum required milestones to be achieved prior to decommissioning.

(c) Payment reductions for exceeding the maximum permissible down-time during maintenance shall apply as stipulated in the General Conditions of Contract and the Contract Data. This stipulation does not include shutdowns during programmed routine preventive maintenance work.

SC 06 DELAYS OF SCHEDULED SHUTDOWNS

Specific dates on which an installation shall be shut down for decommissioning shall be finalised during coordination meetings of all the parties involved, including the Engineer, the Employer, the User Client and the Contractor.

Although a date for each shutdown will be scheduled at the coordination meetings, the actual date of the shutdown shall be determined by the process requirements and user demands, allowing for a window of seven (7) calendar days from the date of the planned shutdown.

Prospective bidders shall make allowances in their bid rates for the shutdown to occur at any time during this seven-day period. No additional payment shall be due if the shutdown occurs within this seven-day period.

If the Contractor fails to commence with the shutdown and decommissioning of the installation within the scheduled period, all additional costs arising from the shutdown at a later stage shall be for the Contractor's account.

SC 07 MATERIAL AND EQUIPMENT PROCUREMENT AND PROTECTION

It is the responsibility of the Contractor to ensure the functionality of all units of new equipment prior to decommissioning, before installation of any specific part of the system. If the equipment, whether free-issued or not, does not conform to the functionality specifications during pre-installation testing, the Contractor shall notify the Engineer in writing without delay.

SC 08 TESTING OF EQUIPMENT PRIOR TO RECOMMISSIONING

The equipment shall be tested for functionality after pre-installation of equipment in parts of the installation.

(a) The Contractor shall inform the Engineer well in advance of his intention to perform the first tests and start-up of equipment in order to allow a representative of the Engineer to witness the tests. The extent of all precommissioning tests and checks shall be agreed with the Engineer prior to commencement.

(b) The Contractor shall first conduct his own tests of the equipment. When he is satisfied that the equipment complies with the specifications, he shall notify the Engineer that he is ready for the official tests on completion. The Contractor shall not conduct an official test without the Engineer's presence or approval. All equipment shall conform to the specified requirements.

(c) Before starting up any part of the installation or filling the tanks and sumps with liquid, the Contractor shall clean out the tanks, pipes, fittings, equipment or

structures and, if necessary, make arrangements with other Contractors to remove their building rubble form the structures, check that all safety devices and alarms have been set and activated, all nuts have been tightened correctly, that all the equipment is complete and ready for start-up, that the plant has been installed correctly, and that copies of the operating manuals have been handed to the Engineer.

(d) The Contractor shall start up each section of equipment after ensuring that oil fillings, lubrication, vibration monitoring, cable termination and so on have been correctly completed. He is also responsible for the first refilling of all lubricating oils and for adjusting the plant to operate according to the specifications. Before any equipment is started or energised, the Contractor shall ensure that it is safe in terms of the personnel and equipment on the site to do so. The Contractor's tendered rates and sums shall allow for these costs.

All equipment shall be tested according to the relevant specifications that form part of this document.

No shutdown or decommissioning of any part of the system shall take place unless all the equipment to be installed have been tested by the Contractor and approved by the Engineer.

SC 09 TESTING OF MATERIAL AND EQUIPMENT SPECIFICATIONS AND WORKMANSHIP

All results of the required non-destructive, precommissioning and manufacturing testing shall be submitted to the Engineer well in advance of testing the equipment on recommissioning. All such test results shall be submitted before Day 1 commissioning tests and no certificate of practical completion shall be issued prior to receipt of the required test results.

SC 10 DECOMMISSIONING

The decommissioning period shall commence on the instant of the entire system shutdown. The recommissioning period shall start in parallel with decommissioning.

Shutdown and decommissioning shall not proceed without compliance with all the milestones in the detailed commissioning programme. The list of milestones in this document is not complete but indicates the minimum requirements. Milestones to be achieved prior to shutdown and decommissioning may be added to the programme at the Engineer's discretion.

The Contractor is responsible for the safe decommissioning of all material, equipment, components and instrumentation to avoid damage to parts or components of the installation.

SC 11 RECOMMISSIONING, COMMISSIONING AND COMPLETION OF INSTALLATIONS

SC 11.01 RECOMMISSIONING

Recommissioning means the commissioning of all sections or systems that form part of the installation to meet the required functional specifications for the individual section or system prior to commissioning of the repaired and upgraded installation.

The Contractor is responsible for the recommissioning of all parts of the system and he shall perform the tasks listed below.

(a) Prior notice shall be given to and proper arrangements shall be made for recommissioning with the Employer, the Engineer, the User Client and the suppliers of equipment that is affected by recommissioning and testing.

(b) If plant and equipment supplied by others are to be commissioned, the supplier's specific permission together with all requirements related to commissioning shall be obtained prior to recommissioning without in any way altering the General Conditions of Contract and the Contract Data with reference to the Contractor's liability in terms of defects.

(c) The new and reconditioned parts of the installation shall be thoroughly inspected by a responsible representative of the Contractor to ensure that manufacture/construction and installation work have been completed according to the specifications.

SC 11.02 COMMISSIONING AND COMPLETION OF REPAIRS, UPGRADING AND/OR NEW WORK

Commissioning means commissioning of the repaired and upgraded installation as a whole to perform in perfect working order.

(a) The commissioning period for each installation as a whole:

(i) Commences with the Day 1 tests of the complete repaired and upgraded installation;

(ii) Includes commissioning of all sections and systems that have been recommissioned prior to the Day 1 tests;

(iii) Includes training of the User Client's operating personnel and the maintenance teams;

(iv) Terminates with a Day 30 test in compliance with the commissioning report.

(b) The purpose of the Day 1 tests is to ensure that:

(i) The electronic, electrical and mechanical equipment and materials are functional and in perfect working order with respect to each other and the installation as a whole;

(ii) The commissioning period, including training, commences on successful completion of the Day 1 tests;

(iii) The Contractor is entitled to a certificate of practical completion for the repairs and upgrading of the installation on successful completion of the Day 1 tests;

(iv) The Contractor becomes responsible for maintenance of the installation and is entitled to performance-based payments in compliance with Additional Specification SA: General Maintenance.

(c) Commissioning shall be undertaken over a trouble-free period up to Day 30. During this period the Contractor shall train the User Client's operators and his maintenance team for operating and maintaining the installation. This training shall allow for all possible operational conditions, including emergency conditions, the correct servicing of every part, the type of oil or grease to be used, and similar tasks. The training shall take place by means of demonstrations, and the operating and maintenance manuals shall be referred to for this purpose.

(d) Day 30 commissioning tests shall be performed thirty calendar days after the successful completion of the Day 1 tests. The commissioning period of the installation terminates upon the successful completion of the Day 30 tests.

(e) The Contractor shall conduct all the tests required to satisfy the Engineer that the installation is performing according to specification, and shall make allowance for these tests in his bid rates and prices. These tests shall be conducted to certify that the installation, as repaired, upgraded and installed, is in perfect working order in terms of the specified functional requirements. The Contractor shall note that all equipment is to be tested as part of an installation, where appropriate, and will not be passed if all protection devices, interlocking with other equipment, etc, are not fully functional.

(f) The Engineer shall provide commissioning sheets to the Contractor at least three weeks before the commissioning period commences, for all the equipment supplied, reconditioned and installed by the Contractor. The Contractor shall complete the commissioning sheets during the commissioning period and all items listed shall be entered. No completion certificate will be issued for an installation of which the equipment has incomplete commissioning reports. Information that is not available or applicable, or instances where certain tests have not been carried out, are subject to the Engineer's decision.

(g) Commissioning of the plant (which includes the thirty days between the Day 1 and Day 30 tests) includes operating under conditions that adequately prove that all the specifications have been met. All safety devices, standby plant, automatic controls and protection devices shall be adequately tested for reliability and correct functioning. The Contractor may be called upon to repeat testing during the maintenance period if the performance of the equipment is suspected to be substandard. Costs related to such tests shall be for the Contractor's account and shall comply with the specified requirements. Copies of updated commissioning reports shall be provided to the Engineer within two days after a test has been performed.

(h) The Contractor is responsible for providing all labour and materials (including testing equipment) during the commissioning period and shall carry out all the servicing and adjustments to ensure that the installation operates as specified. Valid calibration certificates shall be available for all testing equipment on the site during the commissioning period.

(i) Programmes for the Day 1 tests, Day 30 tests and instruction/training sessions with the User Client's operators and maintenance team shall be prepared by the Contractor and submitted to the Engineer at least two weeks before the commissioning period commences. The Contractor shall provide weekly updates of these schedules for the duration of the commissioning period.

(j) The Contractor shall note that if any equipment fails during the commissioning period, the equipment shall be repaired or replaced by the Contractor, and testing and commissioning shall commence from scratch.

(k) Successful commissioning of an installation entitles the Contractor to a certificate of completion for the installation.

SC 12 MEASUREMENT AND PAYMENT

SC.12.01 DECOMMISSIONING AND REMOVING PARTS OF THE INSTALLATION/ SUB-INSTALLATION ..... Unit: sum

The unit of measurement shall be a sum.

The sum bid shall include full compensation for all actions and labour required for shutdown and decommissioning of the entire installation as specified to enable decommissioning and removal of parts of the installation as listed in the Bill of Quantities.

The sum bid shall include full compensation for the decommissioning and removal of the parts and components of an installation as listed individually in the Bill of Quantities, including actions and/or costs resulting from such work, to enable the recommissioning of parts of the repaired and/or upgraded installation.

The sum bid shall include full compensation for final dismantling of decommissioned materials and equipment and the removal of all such items to stores on site, as directed by the Engineer.

SC.12.02 COMMISSIONING AND TESTING OF PARTS OF THE INSTALLATION/SUB-INSTALLATION Unit: sum

The unit of measurement shall be a sum.

The sum bid shall include full compensation for commissioning and testing parts of the installation to be operational while still incomplete in relation to the entire repaired and/or upgraded system or installation.

Separate payment items shall be billed for separate parts of the system.

SC.12.03 **COMMISSIONING AND TESTING OF THE INSTALLATION/ SUB-INSTALLATION** ..... Unit: sum

The unit of measurement shall be a sum.

The sum bid shall include full compensation for commissioning the, repaired, upgraded and/or new installation/sub-installation as a whole and for all costs and expenses related to labour, removal, repair, reinstallation and testing of material and equipment during the commissioning period for each part of the installation. The sum bid shall include full compensation for the final commissioning and testing, including Day 1 and Day 30 tests, of all parts and components of the installation to the specified functional condition.

Payment shall be based on successful completion of the Day 30 tests.

SC.12.04 **PROVISION FOR SAFETY AND HOT WORK REQUIREMENTS DURING SHUTDOWN**.....Unit: number

The unit of measurement shall be the number of shutdowns during which all the required safety and hot work requirements are provided.

The bid rates shall include full compensation for all the required safety and hot work requirements and arrangements in accordance with the specifications during a shutdown period, including all labour, personnel, equipment, materials and consumables required.

SC 13 APPOINTMENT OF AN INDEPENDENT COMMISSIONING AGENT (CxA)

An independent Commissioning Agent (CxA) shall be appointed to develop and coordinate the execution of a detailed testing and commissioning plan, which includes observing and documenting all systems performance to ensure that the systems are functioning in accordance with the baseline design requirements and the contract documents. The CxA will not be responsible for design or general construction scheduling, cost estimating, or construction management, but may assist with problem-solving or resolving non-conformance issues or deficiencies.

Commissioning SPECIFICATION
Commissioning is a process designed to verify that systems operate according to the owner's project requirements and/or basis of design.
Objectives
The objective of the commissioning process is to provide documented confirmation that the installation fulfils the functional and performance requirements of the Client and Operators.
It is necessary to review the basis of design documents detailing the system function, performance, and maintainability requirements, verify and document compliance with these criteria throughout construction, start-up, functional and integrated testing periods. The results shall be presented in a logical manner for acceptance by the Client/Engineer for inclusion in the Operation and Maintenance (O&M) manuals, and to align training on system operation with the results of the commissioning process to ensure the facility is operated as intended.

Commissioning Outcomes

Project Delivery
Delivery of facilities which meet the design intent.
Minimise re-work or duplication of work. Do it right 1st time
Testing and Verification
Robust testing, verification and certification of systems and components to ensure effective operation and conformance with design.
Health and Safety
Excellent safety performance without harm to the environment or personnel
Documenting
Capturing of performance data and quality control processes to be used at a later date.
Consistent reporting of status and progress is vital
Training
Build competence of Operations Team by inclusion in commissioning activities.
Handover
Handover of facilities to Operations Team with detailed Operational Readiness Documentation as well as Standard and Emergency Operating Procedures

Commissioning plan

The Commissioning Plan (CxP) outlines the execution of the commissioning process. This plan provides guidance to distinguish and define the handover between execution of construction phase commissioning (Levels 1 to 3) and the acceptance phase of the project commissioning (Levels 4 and 5).

As part of the close out of the Level 3 commissioning step the below information needs to be provided:

Confirmation letter L1-L3 documents are complete and accepted by the CxA.
Calibration certificates of all measuring equipment are available.
Confirmation letter from the contractor the deep cleaning has been finalized.
Contractor to provide redline drawings update of all construction documents.
Contractor to submit the O&M and System manual.
The Operator Training Program records are available for all systems.
Spare parts schedule and plant replacement strategy available.
CE certificates of all equipment available.
Warranties of all equipment available.
Fire stopping certification available.
SLD's electrical and mechanical on the walls of relevant plant rooms.
Logs of all firmware versions are provided in the manual.
Logs of all equipment software, alarm and setpoints settings are provided in the manual.

Scope of Commissioning

The following sub-installations will be commissioned from Level1 Factory Acceptance Tests (FAT) up to Level 5 Integrated System Testing (IST):

- Sub-Installation 1: CCTV Surveillance System
- Sub-Installation 2: Modular Containerised Data Centre (MCDC) and Hyper-Converged Infrastructure (HCI)
- Sub-Installation 3: Access Control System
- Sub-Installation 4: Cell phone Detection, Intercom and Public Address Systems

Sub-Installation 5: Security Electrical Services
Sub-Installation 6: Sally Port
Sub-Installation 7: Dividing Fence System
Sub-Installation 8: Outer and Inner Security Fencing Systems

COMMISSIONING PROCESS

Level 1: Factory Acceptance Testing
Carried out under strict conditions at equipment manufacturer or vendor factory to ensure system integrity and correct limitations.
Product factory testing and verification to ensure compliance with manufacturers' specifications, ratings and characteristics.
Will include owner defined functional, performance or aesthetic requirements
Component certifications or documentation
This will cover submittal reviews and factory witness testing.
Factory witness testing will include mock-ups of equipment or systems in controlled environments, at the manufacturer or vendor's factory.
Testing in this environment makes it easier and less expensive to find and fix design and implementation issues with equipment and software.
It also allows asynchronous testing of many different systems while the site itself is still under construction, aiding in overall timeline efficiency

Level 2: Site Acceptance Testing
Once the equipment has passed factory acceptance testing and it has been delivered to site, it then needs to undergo site acceptance testing.
Inspection, verification or tests performed on the products upon delivery to the site.
Equipment is inspected to ensure compliance with all design criteria, is not damaged, and that there is a proper storage plan in place.
The inspection is undertaken by the Commissioning Agent.
Test documentation for quality auditing purposes, including method statements and schematics, are also included.
This is to ensure that the equipment brought to the site meets the end user's specifications before it enters the facility
Ensure the products delivered match those purchased and tested during the FAT and have not been damaged or altered during shipment

Level 3: Installation and Verification
Covers installation inspections and verification, sometimes referred to as pre-functional testing. This is the inspection of the installation of the equipment only.
Site inspections and certifications to document that installation is done as per design, verifying compliance with the specifications, maintainability, manufacturer's installation requirements and client directives.
The contractor and commissioning agent work together to determine if the equipment was installed correctly and is in compliance with industry requirements and regulations.
Both the contractors and commissioning agent will verify that all equipment is installed properly, and that installation meets design and operational standards.
This is the first time the equipment is turned over and checked for functionality. Equipment is started for the first time to check proper, independent operation. Testing is repeated after corrections are made to any equipment that fails testing
Energisation and start-up of equipment.

Level 4: Functional Testing Phase
Functional performance testing will be conducted to either individual components or equipment, or tightly coupled components and equipment.
Demonstration that related components, equipment and ancillaries of a defined system operate and function as designed.
Each control loop is checked, actual operation is compared to designed sequences of operation, and performance is observed. Setpoint adjustments may be made as necessary. Performance of monitoring and control functions
Includes isolation for maintenance, emergency and failure scenarios, verification of settings, safeties and capacities
Operational issues are uncovered during this phase.
This level of commissioning will involve more stakeholders, disciplines, and entities working together than other phases, at least with respect to testing.

Level 5: Integrated System Testing
Integrated System Testing demonstrates the performance of interrelated components and systems of the facility as a whole against all design criteria.
Systems are operated in various modes to demonstrate proper response to equipment failures and utility problems.
It's at this point where the response from all systems must be proven to work together in unison and prevent any interruptions to the operation of the facility.
Verify that system, holistically responds as designed to expected and unexpected anomalies.

Commissioning Issue Register Log (IRL)
Updated and circulated after each commissioning activity L1-L5
Centrally managed and controlled
Updated and closed out proactively.
Recommended L1-L3 → Main Contractor. Submit weekly commissioning agent and project management team
Recommended L4-L5 → CxA to submit to project management team and client.
L4-L5 will not proceed without submission and signoff of a L1-L3 IRL.
Level 4 commissioning will not advance to Level 5 without the submission, signoff and acceptance of closed-out items on the L4 IRL

Commissioning Documentation

L0-Design	
Quality Assurance & Quality Control (QAQC) Plan	Contractor
Safety Plan	Contractor
Commissioning Schedule	Contractor
Commissioning Equipment List	Contractor
Design Review Reports	Commissioning Agent
Drawings and Documents	Engineer
L1-Factory Acceptance Tests (FAT)	
FAT Schedule	Contractor
L1 Test Scripts	Contractor
L2 QAQC	
Co-ordination Study	Engineer
Arc Flash Study	Engineer
L2 Electrical Testing Plan	Contractor

LOTO Plan	Engineer
Pre-Energization Plan	Engineer
L2 Commissioning Scripts	Contractor
L3 Startup	
Startup Plan	Engineer
Load Bank Plan	Commissioning Agent
Test Equipment	Contractor
L3 Commissioning Scripts	Contractor
Elec 3rd Party Tests, International Electrical Testing Association for Acceptance Testing Specification (NETA ATS)	Contractor
Mech 3rd Party Tests, Testing, Adjusting and Balancing for HVAC Systems - (TAB)	Contractor
L3 IRL	Commissioning Agent
L4 FPT	
Commissioning Implementation Plan	Commissioning Agent
Load Bank Plan	Commissioning Agent
Test Equipment	Contractor
L4 Commissioning Scripts	Commissioning Agent
L4 Test Reports and Test Data	Commissioning Agent
L4 IRL	Commissioning Agent
L5 IST	
L5 IST Plan	Commissioning Agent
L5 Commissioning Scripts	Commissioning Agent
L5 Test Reports and Test Data	Commissioning Agent
L5 IRL	Commissioning Agent
L6 Handover	
Acceptance Docs	Engineer
Snag Closeout	Engineer
IRL Consolidated	Commissioning Agent
Final Commissioning Report	Commissioning Agent
Training	Contractor
Manuals	Contractor

OPERATIONAL READINESS

Operational Readiness is a process designed to effectively handover to the Client a site fully ready for operations activities. These documents are supplement to the general hand over requirements (occupation certificate, CoC's, etc.) and the requirements stipulated in the project specifications and other contract documents.

These requirements are a prerequisite to the works achieving practical completion. The documents required are detailed in the section to follow:

Mandatory Items to be supplied:
Critical Spares to be purchased, onsite and available
All Emergency Response equipment to be purchased, onsite and available. This includes: First Air Boxes, Oil Spill Kits, and Emergency Apparel cabinets
All Mechanical, Electrical and Electronic schematics
All Equipment O&Ms (soft and hard copies)

All support contacts
All emergency supplier contact information to be in place
Full MEP and integrated control training to take place between IST and Practical Completion as per approved Training Specification
Signed off training register.
Operational readiness documents approved and in final version (soft and hard copies)
Laminated process flow and schematic diagrams to be placed in close proximity of prospective equipment.

Site Configuration Procedure
A documented description of the normal configuration of the site.
This should include all documentation related to the design, commissioning and studies that describe the normal configuration of the site.
This sets the initial conditions for the execution of a SOP or MOP.
To be provided prior to handover

Standard Operating Procedure
Integrated system(s) SOP (Standard Operating Procedure) intended to be overarching document which provides high level control and policy around the change of state of high-risk components of the integrated infrastructure and control philosophy of which includes:
Risk Assessment, Step by step method statement to complete each change, process flows, procedure overview, terminology, Scope & Applicability Quality checks, fail over procedures and roll back plans

Method of Procedure
MOP (Method of Procedure) documents the steps required to execute a particular portion of an SOP, and will include:
Document scope, Prerequisites, Tasks and sequence of tasks

Emergency Operating Procedure (EOP)
Includes detailed written instructions which must be carried out sequentially when an abnormal event occurs.
End to end energisation from complete building black out through to system re-energisation post black out
To indicate the systematic sequential start-up of all plant and the dependency of plant on each other during the start-up process.

Environmental impacts, leaks, floods, etc.
A number of 'what if' scenarios
EOPs will include: Generators, Manual energisation, generator supply off-line, static switching, UPS systems, HVAC units, Fire alarm action, isolating electrical supply in event of fire or flood, chilled water leaks, flood recovery, fire recovery, fuel leaks.

Experience required:

- At least 10 years' experience in Integrated Security System maintenance, operation, construction and/or commissioning
- At least 10 years of construction/commissioning experience with new build projects of a similar nature
- At least 10 years of experience with electrical and mechanical Test Equipment
- Proven understanding of Integrated Security System (ISS) and sub-systems in a Correctional Facility or similar environment, with focus on :
    - Construction Quality Assurance/Quality Control

- Design Review
- Factory Acceptance Tests/Factory Witness Tests observation
- Quality Assurance/Quality Control checks
- Functional Performance Testing
- Integrated Systems Testing
- Equipment Operations
- Warranty/ Seasonal Testing
- Maintenance Development
- Develop and write detailed Commissioning Test Scripts
- Issue identification and resolution management

- ECSA registration is preferred or Commissioning Certification in the relevant field
- The Independent Commissioning Agent shall be appointed for a duration of up to 200 hours
- The Engineer shall check and validate the independency of The Independent Commissioning Agent
- The Independent Commissioning Agent shall be approved by the Engineer upon validation

ADDITIONAL SPECIFICATION

SD GENERAL TRAINING

CONTENTS

SD 01 SCOPE

The Contractor shall be responsible for providing diverse training to various groups, including operating and maintenance personnel. The Contractor shall develop and facilitate initial training sessions for all parties, as well as training sessions at specified intervals to revive and supplement the initial training. An accredited trainer shall present all training sessions.

This specification includes all requirements for methods to be employed, the syllabus required by the User Client, the syllabus required for maintenance managers and workers and the method of measurement and payment.

SD 02 BASIC METHOD REQUIREMENT

The Contractor shall be responsible for conducting a complete investigation of the groups that have to be trained in order to compile a proper training plan.

The investigation shall cover at least the following aspects:

(a) Assess likelihood of conformance to task-specific requirements *(status quo)* of capabilities.

(b) Identify minimum pre-qualification criteria in terms of existing knowledge and skill levels in relation to reaching target requirements.

(c) Evaluate personnel in terms of pre-qualification criteria and tasks to be performed (skills profile).

(d) Identify training needs.

(e) Develop appropriate and accredited training courses and material in terms of task-specific activities and identified training needs, and compile the training syllabus per installation.

The Contractor shall identify an accredited trainer to assist in the above investigation and finalise the compilation of a training plan and syllabus. Approval of the syllabus shall be a condition for issue of a Certificate of Practical Completion for repair of an installation. Once the training plan and syllabus have been approved the Contractor shall liaise with the Engineer to establish a date and appropriate training venue that would be conductive to learning to perform training.

The training shall be revived within one month after initial training to determine its effectiveness. Further regular training sessions shall be scheduled according to the effectiveness of initial maintenance and operating activities.

The Engineer will be responsible for recording all training sessions and shall keep an attendance register. The Engineer will also examine the trainees officially with each training session and issue certificates of trainees' acquired skills on satisfactory completion of the training.

SD 03 TRAINING OF USER CLIENT PERSONNEL

The Contractor's training shall include training of the User Client's operators on biannual basis to acquaint them with operating of installations (especially electrical and mechanical systems). The training sessions shall comprise lectures and on-site (hands-on) demonstrations, and shall be conducted over two-day periods. The Contractor shall liaise with the Engineer to prepare for the correct number of trainee operators.

The content of training courses for operators shall include the essential features of operating the installation, as also described in the Operating and Maintenance Manuals.

Completion of an installation shall, in terms of the Contract Data, be subject to successful completion of training. The training course shall also be based on the Operating and Maintenance Manuals. No training shall commence without the Engineer's approval of the final draft Operating and Maintenance Manual for the particular installation.

SD 04 TRAINING OF MAINTENANCE PERSONNEL

The Contractor shall train either his own employees, or local labourers, with regard to maintenance of the installation.

The training of maintenance managers shall include the following aspects:

(a) Awareness of safety, health and personal hygiene in terms of the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993);

(b) functioning of the installation, including all its systems, services, parts of buildings and infrastructure;

(c) all specific tasks related to routine preventative maintenance;

(d) interpretation and understanding of Operating and Maintenance Manuals with specific reference to requirements in cases of corrective and breakdown maintenance, and

(e) repair/reconditioning and installation/construction of equipment and materials forming part of an installation.

SD 05 MEASUREMENT AND PAYMENT

SD.01 DEVELOPMENT OF A SYLLABUS FOR TRAINING OF OPERATORS ....Unit: sum

The unit of measurement shall be the sum for the compilation of a training syllabus for each installation/ sub-installation that shall be measured separately in the Bill of Quantities.

The sum bid shall include full compensation for identification of pre-qualification criteria and training needs, staff assessment and evaluation prior to training, all technical research, development and compilation of an accredited training course and course material, and all other actions necessary for commencement of official training sessions in accordance with the specification.

The sum bid shall also include full compensation for the compilation of a draft syllabus and for incorporation of all the Engineer's comments and corrective requirements.

SD.02 **PRESENTING A TRAINING COURSE FOR OPERATORS ..... Unit: number**

The unit of measurement shall be the number of training courses presented based on the approved syllabus.

The bid rate shall include full compensation for presenting a two-day training course, including lectures, demonstrations, on-site training and hands-on development and improvement of operators' skills to enable the operators to operate installations safely and efficiently.

The bid rate shall include full compensation for the Contractor's time, appointment of the accredited trainer for the course, and for all material expenses such as paper hand-outs and slides for the whole group of trainees, the number of which shall be determined during development of the training course.

SD.03 **PRESENTING A TRAINING COURSE FOR MAINTENANCE PERSONNEL..... Unit: number**

The unit of measurement shall be the number of training courses presented.

The bid rate shall include full compensation for presenting a two-day training course, including lectures, demonstrations, on-site training and hands-on development, and improvement of maintenance personnel's skills to enable them to maintain and repair installations safely and efficiently at the satisfactory functional condition specified.

The bid rate shall include full compensation for the Contractor's time, appointment of the accredited trainer for the course, and for all material expenses such as paper hand-outs and slides for the whole group of trainees, the number of which shall be determined during development of the training course.

"SECURITY INSTALLATIONS TO THE PERIMETER FENCE, SALLY PORT AND CONTROL ROOM BUILDINGS AT ST ALBANS CORRECTIONAL FACILITY IN GQEBERHA – EASTERN CAPE"

CLIENT **THE INDEPENDENT DEVELOPMENT TRUST** Palm Square Business Park Silverwood House, Bonza Bay Road, Beacon Bay, East London, 5241 **Tel**: 043 711 6000 **Contact Person:** Name: George April Email: GeorgeA@idt.org.za **PRINCIPAL AGENT** Ground Floor, Building 3, Coach House, Bondev Office Park, Royal Elephant Hotel & Conference Centre, Cnr Wierda Road & Willem Botha Street, Eldoraigne, Centurion, Pretoria, RSA	**HEALTH AND SAFETY AGENT** The Built Environment Experts (078) 445 7609 (041) 373 0736 Contact Person: Name: Mr A. Moyo Email**:** admire@tbee.co.za

This specification consists of the following sections:

Preamble

This site-specific health & safety specification has been compiled under the guidelines of the Constitution of the Republic of South Africa, the Occupational Health & Safety Act no. 85 of 1993 as amended (the Act) as well as the Construction Regulations 2014. It must be noted that the specification is an administration instrument and should be used on site to comply with the aforementioned laws, acts, rules or regulations etc in their entirety whether this is implied or stated expressly in this document. Should there be an omission, or any contradiction between this document and the laws, acts, rules or regulations stated herein etc then the laws, acts, rules or regulations etc prevail. Similarly, where this document is mute on a specific health & safety requirement, the laws, acts, rules or regulations etc must be used as the minimum requirement. Should you be uncertain about the specification or any elements contained therein, do not hesitate to contact the health and safety agent.

KEY REFERENCE (Laws, Acts, Rules & Regulations that form part of the specification)

1. The Constitution of the Republic of South Africa
2. Minimum Physical Security Standards
3. Correctional Services Act (Act 111/1998), as amended
4. Rules and regulations for all Contractors and service providers at departmental correctional centres
5. Occupational Health and Safety Act No. 85 of 1993 and Regulations (as amended)
6. Compensation for Injury and Occupational Diseases Act No. 100 of 1993 (as amended)
7. Building agreement as between the Client and the Principal Contractor
8. Prison Incident Management, United Nations
9. South African Roads Traffic Safety Manual (SARTSM) Chapter 2, Volume 13 of 1999
10. Road Traffic Safety Act No. 93 of 1996 (as amended)
11. Construction Specifications & Standards 6.0 for Southern Africa. Hans Wegelin 6th Edition 2010 SANS Code 10400
12. SANS 10400
13. Construction Regulations 2014
14. The latest issue of SABS 0142: "Code of Practice for the Wiring of Premises"
15. The Local Government Ordinance 1939 (Ordinance 17 of 1939) as amended and the municipal by laws and any special requirements of the local supply authority

16. The Fire Brigade Services Act 1987, Act 99 of 1987 as amended
17. The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as amended and relevant proclaimed Regulations (SABS 0400)
18. The Post Office Act 1958 (Act 44 of 1958) as amended
19. The Electricity Act 1984, Act 41 of 1984
20. The Regulations of Local Gas Board(s), including Publications of the SABS Standards and Codes of Practice, with specific reference to GNR 17468 dated 4th October 1997
21. Legislation pertaining to water usage and the environment
22. Legislation governing the use of equipment, which may emit radiation (e.g., X-Rays etc.)
23. Common Law
24. Case law relevant to the works

Key Definitions

"Agent" – means any person who acts as a representative for a client with respect to health and safety matters related to the works.

"Client'' – means any person for whom construction work is performed I.E., the Employer appointing the PC.

Any word or expression to which a meaning has been assigned in the Occupational Health and Safety Act (Act No. 85 of 1993) accompanied by the Construction Regulations (2014) shall have the meaning so assigned to it unless the context otherwise indicates.

'**'Criminal Record''**- A list of a person's previous criminal convictions, including pending cases, reported misdemeanors etc.

"**Construction manager"** means a competent person responsible for the management of the physical construction processes and the coordination, administration, and management of resources on a construction site.

"**Construction site"** means a workplace where construction work is being performed i.e., the site indicated in the site layout plan.

"**Construction supervisor"** means a competent person responsible for supervising construction activities on a construction site.

"Construction work" means any work in connection with -
the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure; or the construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system; or the moving of earth, clearing of land, the making of excavation, piling, or any similar civil engineering structure or type of work.

“Contractor” –means an employer who performs construction work;

"Designer" means-
a competent person who-

- prepares a design.
- checks and approves a design.
- arranges for a person at work under his or her control to prepare a design, including an employee of that person where he or she is the employer; or
- designs temporary work, including its components.
- an architect or engineer contributing to, or having overall responsibility for a design.
- a building services engineer designing details for fixed plant.
- a surveyor specifying articles or drawing up specifications.
- a Contractor carrying out design work as part of a design and building project; or an interior designer, shopfitter or landscape architect;

"**Excavation work**" means the making of any man-made cavity, trench, pit or depression formed by cutting, digging or scooping.

"Fall protection plan" means a documented plan, which includes and provides for—

- all risks relating to working from a fall risk position, considering the nature of work undertaken.

- the procedures and methods to be applied to eliminate the risk of falling; and
- a rescue plan and procedures.

“Health and Safety File” –means a file, or other record containing the information in writing required by the Construction Regulations as detailed in this site-specific specification

“Health and Safety Plan” –means a site, activity or project specific documented plan in accordance with the client’s health and safety specification.

“Health and Safety Specification” –means a site, activity or project specific document prepared by the client pertaining to all health and safety requirements related to construction work;

inmate” means any person, whether convicted or not, who is detained in custody in any correctional centre or remand detention facility or who is being transferred in custody or is en route from one correctional centre or remand detention facility to another correctional centre or remand detention facility

“Method Statement” –means a document detailing the key activities to be performed in order to reduce as reasonably as practicable the hazards identified in any risk assessment;

"Principal Contractor" (PC) means an employer appointed by the client to perform construction work

“Risk Assessment” –means a program to determine any risk associated with any hazard at a construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard.

"National Building Regulations" means the National Building Regulations made under the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), and promulgated by Government Notice No. R. 2378 of 30 July 1990, as amended by Government Notices No's R. 432 of 8 March 1991, R. 919 of 30 July 1999 and R. 547 of 30 May 2008;

"Structure" means—
any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, bulk mixing plant, pylon, surface and underground tanks, earth retaining structure or any structure designed to preserve or alter any natural feature, and any other similar structure;

- any falsework, scaffold or other structure designed or used to provide support or means of access during construction work; or
- any fixed plant in respect of construction work which includes installation, commissioning, decommissioning or dismantling and where any construction work involves a risk of a person falling;

NB

- Due to the high-level risk involved in this facility, the principal Contractor / Contractor is advised to establish a disciplinary and dismissal procedure for personnel who do not adhere to these procedures
- Employees, suppliers and consultants (public) must be informed of the risks of entering the Prison facility. Furthermore, the Contractor must inform the public how to react in the event of an emergency on site, an attack or escape by an inmate etc. Further, a construction works related site induction must be undertaken. The process must be concluded whereupon an indemnity agreement is signed absolving the Employer or agent from any liability as so caused by the signatory's presence on site.

The Purpose of the Site-Specific Health and Safety Specification (SSHSS)

The SSHSS is a project specific document prepared by the Client pertaining to all health and safety requirements to be met by the Principal Contractor for this specific project. The SSHSS highlights the health and safety aspects to be implemented by the Principal Contractor over and above the minimum requirements of current laws. The Principal Contractor is responsible for all health and safety concerning the execution of the works as described hereto accompanied by the applicable health and safety legislation. A Mandatary Agreement in terms of Section 37.2 of the OHSA will be signed between the Principal Contractor and Client prior to the commencement of any works.[1]

In brief the SSHSS serves the following:

- To indicate the scope of work and how it impacts on health and safety
- To indicate the required submissions on health and safety matters (Principal Contractor and Contractors);
- To indicate the safety considerations affecting the project specific site
- To indicate the safety considerations concerning the project environment
- To indicate the risks associated therewith and the health and safety aspects of the associated buildings, structures and equipment
- To indicate the processes and procedures involved in submissions and requests of health and safety matters
- To ensure the Principal Contractor (and his /her Contractor) are fully aware of what is expected with regards to the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and the Construction Regulations 2014 made there-under including the applicable safety standards, and in particular in terms of Section 6,7 and 8 of the construction regulations (2014).

[1] Mandatory Agreement to be signed and attached in health and safety file

- To inform the Principal Contractor that the Occupational Health and Safety Act, 1993 (Act 85 of 1993) in its entirety shall apply to the contract to which this specification document applies as well as the Construction Regulations 2014 promulgated on 07 February 2014.
- To establish the minimum requirements of the Principal Contractor's (and his /her Contractors) health & safety plan/s.
- To provide the PC with a comprehensive qualitative risk assessment, indicative systems of work and method statements

PROJECT SUMMARY

The project will be executed at St Albans Prison, in St Albans, Gqeberha. The Prison provides humane incarceration of inmates, rehabilitation and social reintegration of offenders. The primary security objective of the facility is to provide safety of employees, offenders and the community. The Contractor must uphold these objectives from inception to handover of the works[2].

The project comprises the complete installation of a building management system, access control, intrusion and video surveillance. Details of the design will be provided by the appointed contractor together with all related health and safety requirements pertaining to the design and installation

[2] The Department of Correctional Services

LAYOUT

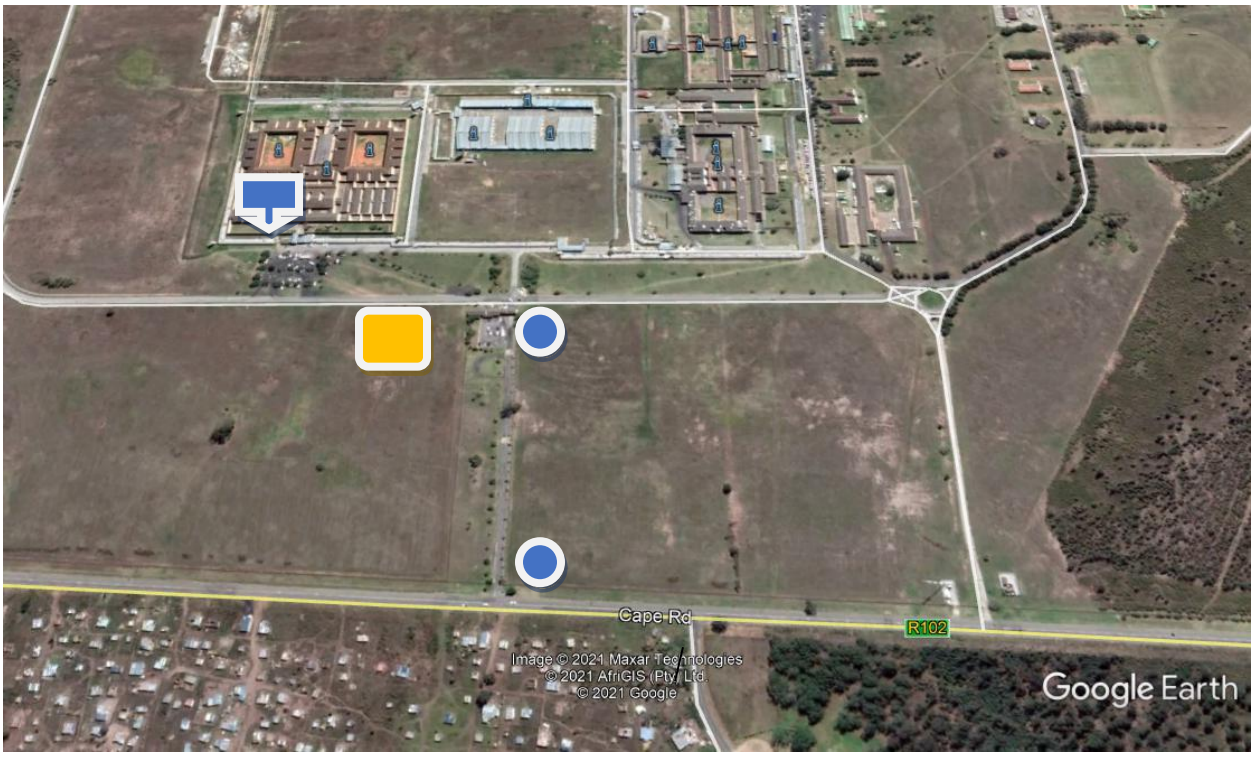
Fig 1: Site Layout of St Albans Prison

The works will only commence after the Department of Labour issues a work permit for the site or alternatively accepts the extension of the existing permit for the fencing works. In turn, the entire works are to be divided into sub sections with a permit (internal) to work for every work section. All employees to obtain security clearance. Ad hoc searches to be conducted for contraband etc by Contractor, prison staff and or Employer Health and Safety Agent

Fig 2: Site Office and Work Sections

Proposed site camp surrounded by hoarding as described in the bills of quantities

Fig 3: Entry and Exit



Main entrance – Site movement and traffic control plan to be discussed and signed off with Prison facility. Contractors' workers to be in official overall or work suit outfit in one uniform colour (not orange). This extends to management staff. Name tags and photo identity documents to be in right beast pocket and clearly visible

Contractor to submit schedule of employees and consultants to be involved in the works with certified copies of identity documents to prison management and security. Prison security to have a file of personnel involved in the project. Daily COVID 19 screening and clearance forms to be submitted to prison security and filed before employees enter site. Roll call to be conducted between 7.00 am and 8 am. Workers must enter site in a co-ordinated manner via Contractors' vehicle and exit in the same manner with a full body count. No one may enter the site on foot and walkabout. Furthermore, none of the consultants or sub-Contractors entering site may do so

without a full certificate of clearance issued by the Contractor. These parties (in particular female or vulnerable persons) must be accompanied by the Contractor's security staff to work sections

HIGH RISK ISSUES

The Principal Contractor / Contractors (Contractor)s is obliged to demonstrate in the health and safety plan who the following risks will be eliminated as a consequence of the works:

- Inmates escaping and harming the public
- Injury to inmates and jail staff because of unsafe conditions
- Inmates and prison staff being victimized by inmates
- Damage to prison facilities or equipment

The health and safety plan must clearly indicate how the works will be conducted with the following objectives addressed

1. Safety – how will the Contractor provide a safe environment for the prison community?
2. Order – What are the activity-based outcomes and how will accountability be achieved?
3. Security – How will project participants be kept safe for all work activities i.e., construction works, site visits, inspections etc (project programme activity specific detail is required)
4. Administration – What documentation is required for all activities i.e., external and internal permits, roll call templates, search procedure (female v male etc)
5. Emergencies – What will be done if there is a prison lockdown or an escape
6. Report daily and weekly incidents, accidents, near misses etc (Liase with agent to compile template)

In order to address the above matters, the Contractor must as a minimum allow for the following:

- Private security industry regulation authority registered security personnel with no previous or pending criminal records
- A fulltime watchman to assist the site security personnel. The duties of the watchman shall be as follows

  - Task and activity observation and reporting
  - Assisting Prison and Contractor security to maintain security check points and dealing directly with suppliers, employees etc for security purposes
  - Patrolling work sections on foot and ensuring employees are working safely and securely, as well as following and enforcing site visitor check-in procedures
  - Permitting authorized visitors and stopping unauthorized visitors' access, to the works
  - Preventing property damage
  - Reporting any potential safety hazards or risks
  - Keeping alert and detecting offenses, vandalism, trespassing, theft, damages
  - Reporting incidents to the police and prison security
  - Maintaining rules and policies by requiring employees and Contractors to show their badges and IDs when entering the prison property
  - Inspecting vehicles and personal bags as employees leave the site
  - Conducting ad hoc searches

-

- The works must be separated into identifiable work areas e.g., Area A, B, C or D or as per the names preferred by the Prison Authorities The site will be operated on a permit to work system. Each separate identifiable work area requires an internal permit. Each permit to work must be signed off by the Contractor and authorised prison authority before work proceeds. The permit must declare the scope of works, the tools to be used, the number of personnel involved, their identity

numbers, the duration of the work, the risks inherent and the proposed safe work procedure

- No employees will be recruited on site. All employees must be subjected to police / and or prison security clearance. No employee with an existing criminal record or pending criminal matter must be allowed on site
- The Contractor/s staff must be kept separate from the workforce of other Contractors. No exchange of employees or assistance (lending a hand) will be permitted
- Tool management – A tools inventory must be compiled and updated daily. A tools audit must be conducted before and after every shift to account for all work tools. All audit outcomes must be filed and any missing tools must be immediately reported to prison authorities with a full description of the tool and the employee who was assigned the tool with an including the possible area in which it was lost
- Escape by one or more prisoners as occasioned by the Contractors or his personnel's negligence and how personnel on site will be protected from harm
- Socio / political threat on and off site and how personnel on site will be protected from harm
- Escape by one or more prisoners not so caused by the Contractor and how personnel on site will be protected from harm
- Lockdown of the facility and how the works and personnel will be kept safe
- Unauthorized entry into the facility by Contractors' personnel
- Unauthorized movement within the facility by people looking for work or visitors
- Unauthorised entry and movement on site as a result of the construction works
- The prohibited introduction of contraband into the facility by Contractors' personnel – the frequency of ad hoc inspections and personnel search procedure must be detailed
- How inmate assault on Contractors' personnel, client personnel or consultant staff will be eliminated
- How the Contractor will handle unplanned disturbance or riot on site
- How the Contractor will deal with an external attack on the facility

The Principal Contractor must clearly demonstrate how these matters will be dealt with in the health and safety plan in detail including the attachment of templates to deal with the same (e.g., Ad hoc search procedures or tools Audits). Contingency plans must be provided for each instance

Furthermore, the Contractor must undertake a comprehensive study with the assistance of the prison to determine the probable sources of contraband (Contraband Survey) that may arise as a result of the works and how these sources will be eliminated. As such, the contraband survey will form part of the health and safety plan and it must list the type of contraband that is prevalent in the facility and how the works will be managed to ensure that they do not become a source of contraband

The following construction related issues must be addressed in the health and safety plan:

NB: The works entail certain demolitions and removals. All items that will be removed from buildings i.e., bolts, cables, bricks etc are potential weapons or possible escape tools or contraband and must be disposed off immediately or kept in a secure lockable refuse area that is at least 1 km away from the physical reach of inmates and or the public

1. **Mobile Vehicles (For lifting or deliveries etc)** – The Contractor must warn and/or schedule structured induction sessions for his employees, staff, end-user and interested parties about work on site and the presence, effect and risks posed by mobile vehicles and equipment. Access to and from site must be coordinated and standardized with the prison. All vehicles must have permits to access site. Reversing on site, in particular the main entrance area, or areas that are open to the public should be avoided as it causes a risk of injury to personnel or damage to buildings which may result in security breaches. In the unlikely event that reversing is the only option to manoeuvre this must be done under the care and supervision of a competent traffic controller and flagman. In conclusion, the Contractor must clearly demonstrate how s/he will deal with aspect of the works.

2. **Falls** – The structures to be completed, renovated are mostly single storey structures. The estimated maximum building heights (sally port) exceeding **4 to 12** metres or higher at most and will entail work at height. As a result, the health and safety plan must guard against falls and present a detailed fall protection plan that details the type of fall arrest and prevention systems to be used eg scaffolding, ladders etc. The Contractor must appreciate that work at height equipment may be used as a means of escape or as weapons. Ladders and scaffolding etc must therefore be removed or dismantled after work is completed or be shifted to an extent that it can be used for other purposes by inmates or the public. The Contractor must clearly demonstrate how s/he will deal with aspect of the works.

3. **Electrical and Mechanical Installation** - New electrical and mechanical installations will have to be put in place. In certain instances, connecting to existing services or replacement of old and outdated installations will be required. The Contractor must undertake a survey of existing installations with the assistance of the relevant professional and indicate how he will guard against damaging infrastructure, causing accidents and or incidents in this regard. The contractor must appreciate that damaging infrastructure may lead to security breaches e.g., loss of power or provision of power where it is not required. This may enable inmates to escape or contemplate escaping. The Contractor must clearly demonstrate how s/he will deal with aspect of the works.

4. **Falling material and collapses** – The Contractor will have to erect scaffolding for the works. Tools and various work objects will probably be placed on these platforms thereby presenting a risk of falling material and collapses. These temporary structures must also be erected by specialists and certified as being fit for use. The Contractor must clearly demonstrate how s/he will deal with this aspect of the works.

5. **Trips** – The Contractor will have to manage his/her access routes as there is a possibility that people may trip in footpaths. The Contractor must clearly demonstrate how s/he will deal with this aspect of the works.

6. **Manual handling**- The Contractor is expected to use manual labour for various trades such as laying of brickwork, paving and or concrete work (repairs and new work), loading of rubble etc. The Contractor must clearly demonstrate how s/he will deal with aspect of the works.

7. **Noise and vibrations** – High levels of noise are expected as the Contractor will most likely use power tools in the following areas, demolitions etc. The Contractor must clearly demonstrate how s/he will deal with aspect of the works.

8. **Chemicals** – The Contractor will use several chemicals and solvents for the works. Some chemical may in isolation or combination be used as a means of escape or possibly be harmful to inmates or be used for the purposes of intoxication. The Contractor must submit a schedule of all the chemicals he intends to use before using them on site for the Prison facilities records and approval. Material data sheets are to be supplied to the Health and Safety Agent prior to the commencement of work. The safe work procedures, precautions and ppe indicated in the material data sheet should be adhered to as a minimum. Furthermore, the Contractor must clearly demonstrate how she/he will deal with aspect of the works.

10. **Decanting**

The Contractor should liaise with the Prison facility via the Principal Agent to coordinate their programmes and compile decanting plans. Contractor to present their decanting plans in the health and safety plan

11. **Work Section Preparedness**

- The Contractor shall set aside and use the following for each work section
- Two-way radio communication
- Cell phone communication
- Uninterrupted power supply/generator
- Emergency lighting/torches

- Display Emergency contact numbers for the Prison Authority, Hospital, Ambulance and Police
- Fire extinguishers (kept in lockable container)
- First aid kit (kept in lockable container)

PROJECT SPECIFIC ADMINISTRATIVE AND LEGAL REQUIREMENTS TO BE IMPLEMENTED BY THE PC			
OHS Act Section/ Regulation	**Subject**	**Requirements**	**Comment**
General Admin Regulations 4	Copy of OH&S Act (Act 85 of 1993)	Updated copy of Act & Regulations available on site. Readily available for perusal by employees.	Contractor to advertise up to end of contract
COID Act Section 80	Registration with Compensation Insurer	Written proof of registration/Letter of good standing available on Site	
Construction Regulations 5(1)	SHE Specification and Program	SHE Spec received from Client and/or its Agent SHE Program developed and updated.	
Section 8(2)(d) of the OHS Act and Regulations 5(1) & 7 of the Construction.	Hazard Identification & Risk Assessment	Identifications of hazards/Recorded Risk Assessment and – Plan drawn up/Updated Risk Assessment Plan available on-Site Employees/Contractors informed/trained	
Section 16(2)	Assigned duties (Managers)	Responsibility of complying with the OH&S Act assigned to other person/s by CEO.	
Construction Regulations 8(1)	Designation of Person Responsible on Site	Competent person appointed in writing as Construction Manager with job description	
Construction Regulations 8(2)	Designation of Assistant for above	Competent person appointed in writing as Assistant Construction Manager with job description	

Section 17 & 18 General Administrative Regulations 6 & 7	Designation of SHE Representatives	More than 20 employees - one H&S Representative, one additional H&S Rep. for each 50 employees or part thereof. Designation in writing, period and area of responsibility specified in terms of GAR 6 & 7 Meaningful H&S Rep. reports. Reports actioned by Management.
Section 19 & 20 General Administrative Regulations 5	Health & Safety Committee /s	SHE Committee/s established. All SHE Reps shall be members of SHE Committees Additional members are appointed in writing. Meetings held monthly; Minutes kept. Actioned by Management.
Section 37(1) & (2)	Agreement with Mandatories/ Contractors	Written agreement with Contractors List of Contractors displayed. Proof of Registration with Compensation Insurer/Letter of Good Standing (COID) Construction Manager designated Written arrangements regarding SHE Reps and Committee (OHSA Section 17,18) Written arrangements for First Aid (COID)
Section 24 & General Admin. Regulation 8, Construction Regulations 5(3) & COID Act Sect.38, 39 & 41	Reporting of Incidents (Dept. of Labour)	Incident Reporting Procedure displayed. All incidents in terms of Sect. 24 reported to the Provincial Director, Department of Labour, within 3 days. (Annexure 1)(WCL 1 or 2) and to the Client and/or its Agent on its behalf Cases of Occupational Disease Reported Copies of Reports available on-Site Record of First Aid injuries kept
General Admin. Regulations 9	Investigation and Recording of Incidents	All injuries which resulted in the person receiving medical treatment other than first aid, recorded and investigated by investigator designated in writing. Copies of Reports (Annexure 1) available on Site Tabled at H&S Committee meeting Action taken by Site Management.
Construction Regulations 10	Fall Prevention & Protection	Competent person appointed to draw up and supervise the Fall Protection Plan Proof of appointee's competence available on Site Risk Assessment

		carried out for work at heights Fall Protection Plan drawn up/updated and available on Site
Construction Regulations 10(5)	Roof work	Competent person appointed to plan & supervise Roof work. Proof of appointee's competence available on Site Risk Assessment carried out Roof work Plan drawn up/updated Roof work inspect before each shift. Inspection register kept Employees medically examined for physical & psychological fitness. Written proof on site
Construction Regulations 11	Structures	Information re. the structure being erected received from the Designer including: geo-science technical report where relevant the design loading of the structure the methods & sequence of construction anticipated dangers/hazards/special measures to construct safely Risk Assessment carried out Method statement drawn up All above available on Site

		Structures inspected before each shift. Inspection's register kept
Construction Regulations 12	Temporary Works	**Competent persons appointed in writing to:** - Inspect structures - Ensure that design is followed
Construction Regulations 13	Excavations	Competent person/s appointed in writing to supervise and inspect excavation work Written Proof of Competence of above appointee/s available on Site Risk Assessment carried out Inspected: - before every shift - after any blasting - after an unexpected fall of ground - after any substantial damage to the shoring - after rain. Inspection's register kept Method statement developed where explosives will be/ are used
Construction Regulations 14	Demolition Work	Competent person/s appointed in writing to supervise and control Demolition work Written Proof of Competence of above appointee/s available on Site Risk Assessment carried out Engineering survey and Method Statement available on-Site Inspections to prevent premature collapse carried out by competent person before each shift. Inspection register kept
Construction Regulations 16	Scaffolding	**Competent persons appointed in writing to:** - erect scaffolding (Scaffold Erector/s) - act as Scaffold Team Leaders - inspect Scaffolding weekly and after inclement weather (Scaffold Inspector/s) Written Proof of Competence of above appointees available on Site. Copy of SABS 085 available on-Site Risk Assessment carried out. Inspected weekly/after bad weather. Inspection register/s kept

Construction Regulations 22/ Driven Machinery Regulations 18 & 19	Lifting Machines	Competent person appointed in writing to inspect Cranes, Lifting Machines & Equipment Written Proof of Competence of above appointee available on Site. Cranes & Lifting tackle identified/numbered Register kept for Lifting Tackle Log Book kept for each individual Crane **Inspection**: - All cranes - daily by operator - Tower Crane/s - after erection/ 6 monthly - Other cranes - annually by comp. person - Lifting tackle (slings/ropes/chain slings etc.) - daily or before every new application
Construction Regulations 24/Electrical Machinery Regulations 9 & 10/ Electrical Installation Regulations	Inspection & Maintenance of Electrical Installation & Equipment (including portable electrical tools)	**Competent person appointed** in writing to inspect/test the installation and equipment. Written Proof of Competence of above appointee available on Site. Inspections: - Electrical Installation & equipment inspected after installation, after alterations and quarterly. Inspection Registers kept Portable electric tools, electric lights and extension leads must be uniquely identified/numbered. Weekly visual inspection by User/Issuer/Storeman. Register kept.
Construction Regulations 25	Use of temporary storage of flammable liquids on construction site	Flammable liquids must be stored in a way that it does not cause a fire or explosion hazard, and that the workplace is well ventilated. Suitable notices to be posted.

		falling into water and have a rescue plan in case of such incident happening to prevent drowning.
Construction Regulations 27	Housekeeping	Suitable housekeeping measures must be implemented to reduce the risk of injuries and damage to the structures, machinery, etc. Debris must be removed with a chute from a high place. Construction area must be fenced off.
Construction Regulations 28/ General Safety Regulations 8(1)(a)	Designation of Stacking & Storage Supervisor.	**Competent Person/s** with specific knowledge and experience designated to supervise all Stacking & Storage Written Proof of Competence of above appointee available on Site
Construction Regulations 29/ Environmental Regulations 9	Designation of a Person to Co-ordinate Emergency Planning and Fire Protection	Person/s with specific knowledge and experience designated to co-ordinate emergency contingency planning and execution and fire prevention measures Emergency Evacuation Plan developed: - Drilled/Practiced - Plan & Records of Drills/Practices available on-Site Fire Risk Assessment carried out All Fire Extinguishing Equipment identified and on *register*. Inspected weekly. And inspection register kept. Serviced annually
Construction Regulations 30	Employees Facilities	The Contractor must provide and maintain in hygienic condition facilities for employees that include: • Showers (1 for every 15 employees) • Sanitary facilities for each sex (1 for every 30 employees) • Changing facilities for each sex • Sheltered eating areas
General Safety Regulations 3	First Aid	Every workplace provided with sufficient number of First Aid boxes. (Required where 5 persons or more are employed) First Aid freely available Equipment as per the list in the OH&S Act. One qualified First Aider appointed for every 50 employees. (Required where more than 10 persons are employed) List of First Aid Officials and Certificates Name of person/s in charge of First Aid box/es displayed. Location of First Aid box/es clearly indicated.

		Signs instructing employees to report all Injuries/illness including first aid injuries
General Safety Regulations 2	Personal Safety Equipment (PPE)	PPE Risk Assessment carried out Items of PPE prescribed/use enforced Records of Issue kept Undertaking by Employee to use/wear PPE. PPE remains property of Employer, and is not to be removed from the premises GSR 2(4)
General Safety Regulations 9	Inspection & Use of Welding/Flame Cutting Equipment	Competent Person/s with specific knowledge and experience designated to Inspect Electric Arc, Gas Welding and Flame Cutting Equipment Written Proof of Competence of above appointee available on Site All new vessels checked for leaks, leaking vessels NOT taken into stock but returned to supplier immediately Equipment identified/numbered and entered into a register Equipment inspected weekly. Inspection Register kept Separate, purpose made storage available for full and empty vessels

Hazardous Chemical Substances (HCS) Regulations Construction Regulations 25	Control of Storage & Usage of HCS and Flammables	**Competent Person/s** with specific knowledge and experience designated to Control the Storage & Usage of HCS (including Flammables) Written Proof of Competence of above appointee available on Site Risk Assessment carried out Register of HCS kept/used on Site Separate, purpose made storage available for full and empty containers
Construction Regulations 23	Construction Vehicles and Earth Moving Equipment	Operators/Drivers appointed to: - Carry out a daily inspection prior to use - Drive the vehicle/plant that he/she is competent to operate/drive Written Proof of Competence of above appointee available on Site. Record of Daily inspections kept
General Safety Regulations 13A	Inspection of Ladders	**Competent person** appointed in writing to inspect Ladders Ladders inspected at arrival on site and weekly thereafter. Inspection's register kept. Application of the types of ladders (wooden, aluminum etc.) regulated by training and inspections and noted in register
General Safety Regulations 13B	Ramps	**Competent person appointed** in writing to Supervise the erection & inspection of Ramps. Inspection register kept. Daily inspected and noted in register
Asbestos Regulations 2 - 21	Handling, storage, transportation	**All applicable requirements as per scope of work;** **Asbestos regulations 2 - 21**

Education & Training

Subject	Requirement
Company OH&S Policy Section 7(1)	Policy signed by CEO and published/Circulated to Employees Policy displayed on Employee Notice Boards Management and employees committed.
Company/Site SHE Rules (Section 13(a)	Rules published Rules displayed on Employee Notice Boards Rules issued and employees effectively informed or trained: written proof Follow-up to ensure employees understand/adhere to the policy and rules.
Induction & Task Safety Training (Section 13(a)	All new employees receive SHE Induction Training. Training includes Task Safety Instructions. Employees acknowledge receipt of training. Follow-up to ensure employees understand/adhere to instructions.
General SHE Training (Section 13(a)	All current employees receive specified SHE training: written proof Operators of Plant and Equipment receive specified training Follow-up to ensure employees understand/adhere to instructions.

Public Safety, Security Measures & Emergency Preparedness

Subject	Requirement
Notices &Signs	Notices & Signs at entrances / along perimeters indicating **"No Unauthorized Entry".** Notices & Signs at entrance instructing visitors and non - employees what to do, where to go and where to report on entering the site/yard with directional signs. e.g. **"Visitors to report to Office"** Notices & Signs posted to warn of overhead work and other hazardous activities. e.g. **General Warning Signs**
Site Safeguarding	Nets, Canopies, Platforms, Fences etc. to protect members of the public passing / entering the site.
Security Measures	Access control measures/register in operation Security patrols after hours during weekends and holidays Sufficient lighting after dark Guard has access to telephone/ mobile/other means of emergency communication
Emergency Preparedness	Emergency contact numbers displayed and made available to Security & Guard Emergency Evacuation instructions posted up on all notice boards (including employees' notice boards) Emergency contingency plan available on site/in yard Doors

	open outwards/unobstructed Emergency alarm audible all over (including in toilets)
Emergency Drill and Evacuation	Adequate No. of employees trained to use Fire Fighting Equipment. Emergency Evacuation Plan available, displayed and practiced.

Personal Protective Equipment

Subject	**Requirement**
PPE needs analysis	Need for PPE identified and prescribed in writing. PPE remain property of Employer, not to be removed from premises GSR 2(4)
Head Protection 	All persons on site wearing Hardhats including Contractors and Visitors (where prescribed)
Foot Protection 	All employees on site wearing Safety Footwear including Gumboots for concrete / wet work and non-slip shoes for roof work. Visitors to wear same upon request or where prescribed

Eye and Face Protection 	Eye and Face (also Hand and Body) Protection (Goggles, Face Shields, Welding Helmets etc.) used when operating the following: • Angle Grinders • Electric Drills (Overhead work into concrete / cement / bricks • Explosive Powered tools • Hammers & Chisels • Cutting / Welding Torches • Cutting Tools and Equipment
Hearing Protection 	Hearing Protectors (Muffs, Plugs etc.) used when operating the following: • Explosive Powered Tools
Hand Protection 	Protective Gloves worn by employees handling / using: • Cement / Bricks / Chemicals • Hammers & Chisels
Respiratory Protection 	Suitable/efficient prescribed Respirators worn correctly by employees handling / using: • Dry cement • Dusty areas • Hazardous chemicals • Angle Grinders
Fall Prevention Equipment 	Suitable Safety harnesses / Fall Arrest Equipment correctly used by persons working on / in unguarded, elevated positions e.g.: • Scaffolding • Edge work • Ring beam edges etc. Other methods of fall prevention applied e.g. catch nets
Protective Clothing 	All jobs requiring protective clothing (Overalls, Rain Wear, Welding Aprons etc.) Identified and clothing worn. Disposable overalls when Asbestos is handled.

PPE Issue & Control	Identified Equipment issued free of charge. All PPE maintained in good condition. (Regular checks). Workers instructed in the proper use & maintenance of PPE. Commitment obtained from wearer accepting conditions and to wear the PPE. Record of PPE issued kept on H&S File. PPE remain property of Employer, not to be removed from premises GSR 2(4) Asbestos Regulations, 2001 section 22(b)

Housekeeping

Subject	Requirement
Scrap Removal System	All items of Scrap/Unusable Off-cuts/Rubble and redundant material removed from working areas on a regular basis. (Daily) Waste removal to comply with Asbestos regulations section 20. Nothing thrown/swept over sides. Scrap disposed of in designated containers/areas Removal from site/yard on a regular basis. Walkways, roadways, doorways to remain unobstructed.
Stacking & Storage (See Section 1 for Designation & Register)	<u>Stacking:</u> * Stable, on firm level surface/base. * Prevent leaning/collapsing * Irregular shapes bonded * Not exceeding 3x the base * Stacks accessible * Remova l from top only. <u>Storage:</u> * Adequate storage areas provided. * Functional – e.g. demarcated storage areas/racks/bins etc. * Special areas identified and demarcated e.g. flammable gas, cement etc. * Neat, safe, stable and square. * Store/storage areas clear of superfluous material. * Storage behind sheds etc. neat/under control. * Storage areas free from weeds, litter etc.
Waste Control/Reclamation	Re-usable off-cuts and other re-usable material removed daily and kept to a minimum in the work areas. All re-usable materials neatly stacked/stored in designated areas. (Nails removed/bent over in re-usable timber). Issue of hardware/nails/screws/cartridges etc. controlled and return of unused items monitored.
Contractors (Housekeeping)	Contractors required to comply with Housekeeping requirements.

Working at Heights

Subject	Requirement
Openings	Unprotected openings adequately guarded/fenced/barricaded/catch nets installed
Roof work	Roof work discontinued when bad/hazardous weather Fall protection measures (including warning notices) when working close to edges or on fragile roofing material Covers over openings in roof of robust construction/secured against displacement

Scaffolding / Formwork / Support Work

Subject	**Requirement**
Access/System Scaffolding	• Foundation firm / stable • Sufficient bracing. • Tied to Structure/prevented from side or cross movement • Platform boards in good condition/sufficient/secured. • Handrails and toe boards provided. • Access ladders / stairs provided. • Area/s under scaffolding tidy. • Safe/unsafe for use signs • Complying with OH&S Act/SABS 085
Free Standing Scaffolding	• Foundation firm / stable • Sufficient bracing. • Platform boards in good condition/sufficient/secured. • Handrails and toe boards provided. • Access ladders / stairs provided. • Area/s under scaffolding tidy. • Safe/unsafe for use signs • Height to base ratio correct • Outriggers used /tied to structure where necessary • Complying with OH&S Act/SABS 085
Mobile Scaffolding	• Foundation firm / stable • Sufficient bracing. • Platform boards in good condition/sufficient/secured. • Handrails and toe boards provided. • Access ladders / stairs provided. • Area/s under scaffolding tidy. • Safe/unsafe for use signs
Mobile Scaffolding	• Wheels / swivels in good condition • Brakes working and applied. • Height to base ratio correct. • Outriggers used where necessary • Complying with OH&S Act/SABS 085

Edges & Openings	• Edges barricaded to acceptable standards. • Manhole openings covered / barricaded. • Openings in floor / other openings covered, barricaded/fenced. • Stairs provided with handrails.

Ladders

Subject	Requirement
Physical Condition / Use & Storage	• Stepladders - hinges/stays/braces/stiles in order. • Extension ladders - ropes/rungs/stiles/safety latch/hook in order. • Extension / Straight ladders secured or tied at the bottom / top. • No joined ladders used • Wooden ladders are never painted except with varnish • Aluminum ladders NOT to be used with electrical work • All ladders stored on hooks / racks and not on ground. • Ladders protrude 900 mm above landings / platforms / roof. • Fixed ladders higher than 5 m have cages/Fall arrest system

Electricity (as part of, or additional to the manual "Safety & Switching Procedures for Electrical Installations" - see attached document)

Subject	Requirement
Electrical Distribution Boards & Earth Leakage	• Color coded / numbered / symbolic sign displayed. • Area in front kept clear and unobstructed. • Fitted with inside cover plate / openings blanked off / no exposed "live" conductors / terminals/Door kept close • Switches / circuit breakers identified. • Earth leakage protection unit fitted and operating. • Tested with instrument: Test results within 15 – 30 milliamps • Aperture/Opening/s provided for the plugging in and removal of extension leads without the need to open the door • Apertures and openings used for extension leads to be protected against the elements and especially rain.
Electrical Installations & Wiring	Temporary wiring / extension leads in good condition / no bare or exposed wires. Earthing continuity / polarity correct: Looking at the open connectors to connect the wiring, the word "Brown" has the letter 'R' in it, so the b'R'own wire connects to the 'R'ight hand connector. "Blue" has the letter 'L' in it, so the b'L'ue wire connects to the 'L'eft hand connector. Cables protected from mechanical damage and moisture. Correct loading observed e.g. no heating appliance used from lighting circuit etc. Light fittings/lamps protected from mechanical damage/moisture. Cable arrestors in place and used inside plugs

Physical condition of Electrical Appliances & Tools	Electrical Equipment and Tools: (includes all items plugging in to a 16 Amp supply socket) Insulation / casing in good condition. Earth wire connected/intact where not of double insulated design Double insulation mark indicates that no earth wire is to be connected. Cord in good condition/no bare wires/secured to machine & plug. Plug in good condition, connected correctly and correct polarity.

Emergency and Fire Prevention and Protection

Subject	Requirement
Fire Extinguishing Equipment 	Fire Risks Identified and on record The correct and adequate Fire Extinguishing Equipment available for: Offices General Stores Flammable Store Fuel Storage Tank/s and catchment well Where flammable substances are being used / applied. * Equipment Easily Accessible
Maintenance	Fire equipment checked minimum monthly, serviced yearly
Location & Signs	Fire Extinguishing Equipment: Clearly visible Unobstructed Signs posted including “No Smoking” / “No Naked Lights” where required. (Flammable store, Gas store, Fuel tanks etc.)
Storage Issue & Control of Flammables (incl. 	Storage Area provided for flammables with suitable doors, ventilation, bund etc. Flammable store neat / tidy and no Class A combustibles. Decanting of flammable substances carried out in ignition free and adequately ventilated area. Container bonding principles applied Only sufficient quantities issued for one task or one day’s usage Separate, special gas cylinder store/storage area. Types of Gas Cylinders clearly identified as well as the storage area and stored separately. Full cylinders stored separately from empty cylinders. All valves, gauges, connections, threads of all vessels to be checked regularly for leaks. Leaking acetylene vessels to be returned to the supplier IMMEDIATELY.
Storage, Issue & Control of Hazardous Chemical Substances (HCS) 	HCS storage principles applied: products segregated Only approved, non-expired HCS to be used Only the prescribed PPE shall be used as the minimum protection Provision made for leakage/spillage containment and ventilation Emergency showers/eye wash facilities provided HCS under lock & key controlled by designated person Decanted/issued in containers as prescribed with information/warning labels Disposal of unwanted HCS by accredited disposal agent No dumping or disposal of any HCS on or inside the storage area or anywhere else on the project site All vessels or containers to be regularly checked for leaks

Tools

Subject	Requirement
Hand Tools	<u>Shovels / Spades / Picks:</u> • Handles free from cracks and splinters • Handles fit securely • Working end sharp and true <u>Hammers:</u> • Good quality handles, no pipe or reinforcing steel handles. • Handles free from cracks and splinters • Hand les fit securely <u>Chisels:</u> • No mushroomed heads / heads chamfered • Not hardened • Cutting edge sharp and square <u>Saws:</u> • Teeth sharp and set correctly • * Correct saw used for the job
Explosive Powered Tools.	• Only used by trained / authorized personnel. • Prescribed warning signs placed / displayed where tool is in use. • Work area must be properly isolated/demarcated during use of tool. • Inspected at least monthly by competent person and results recorded. • Issue and return recorded including cartridges / nails and unused cartridges / nails / empty shells recorded. • Cleaned daily after use.

Transport & Materials Handling Equipment

Subject	Requirement
Site Vehicles	All Site Vehicles, Dumpers, Bobcats, Loaders etc.; checked daily before use by driver / operator. Inventory of vehicles used/operated on site Inspection by means of a checklist / result recorded. No persons riding on equipment not designed or designated for passengers. Site speed limit posted, enforced and not exceeded. Drivers / Operators trained / licensed and carrying proof. No unauthorized persons allowed to drive / operate equipment.

Site Plant and Machinery

Subject	Requirement
Brick Cutting Machine	Operator Trained. Only authorized persons use the machine. Emergency stop switch clearly marked and accessible. Area around the machine dry and slip/trip free/clear of off-cuts All moving drive parts guarded/electrical supply cable protected Operator using correct PPE - eye/face/hearing/foot/hands/body.
Electric Arc Welder	Welder Trained. Only authorized / trained persons use welder. Earth cable adequately earthed to work. Electrode holder in good condition/safe Cables, clamps & lugs/connectors in good condition. Area in which welding machine is used is dry/protected from wet. Welder using correct PPE - eye/ face/foot/body/respirator. Correct transparent screens & warning signs placed
Concrete Mixer / Batch Plant	Top platform provided with guardrails. Dust abatement methods in use. Operators using correct PPE - eye / hands / respirators. All moving drive parts guarded. Emergency stops identified / indicated and accessible. Area kept clean/dry/and free from tripping and slipping hazards. Operator’s overseer identified and crane signals displayed and used.

Plant & Storage Yards/Site Workshops Specifics

Subject	Requirements
Section 8(2)(1) General Machinery Regulation 2(1): Supervision of the Use & Maintenance of Machinery	Person/s with specific knowledge and experience designated in writing to supervise the Use & Maintenance of Machinery. Critical items of Machinery identified/numbered/placed on register/inventory. Inspection/maintenance schedules for abovementioned. Inspections/maintenance carried out to above schedules. Results recorded.
General Machinery Regulation 9(2): Notices re. Operation of Machinery	Schedule D Notice posted in Work areas.
Pressure Equipment Regulation 13(1)(b): Supervision of the Use & Maintenance of Vessels under Pressure or Pressure Equipment	Person/s with specific knowledge and experience designated in writing to supervise the Use &Maintenance of Pressure Equipment. Pressure Equipment identified/numbered/placed on register/Manufacturers plate intact.Inspection/maintenance carried out according to schedule. Results recorded/Test certificates available.
Lock-out Procedure	Lock-out procedure in operation
Ergonomics	Ergonomics survey conducted – results on record. Survey results applied.
Demarcation & Color Coding	Demarcation principles applied All services, pipes, electrical installation, stop-start controls, emergency controls etc. colour coded to own published or SABS standard Employees trained to identify colour coding
Portable & Bench Grinders	Area around grinder clear/trip/slip free Bench grinders mounted securely/grinder generally in good condition/No excessive vibration On/Off switch/button clearly demarcated/accessible Adequate guards in place Tool rest – secure/square/max. 2 mm gap, perpendicular to drive shaft Stone/disk - correct type and size/mounted correctly/dressed Use of Eye protection enforced
Battery Storage & Charging	Adequately ventilated, ignition free room/area/no smoking sign/s Batteries placed on rubber/wooden surface Emergency shower/eye wash provided No acid storage in area Prescribed methods in place and adhered to when charging batteries
Ancillary Lifting Equipment	Chain Blocks/Tirfors/jacks/mobile gantries etc. identified/ numbered on register Chains in good condition/links no excessive wear/checked daily Lifting hooks – throat pop marked/safety latch fitted SWL/MML marked/displayed
Presses/Guillotines/ Shears	Only operated by trained/authorised persons Interlocks/lock-outs fitted/PPE worn or used at all times

Workplace Environment, Health and Hygiene

Subject	Requirement
Lighting	Adequate lighting in places where work is being executed e.g. stairwells and basements. Light fittings placed / installed causing no irritating/blinding glare. Stroboscopic effect eliminated (not only reduced) where moving objects or machinery is used
Ventilation	Adequate ventilation / extraction / exhausting in hazardous areas e.g. chemicals / adhesives
Noise	Tasks identified where noise levels exceeds 85 dB at any one time. All reasonable steps taken to reduce noise levels at the source.Hearing protection used where noise levels could not be reduced to below 85 dB.
Heat Stress	Measures in place to prevent heat exhaustion in heat stress problem areas e.g. steel decks, when the WBGT index reaches 30. Cold drinking water readily available at all times.
Ablutions	Sufficient hygiene facilities provided - 1 toilet per 10 employees (National Building Regulations prescribe chemical toilets for Construction sites).Toilet paper available. Sufficient showers provided. Facilities for washing hands provided. Soap/cleaning agent available for washing hands.Means of drying hands available. Lock-up changing facilities / area provided.Ablution facilities kept hygienic and clean.
Eating / Cooking Facilities	Adequate storage facilities provided. Weather protected eating area provided, separate from changing area. Refuse bins with lids provided. Facilities kept clean and hygienic.
Pollution of Environment	Measures in place to minimize dust generation. Accumulation or littering of empty cement pockets, plastic wrapping / bags, packing materials etc. prevented. Spillage / discarding of oil, chemicals and diesel into storm water and other drains or into existing or newly dug holes/cavities on site expressly prohibited.
Hazardous Chemical Substances	All substances identified and list available e.g. acids, flammables, poisons etc. Material Safety Data Sheets (MSDS) indicating hazardous properties and emergency procedures in case of incident on file and readily available. Substances stored safely. Expiry dates meticulously checked where applicable.

The principal Contractor must request, study, understand, review and adopt the existing all the existing correctional services policies rules and regulations http://www.dcs.gov.za/?page_id=172. The Principal Contractor must therefore ensure that all necessary health and safety provisions are catered for in terms of the Employers existing or implied health and safety policies. In all activities the PC must therefore provide

- a safe place of work
- provide safe plant and equipment
- provide a safe system of work
- provide competent criminal record free employees including the provision of adequate supervision, instruction and training

In order to implement these safety requirements, the Principal Contractor must (provide a plan that indicates how you will deal with the following items) as applied to his own work and that or subcontractors and suppliers (Contractors):

- Follow the principal or health and safety liason (Prison) or representative's health and instructions at all times
- Report arrival and departure from site always to the Health and Safety liason (Prison) or representative
- Discuss the proposed works programme, layout of services, workplace equipment functions and disturbance levels (noise etc), placement of equipment with the prison facility and principal agent and seek approval thereof in writing
- request, study, understand review, adopt and implement the existing health and safety provisions
- Present, discuss and seek approval from the prison for the emergency plan procedures
- Provide identification tags and uniforms for his staff bearing his company logo, pictures and name

- The PC's uniform colours must be distinct from Contractor uniforms (no orange uniform is allowed as it may cause confusion in the facility which may aid in the risk of escape or harm)
- Present, discuss and seek approval from the Prison Manager for the security plan
- Provide the Prison Manager with the project hazard identification and risk assessment profile in a tabulated format
- Carry out regular audits and inspections and report findings to the Prison Manager via the Agent
- Liaise with the Prison 's health and safety officers or Prison Manager at all times regarding the execution of the works, the impact on the daily activities of the Prison as well as the adequacy of the health and safety provisions thereof. Sign off on access and ingress is required prior to the commencement of work activities.
- Report suspected or actual hazards to the Prison 's health and safety liaison or representative and/or Prison Manager immediately
- Report the presence of unknown persons on site immediately
- Report work-related injuries or near miss or concerning incidents to the health and safety agent and health and safety representative or liason and complete requisite paperwork
- Cooperate with the Prison Manager and other members of the management team, the health and safety representative and liason, health and safety committee members (where applicable)
- Ongoing and "refresher" training concerning health and safety on site
- Provide and maintain a functional Prison environment where the staff, and visitors are not exposed to hazards.
- Request for the clients list of notifiable diseases and periods of exclusion thereof e.g., COVID 19

DECLARATIONS

To this end, the health and safety plan must contain an express declaration that the Principal Contractor/ Contractor has received, studied, reviewed and discussed the designs and specification information listed below[3]

Document Type	Declaration	Principal Contractor /Contractor Name Surname & Signature	Drawing/Document No's
Bills of Quantities	I have obtained, studied, reviewed, discussed, filed, will use and update		
Building Condition Assessment	I have obtained, studied, reviewed, discussed, filed, will use and update		
Structural Survey	I have obtained, studied, reviewed, discussed, filed, will use and update		
Demolition's drawings	I have obtained, studied, reviewed, discussed, filed, will use and update		
Architectural Drawings	I have obtained, studied, reviewed, discussed, filed, will use and update		
Structural drawings	I have obtained, studied, reviewed, discussed, filed, will use and update		
Electrical Drawings	I have obtained, studied, reviewed, discussed, filed, will use and update		
Plumbing and Drainage drawings	I have obtained, studied, reviewed, discussed, filed, will use and update		
Finishes schedules	I have obtained, studied, reviewed, discussed, filed, will use and update		
Detail and fixing drawings	I have obtained, studied, reviewed, discussed, filed, will use and update		

[3] In signing the mandatory agreement, the Contractor agrees that he has been furnished with all design information required of him to commence with the works and that he has reviewed the designs

The Principal Contractor shall demonstrate to the Client's Health and Safety Agent that they have the necessary competencies and resources to carry out the work safely. In this respect, the health and safety plan must be accompanied by priced health and safety Bills of Quantities – (refer to attached health and safety bills of quantities) that cater for the provision of adequate health and safety during construction. If a health and safety budget was submitted at tender a breakdown is required

Adequate health and safety can only be achieved on this construction site if all stakeholders adopt the participative approach, that is, if everyone buys into the health and safety management plan. In order for this project to achieve this primary goal the health and safety of all, i.e., Contractor's employees, consultants, prison community, etc must be catered for in accordance to the requirements demands and obligations of the Occupational Health and Safety Act, 85 of 1993 and the Construction Regulations, 2014. As a primary measure the Contractor must issue a printed health and safety motto in English, Afrikaans and IsiXhosa to everyone who will enter the site that reads as follows:

> ***My Health and Safety on and off the site is my responsibility, The Health and Safety of everyone on site is everyone's responsibility, everyone must report. Unsafe Acts or incidents and Unsafe Conditions to their superior immediately***

It is critical for the Contractor to familiarize him/herself with the site and any other unique attributes that are present prior to preparing the Health and Safety plan in response to this specification. To this end, the health and safety plan must contain a declaration of a confirmed site visit by the Principal Contractor/Contractor.

LEGAL APPOINTMENTS REQUIRED FOR THIS PROJECT

The contracting organization is deemed to have the following designated personnel (table below). The competencies of these personnel (CV's and Certified qualification certificates) must be submitted to the agent for review and thereafter filed in the site Health and Safety plan and file bundle.

ITEM	CONSTRUCTION REGULATION	APPOINTMENT	RESPONSIBLE PERSON	REQUIRED
1.	5(1)(h)	Principal Contractor has adequate competencies and resources	Client / Agent	OHS budget and project specific organogram, CVs & qualifications
2.	6	Designer	Client / Agent	Appointment letters, CVs, qualifications incl temporary works
3.	7(1)(c)(v)	Contractor	Principal Contractor	Appointment letters
4.	7(2)(c)	Contractor / Sub-Contractor	Contractor	Appointment letters, CVs, qualifications incl temporary works
5.	8(1)	Construction Manager	Principal Contractor	Appointment letters, CVs, qualifications x 1
6.	8(2)	Assistant Construction Manager	Principal Contractor	Appointment letters, CVs, qualifications x 1
7.	8(6)	Construction Safety Officer	Principal Contractor & Contractor	Appointment letters, CVs, qualifications x 1
8.	8(7)	Construction Supervisor	Construction Manager	Appointment letters, CVs, qualifications for each activity
9.	8(8)	Assistant Construction Supervisor	Principal Contractor & Contractor	Appointment letters, CVs, qualifications for each activity
10.	9(1)	Person to carry out risk assessment	Principal Contractor & Contractor	Appointment letters, CVs, qualifications. Experience in previous similar projects
11.	9(4)	Trainer/Instructor	Principal Contractor & Contractor	Appointment letters, CVs, qualifications

12.	10(1)(a)	Fall protection officer	Principal Contractor & Contractor	Appointment letters, CVs, qualifications. Experience in previous similar projects
13.	11(2)	Competent structure inspector	Owner	Appointment letters
14.	6(2) & 12(1)	Temporary Works Designer	Principal Contractor & Contractor	Appointment letters, CVs, qualifications
15.	12(2)	Temporary Works Supervisor	Principal Contractor & Contractor	Appointment letters, CVs, qualifications
16.	13(1)(a)	Excavation supervisor	Principal Contractor & Contractor	Appointment letters, CVs, qualifications
17.	13(2)(b)(ii)(bb)	Professional engineer or technologist	Principal Contractor & Contractor	Appointment letters, CVs, qualifications
18.	13(2)(k)	Explosives expert	Principal Contractor & Contractor	N/A
19.	14(1)	Supervisor demolition work	Principal Contractor & Contractor	Appointment letters, CVs, qualifications
20.	14(2) + (3)	Demolition expert	Principal Contractor & Contractor	N/A
22.	16(1)	Scaffold supervisor	Principal Contractor & Contractor	Appointment letters, CVs, qualifications. Experience in previous similar projects
24.	17(2)(c)	Compliance plan developer	Principal Contractor & Contractor	Appointment letters, CVs, qualifications. Experience in previous similar projects

In addition, the organization must provide an organogram for the works. The organisation must indicate the hierarchy of roles and responsibilities for this project based on the requirements indicated below

PARTY IN PROJECT ORGANOGRAM	RESPONSIBILITIES	REQUIRED
OHS Agent	The Agent shall ensure that the Principal Contractor, appointed in terms of Construction Regulation 5(1)(k), implements and maintains the agreed and approved Health and Safety Plan. Failure on the part of the Client or Agent to comply with this requirement will not relieve the Principal Contractor from any duties under the Act and Regulations.	Periodic audits and document verification twice a month on dates indicated by the Agent
Principal Contractor	The Chief Executive Officer of the Principal Contractor in terms of Section 16 (1) of the OHS Act to ensure that the Employer (as defined in the Act) complies with the Act.	The pro forma Legal compliance Audit may be used for this purpose by the Principal Contractor or his/her appointed Contractor.
Person responsible for Health and Safety Section 16(2)	OHS Act (85 /1993), Section 16 (2) appointee/s as detailed in their respective appointment forms shall regularly, in writing, report to management on health and safety matters or deviations identified during routine or ad hoc inspections/ audits.	All reports shall be made available to the Principal Contractor to become part of their site records (Health & Safety File).
Construction Manager Or Assistant	The Construction Manager and Assistant Construction Supervisor/s appointed in terms of Construction Regulation 8 shall regularly, in writing, report to their managers on health and safety matters or deviations identified during inspections.	All reports shall be made available to the Principal Contractor to become part of site records (Health & Safety File).

SHE Representatives	All Health and Safety Representatives (SHE-Reps) shall act and report as per Section 18 of the OHS Act. She Representatives shall inspect and monitor activities on a daily basis and report findings to the Client and Health and Safety manager immediately. These safety representatives have the right to stop any unsafe work or work due to unsafe conditions	Report findings and reasons and make available in health and safety file

The appointed Principal Contractor shall submit to the Client his project- and site-specific Occupational Health and Safety Plan and H&S File for evaluation and approval at least 30 working days prior to his intended commencement of the works. Once the Principal Contractor's H&S Plan and H&S File has been approved for implementation, H&S Compliance Monitoring and monthly Audits of the Principal Contractor's performance will be carried out at least once a month. To this end the Principal Contractor must submit a template of its own internal compliance audit checklist for consideration and approval by the client's agent.

The Client is required to stop work which is not in accordance with the approved H&S Plan or which poses a threat to the health and safety of persons. Any delays and other costs incurred by the Principal Contractor resulting from non-compliance(s) to OHS legal and contractual obligations will be at the Principal Contractor's expense and no claims will be entertained in this regard. The OHS act together with its applicable Regulations forms part of this project- and site-specific Occupational Health and Safety Specification.

HAZARD IDENTIFICATION AND RISK ASSESSMENT

The risk assessment should include the following:

(a) the identification of the risks and hazards to the health and safety to which persons (staff, workers, consultants, prisoners) may be exposed;
(b) the analysis and evaluation of the hazards identified;
(c) a documented plan and safe working procedures to mitigate, reduce or control the risks identified; and
(d) The monitoring and review plan of the risks and hazards.
(e) The relevant personal protective equipment or clothing.

Access and Site Establishment

Access to the site shall be through controlled access managed by permanent traffic accommodation officers. The attention of the worker or visitor must be drawn to a

site notice board with contains a map of the site. The map must clearly indicate the safe zones and current work zones and the means to access to the site office. The notice board must contain a list of site rules. Rule no.1 shall read, "**Report to the site office**". The site office establishment shall be on level ground in a location that is as far away as reasonably practicable from the works. The Principal Contractor must install a permit system for access and egress to and from the site. As a result, **the Principal Contractor and his work staff are limited to the construction site only**. If the Principal Contractor or his/her workforce is found beyond the demarcated boundaries of the site they will be trespassing on the client's property. The Client reserves the right to apply a trespassing fee of **R 2 000.00** rand per person found trespassing.

Environment

The Contractor must abide by the strict environmental management objectives that the Client abides by as per the National Environmental Management Act[4]. The Principal Contractor shall ensure that the management of the works is complimentary and supportive of the client's objectives. The Contractor must as far as is reasonably possible ensure that there is minimal, dust, waste, hazardous chemical substances and flammable substances on or stored on site. Waste shall be sorted by type, securely stored on site, and disposed of routinely in an approved manner. Any leaks or spills of hazardous chemical substances shall be cleaned up immediately using appropriate spill clean-up kits provided and maintained by the Principal Contractor. If leaks or spills take place on soil then the contaminated soil shall be removed. The clean-up of hazardous chemical substances will generate hazardous waste which shall be disposed of in an approved manner. Nothing contained in or omitted from this concise specification, or the client's Environmental policy shall relieve the Principal Contractor of any of his/her obligations or liabilities as stated in the National Environmental Management Act (Act 107 of 1998). As a result, the Contractor must, using and Environmental Management Plan clearly demonstrate how s/he will deal with aspect of the works.

[4] Act 107 of 1998

Traffic Accommodation

The Principal Contractor shall ensure that normal operations including access and egress remain operational. Should there be a need for abnormal work or loads that require unique road usage the Principal Contractor must apply for a road closure permit/s were applicable. This application must be submitted 5 working days before such event. To this end the Principal Contractor must always ensure that vehicles and pedestrian traffic is effectively and efficiently accommodated. Where necessary the Principal Contractor shall isolate the construction activities from the client's activities using SABS approved construction safety fencing and prominently displayed information and warning signs (and flagmen where required). The construction safety fencing shall be secured in such a manner that it will not be displaced by more than 150mm (in the vertical or horizontal plane) when a force of **2 KN** (approx. 204 kg) is applied to it. Provision may need to be made to 'open' the construction safety fencing in order to allow the Clients vehicle traffic through. Information signs shall include information relating to deviations or alternate routes due to the construction activities. Warning signs shall include those relating to overhead work, work at height, noise, construction vehicles, mobile plant and machinery in operation. Traffic accommodation as stated by the South African Road Traffic Signs Manual (SARTSM), Volume 2, Chapter 13, (Roadwork's: published by the Government Printing Works) must be observed for any construction activity that is related to this project. A traffic accommodation officer should be positioned to deal with traffic.

Compulsory Personal Protective Equipment and Clothing

The Principal Contractor shall ensure that all persons (entering and or working on the site) are wearing at least the following SANS approved Personal Protective Equipment and Protective Clothing that are in a good condition:

- Hard hat;
- Snake Gaiters where there is a risk of snake bites
- Overalls with a permanent name tag;

- Safety shoes, and
- Hi-viz reflective zip-up vest
- Hand Sanistizer with at least 70% alcohol in all work sections
- COVID 19 Mask

All other Personal Protective Equipment and Protective Clothing to be provided and maintained as identified in Principal Contractors' and any (Sub-)Contractors' or suppliers' Risk Assessments. Spares must be kept on site for workers, impromptu visits by the Client or his representative/s.

Summary of Health and Safety Obligations and Duties

The Principal Contractor and each Contractor working on the site must prepare a Health and Safety Plan to address and manage all applicable sources of risk as per items identified above as well as any other sources of risk which will or may be identified during the Contractor's own risk assessments. The Principal Contractor shall incorporate these into a single Health and Safety Plan for the execution of the works. Should any further risks be identified in the course of the construction work, such risks must be assessed and addressed in the amended Health and Safety Plan/s which must then be submitted to the clients for approval.

- The Principal Contractor shall keep, and on demand make available, a copy of health and safety laws on site at all times and in addition to that he/she will introduce and maintain a file titled "Health and Safety File", or other record in permanent form, which shall contain all relevant aspects and information as contemplated in the Construction Regulations.
- He/she will make this file available to the Client, DoI or his representative whenever necessary or on request to an interested party
- Provide a budget for health and safety
- The project under control of the Principal Contractor shall be subject to periodic health and safety audits that will be conducted by the Client at intervals agreed

upon between the Principal Contractor and the Client, provided such intervals will not exceed periods of one month.

- The Principal Contractor is to ensure that he/she and all persons under his control on the construction site shall adhere to the above specifications.
- The Principal Contractor should note that he/she shall be held liable for any anomalies including costs and resulting deficiencies due to delays caused by non-conformance and/or non-compliance to the above Health and Safety Specifications and the Health and Safety Plan based on these specifications.

In brief, the Health and Safety Plan[5] must address the following matters:

Legal appointments required by the Act and any Regulations under the Act.

Procedures for compliance with all requirements of the Act and in particular Sections 8 and 9 of the Act.

Undertaking and procedure to stop any work which endangers the safety or health of any person.

System for recording and reporting of incidents both internal and external to the Department of Labour.

Copy of the Act and its Regulations to be kept on the site and to be readily available to employees.

Incident register to be kept on the site.

Employment of only persons who are competent and have the necessary knowledge, training, qualifications and experience to perform the required construction work safely and effectively.

Appointment of only competent, knowledgeable, trained, qualified and experienced persons to supervise the construction work.

Procedures and arrangements for first aid facilities on the site.

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Contractor to Note: The Health and Safety File will remain the property of the Client and/or its Agent on its behalf throughout the period of the project and shall be consolidated and handed over to the Client and/or its Agent on its behalf at the time of completion of the project.

Procedures and arrangements for prompt reporting of injuries and other losses/incidents.

Emergency plans to deal effectively with potential site emergencies.

Use of effective processes for the identification and close out of root causes of incidents and accidents.

Attendance by all Contractors of monthly site health and safety meetings.

Demonstration by all Contractors of their health and safety monitoring and auditing systems to ensure compliance with their Health and Safety Plans, as part of their Health and Safety Plans.

Effective site health and safety induction programme for all workers on the site

Additional duties of Principal Contractor

a. The Principal Contractor must notify the Department of Labour of the intention to carry out construction work.

b. The Principal Contractor must coordinate the activities of all Contractors and sub-Contractors in the interests of health and safety.

c. The Principal Contractor must carry out all other duties described in Regulation 5 of the Construction Regulations 2014.

d. The Principal Contractor must register in terms of the Compensation for Occupational Injuries and Diseases Act or any other compensation fund approved by the Commissioner for its workmen, and provide to the Client proof thereof and also that it is in good standing with the Compensation Commissioner or approved insurer.

Health and Safety File Index Guide

i. Police Clearance certificates for staff members and non sex offender status certification
ii. Details of the client, that is the person commissioning the construction work, for example their name, representative and contact details;
iii. Details of the Principal Contractor;
iv. Details of the construction project, for example address of the workplace, anticipated start and end date and a brief description of the type of construction work that the H&S plan will cover;
v. Details on how sub-Contractors will be managed and monitored, including how the Principal Contractor intends to implement and ensure compliance

with the H&S plan such as checking on the performance of subcontractors and how non-compliance will be handled; and

vi. Details on how the risks associated with falls, falling objects, moving plant, electrical work and all high-risk construction work that will take place on a construction project will be managed.
vii. Copy of OH&S Act (updated) (General Administrative Regulation 4.)
viii. Proof of Registration and good standing with a COID Insurer (Construction Regulation
ix. Project organogram
x. Record of survey – contraband, tools etc
xi. Appointments – in terms of the Construction Regulations
xii. Notification of Construction Work
xiii. H&S Specifications
xiv. H&S Plan – Principal Contractor, Contractor & Sub-Contractors
xv. Proof of Periodic Audits
xvi. List of all Contractors (accountable to Principal Contractor) on site
xvii. Contractor Agreements
xviii. Type of work done on site (Scope of Works as per the Tender)
xix. Health and safety budget as tendered (Preliminaries and General)
xx. Records of drawings (Architectural, civil etc), designs, materials used and similar information concerning the completed structure
xxi. Input by Construction Safety Officer
xxii. Risk Assessment
xxiii. Copy of Risk Assessment
xxiv. Proof of H&S Induction Training
xxv. Proof of training on Hazards and Work-Related Procedures
xxvi. Fall Protection Plan
xxvii. Designer notice to Contractor of dangers and hazards relating to construction work
xxviii. Drawing's
xxix. Records of Inspections of structures
xxx. Method Statement
xxxi. Operational Compliance Plan
xxxii. Certificates, design calculations, sketches and test results
xxxiii. Examination results
xxxiv. Register for control of cartridges/nails studs – explosive powered tools
xxxv. Record of Temporary Electrical Installation Inspections
xxxvi. Record of Electrical Machinery Inspections
xxxvii. Proof of Training
xxxviii. Evacuation Plan
xxxix. H&S Rep & Committee Members details
xl. H&S Committee Meetings' Minutes
xli. Other appointments in terms of H&S Act
xlii. Details of Inspections (by DoL)
xliii. Recording and Investigation of Incidents
xliv. Action taken on all incidents
xlv. Certificates of Competency in First Aid
xlvi. Record of Medical Surveillance

xlvii. Proof of compliance with Major Hazard Installation requirements

Agreement Framed In Terms of Section 37 (2) of the Occupational Health and Safety Act

PREAMBLE

(Note that where the term Contractor is used in this document this shall also be taken to mean Principal Contractor where applicable.)

Nothing contained in or omitted from this Health and Safety Specification, or the Health and Safety Plan based on this specification, shall relieve the Principal Contractor of any of its obligations or liabilities. The Client shall not be liable for any civil claim because of anything contained in or omitted from this Health and Safety Specification.

The Contractor and his/her witnesses are to sign two copies, initial each page and return these copies to the clients Health and Safety Agent.

I, the undersigned, in my capacity as the authorised officer of, and as such representing the under mentioned contracting firm, hereby acknowledge that I have read and understood the attached site specific health and safety specification for the project and confirm that I, as well as my construction supervisor have studied, reviewed and discussed the project designs and specifications as provided by the relevant experts for the project to enable us to allow for all health and safety requirements. Having read and understood the specification and designs we hereby confirm that I /we agree to abide by these regulations in all respects. I/we acknowledge that I am a mandatory in terms of the Occupational Health and Safety Act and agree to comply with the Act and Safety Regulations. To this end, I will comply in full with the Occupational Health and Safety Act and in particular with the Construction Regulations 2014.

The Contractor hereby indemnifies the Client and Health and Safety Agent against any liability, loss, claim or proceedings whatsoever, whether arising in Common Law or by Statute; consequent personal injuries or the death of any person whomsoever (including claims by employees of the Contractor and their dependents); or

consequent loss of or damage to any moveable or immoveable property arising out of or caused by or in connection with the execution of the Contractor's contract with the Company.

The Contractor agrees:

- To ensure all employees receive the necessary training before commencing work and carry such proof of training with them.
- To ensure provision of welfare facilities as per Construction Regulation 28.
- To provide the Client with a fully documented Safety, Health and Environment (SHE) plan and specifications.
- To provide risk assessments, safe work procedures and method statements.
- To provide first aid facilities and first aiders as per General Safety Regulations.
- To comply with the hazardous chemical substance regulations and where applicable lead and asbestos regulations.
- To comply with environmental requirements as per the environmental impact study and the environmental regulation for workplaces.
- To keep on site the written appointment for supervision of construction work.
- To provide written designation of health and safety representatives and minutes of all meetings, whether site or separate, regarding occupational health and safety.
- To provide all legal safety and health documents and registers as required by the Act and Regulations, including a copy of the Occupational Health and Safety Act.
- To comply with Construction Regulation 22, Electrical Machinery Regulations, and Electrical Installation Regulations regarding temporary electrical installations on site.
- To comply with Construction Regulations relating to construction vehicles.
- To prepare a fully documented fall protection plan.
- To comply with General Safety Regulation 2 regarding protective clothing and equipment.
- To report all incidents and accidents and occupational diseases as per Section 24 of the OHS Act and Regulation 6 of the General Administrative Regulations.
- To comply with the General Safety Regulations

- This should be read in conjunction with Construction Regulation 27 regarding the appropriate measures to be taken to avoid the risk of fire and explosion (see Construction Regulation 27).
- To ensure that when using scaffolding and ladders, he complies with Construction Regulation 10 and others.
- That good housekeeping be done, including monitoring of stacking and storage and temporary storage of flammable materials as per Construction Regulations 25 and 26.
- That where explosive power tools are used, correct training is given, registers kept and precautions exercised.
- That excavation work is done in accordance with Construction Regulation 11.
- That demolition work is done in accordance with Construction Regulation 12.
- That when erecting or using scaffolding, in addition to the Construction Regulation requirements, SANS code 85 is complied with.

_____

SIGNATURE OF PRINCIPAL CONTRACTOR
NAME IN BLOCK LETTERS

_____ _____

WITNESS NAME IN BLOCK LETTERS

_____
DATE

_____
SIGNATURE OF HEALTH AND SAFETY AGENT (**A MOYO)**

Administrative & Legal Requirements

Subject	Requirements
Notice of carrying out Construction work	Department of Labour notified Copy of Notice available on Site
Copy of OH&S Act (Act 85 of 1993)	Updated copy of Act & Regulations on site. Readily available for perusal by employees.
Registration with Compensation Insurer.	Written proof of registration/Letter of good standing available on Site
H&S Specification & Programme	H&S Spec received from Client and/or its Agent on its behalf OH&S programme developed & Updated regularly
Hazard Identification & Risk Assessment	Hazard Identification carried out/Recorded Risk Assessment and – Plan drawn up/Updated RA Plan available on Site Employees/Sub-Contractors informed/trained
Assigned duties (Managers)	Responsibility of complying with the OH&S Act assigned to other person/s by CEO.
Designation of Person Responsible on Site	Competent person appointed in writing as Construction Supervisor with job description
Designation of Assistant for above	Competent person appointed in writing as Assistant Construction Supervisor with job description
Designation of Health & Safety Representatives	More than 20 employees - one H&S Representative, one additional H&S Rep. for each 50 employees or part thereof. Designation in writing, period and area of responsibility specified in terms of GAR 6 & 7 Meaningful H&S Rep. reports. Reports actioned by Management.

Health & Safety Committee/s	H&S Committee/s established. All H&S Reps shall be members of H&S Committees Additional members are appointed in writing. Meetings held monthly; Minutes kept. Actioned by Management.
Agreement with Mandatories/ (Sub-)Contractors	Written agreement with (Sub-)Contractors List of Sub Contractors displayed. Proof of Registration with Compensation Insurer/Letter of Good Standing Construction Supervisor designated Written arrangements re. H&S Reps & H&S Committee Written arrangements re. First Aid
Reporting of Incidents (Dept. of Labour)	Incident Reporting Procedure displayed. All incidents in terms of Sect. 24 reported to the Provincial Director, Department of Labour, within 3 days. (Annexure 1)(WCL 1 or 2) and to the Client and/or its Agent on its behalf Cases of Occupational Disease Reported Copies of Reports available on Site Record of First Aid injuries kept
Investigation and Recording of Incidents	All injuries which resulted in the person receiving medical treatment other than first aid, recorded and investigated by investigator designated in writing. Copies of Reports (Annexure 1) available on Site Tabled at H&S Committee meeting Action taken by Site Management.
Fall Prevention & Protection	Competent person appointed to draw up the Fall Protection Plan Proof of appointee's competence available on Site Risk Assessment carried out for work at heights Fall Protection Plan drawn up/updated Available on Site

Cranes & Lifting Machines Equipment	Competent person appointed in writing to inspect Cranes, Lifting Machines & Equipment Written Proof of Competence of above appointee available on Site. Cranes & Lifting tackle identified/numbered Register kept for Lifting Tackle Log Book kept for each individual Crane Inspection: - All cranes - daily by operator Tower Crane/s - after erection/ 6 monthly Other cranes - annually by comp. person - Lifting tackle (slings/ropes/chain slings etc.) - daily or before every new application
Designation of Stacking & Storage Supervisor.	Competent Person/s with specific knowledge and experience designated to supervise all Stacking & Storage Written Proof of Competence of above appointee available on Site
Designation of a Person to Co-ordinate Emergency Planning And Fire Protection	Person/s with specific knowledge and experience designated to co-ordinate emergency contingency planning and execution and fire prevention measures Emergency Evacuation Plan developed: Drilled/Practiced Plan & Records of Drills/Practices available on Site Fire Risk Assessment carried out All Fire Extinguishing Equipment identified and on register. Inspected weekly. Inspection Register kept Serviced annually
First Aid	Every workplace provided with sufficient number of First Aid boxes. (Required where 5 persons or more are employed) First Aid freely available Equipment as per the list in the OH&S Act. One qualified First Aider appointed for every 50 employees. (Required

	where more than 10 persons are employed) List of First Aid Officials and Certificates Name of person/s in charge of First Aid box/es displayed. Location of First Aid box/es clearly indicated. Signs instructing employees to report all Injuries/illness including first aid injuries
Personal Safety Equipment (PSE)	PSE Risk Assessment carried out Items of PSE prescribed/use enforced Records of Issue kept Undertaking by Employee to use/wear PSE PSE remain property of Client, not to be removed from premises GSR 2(4)
Inspection & Use of Welding/Flame Cutting Equipment	Competent Person/s with specific knowledge and experience designated to Inspect Electric Arc, Gas Welding and Flame Cutting Equipment Written Proof of Competence of above appointee available on Site All new vessels checked for leaks, leaking vessels NOT taken into stock but returned to supplier immediately Equipment identified/numbered and entered into a register Equipment inspected weekly. Inspection Register kept Separate, purpose made storage available for full and empty vessels
Inspection of Ladders	Competent person appointed in writing to inspect Ladders Ladders inspected at arrival on site and weekly thereafter. Inspections register kept Application of the types of ladders (wooden, Aluminium etc.) regulated by training and inspections and noted in register
Ramps	Competent person appointed in writing to supervise the erection & inspection of Ramps. Inspection register kept. Daily inspected and noted in register

Baseline Risk Assessment

The following baseline risk assessment is a preliminary risk assessment based on the proposed scope of work. The Principal Contractor must submit a detailed risk assessment which address the items below as a minimum. The principles to be used are as follows:

- elimination
- substitution
- changing work methods/patterns
- reduced or limited time exposure
- engineering controls (e.g. isolation, insulation and
- ventilation)
- good housekeeping
- safe systems of work
- training and information
- personal protective equipment
- welfare
- monitoring and supervision
- review

Issue	Hazards and Issues	Typical Management and Control Strategies
Accidents that involve staff, inmates, or others present in the facility. ■ Accidents that involve the facility or other jail property, including vehicles. ■ Illnesses affecting staff, inmates, or others in the facility because of conditions in the facility eg COVID 19 ■ Violation of the jail's legal duty to protect and provide due care to inmates.	■ Injury, illness, or death of staff, inmates, and others present in the facility. ■ Health care expenses for injured or ill inmates and workers' compensation benefits for injured staff. ■ Damage to prison property. ■ Loss of valuable employee services because of missed work time and time spent dealing with claims. ■ Lawsuits against the prison to compensate visitors for injuries and the resulting expenses for legal fees and increased insurance premiums.	• elimination • substitution • changing work methods/patterns • reduced or limited time exposure • engineering controls (e.g., isolation, insulation and • ventilation)
Riot/Strike or lock out/down	Hazards associated with disorderly conducted e.g. vandalism, breakout	Obtain daily news feed regarding community activities Shutdown and secure site
Fire Protection	Bushfire, property damage, environmental damage	Firefighting equipment such as fire extinguishers, Site clearing (where permitted) Training and induction Liaison and consultation with authorities Liaison and consultation with landowners and councils

Issue	Hazards and Issues	Typical Management and Control Strategies
General building - Concrete Formwork and Reinforcement Brickwork Roof work Tiling Paving Plumbing and Drainage External works	Working at Height Moving Objects Slips, Trips, & Falls Noise Hand Arm Vibration Syndrome Material & Manual Handling Collapse Asbestos	Prevent exposure Substitution Engineering controls PPE Inspection of equipment Use of correctly rated equipment Training Qualified personnel Procedures Minimize required access to height
Protection of the Public - construction workers, staff,students	Excavations Plant and machinery Access to construction sites Vehicle access Hazards associated with welding activities Crossing roads etc Hazards associated with building trades	Security of plant and equipment Signage Barricading and barriers Traffic management Notifications and planning Training of personnel Qualifications of personnel Security personnel Identification of high-risk areas/locations
Power lines and Adjacent Infrastructure Including Underground Power	Induced voltage Touch and Step potential Fault currents Electrical storms and lighting Excavations hitting services	Identification of power lines and underground services Notification to power local authorities and Eskom Supervision Working outside Exclusion zones Procedures for working in storms Earth mats Engineering review of work adjacent to or under power lines Spotters

Issue	Hazards and Issues	Typical Management and Control Strategies
Excavations	Public, personnel and fauna injury Traffic hazards Night-time hazards Underground services such as power, water, telecommunications Pipe damage	Barricading and barriers Notification Minimize open trench Procedures and processes to avoid trench entry Lighting Surveillance and/or security Shoring Minimize trench depth where possible
Lifting of Materials	Falling objects Swinging objects	PPE Inspection of equipment Use of correctly rated equipment Training Qualified personnel Procedures Minimize required access to height
Handling of Chemicals	Spillage Fire Injury Environmental damage	Procedures Compliance with legislative requirements MSDS Correct storage Handling procedures PPE Material handling equipment

Issue	Hazards and Issues	Typical Management and Control Strategies
Site Communication	Lack of understanding of procedures	Meetings Records Newsletters Toolbox meetings Committee Meetings and distribution of minutes Supervisor Meetings Hazard reports/alerts
Incident Reporting and Investigations	Lack of learning from incidents	Reporting procedures Training and induction Training for investigators Records Investigation processes Corrective action database/list Responsibilities assigned
Competency	Incidents and injury Inefficient processes Property and equipment damage	Pre-employment processes Interview and/or reference checks On-the-job evaluation of skills Inductions Development of skills matrices Training records Training programs
Management of Change	Lack of review of implications when changing process and plant	Procedures Review of change implications prior to implementation Communication of change Document control processes Change control register

Issue	Hazards and Issues	Typical Management and Control Strategies
Fitness for Work	Personnel putting themselves and others at risk Impaired judgement	Evaluation of cycle breaks in early stages of project development Fit for Work policies Rehabilitation services Drug and alcohol testing programs Provision of exercise facilities Management of hours of work Management of extremes of climate Camp/accommodation Fatigue minimization measures
Vehicles and Driving	Third party road users Road quality Fatigue Vehicle type and setup Remote travel Terrain Effects of drugs/alcohol	Training, competence, attitude and assessment Work Scheduling Vehicle maintenance Vehicle type, setup and equipment Project vehicle speeds (ROW) Licensing Fit for Work Policy Fatigue management Refer to relevant legislation and statutory authorities
Trip, Slip and Fall Hazards	Uneven ground Access and egress from plant and vehicles	PPE, especially appropriate footwear Awareness Lighting Housekeeping OHS Inspections Use of handrails and ladders

Issue	Hazards and Issues	Typical Management and Control Strategies
Electrical Equipment	Electric shock	Pre-use inspections Earthing Portable RCDs Housekeeping Test and tagging program Tagging and isolation Resuscitation qualified electrical personnel All electric leads kept dry All electric leads kept insulated Avoid live work situations Protect overhead cables Maintain safe clearances – exclusion zones
Use of Plant	Plant defects Pinch points Crush points Noise exposure Dust exposure Rollover	Shut down plant for maintenance Plant risk assessments conducted Plant noise surveys Wheeled plant to be fitted with Roll-Over Protection Sealed cabins PPE and hearing protection
Manual Handling	Crushing injuries Pinch injuries Posture strain Repetitive strain Vibration Hand tools Power tools Load handling	Manual handling training PPE – gloves Hand and power tool training Load handling – team lifting Mechanical devices Team lifting

Important Contact Details

The Principal Contractor is to add all the important contact information about essentials services, support and assistance.

SERVICE	NUMBER	CONTACT PERSON
Hospital		
Ambulance		
Water		
Electricity		
Police		
Fire Brigade		
Engineer		

Health and Safety Budget					
Contractor to give a breakdown of his Health and Safety costs on these bills of quantities					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**RATE**	**TOTAL**
1	**MEDICALS**				
1.1	Pre-employment medical	Nr.			
1.2	Psychological medical for working at heights	Nr.			
1.3	Psychological medical for working motorized equipment & construction machinery	Nr.			
1.4	Medical for working asbestos	Nr.			
1.5	Routine medical as per requirement of job activities	Nr.			
1.6	Re-medicals - yearly	Nr.			
1.7	Exit medicals	Nr.			
	TOTAL				
2	**PERSONAL PROTECTIVE EQUIPMENT**				
2.1	Overalls (Blue)	Nr.			
2.2	Specialized overalls (asbestos, chemicals etc.)	Nr.			
2.3	Hard hats and safety glasses	Nr.			

2.4	Safety boots/shoes	Nr.			
2.5	Gloves	Nr.			
2.6	Breathing apparatus (confined space, asbestos & chemicals)	Nr.			
2.7	Life jackets	Nr.			
2.8	Reflector Bibs	Nr.			
2.9	Testing equipment (oxygen measuring, noise, lighting, lightning & wind) (Centralized)	Nr.			
2.10	Orange Star Netting - 1.2m High	m			
2.11	Orange Plastic road cones	Nr.			
2.12	Plastic Reinforce Caps(Rebar)	Nr.			
2.13	Dust masks	Nr.			
	TOTAL				
3	**FIRE FIGHTING**				
3.1	Fire extinguishers - 4.5Kg	Nr.			
3.2	Training	Nr.			
3.3	Surveys	Nr.			
3.4	Other - Drip trays	Nr.			
	TOTAL				
4	**HEALTH AND SAFETY PERSONNEL**				

4.1	Safety Manager (50%)	Nr.			
4.2	Safety Officer	Nr.			
4.3	Full time Safety Representatives if required	Nr.			
4.4	Fire Watchers	Nr.			
4.5	First aiders	Nr.			
4.6	External auditors' costs	Nr.			
4.7	Occupational hygienist	N/A			
4.8	Construction Phase Safety, Health, Environmental and Waste Management Plan	Nr.			
4.9	Safety Administrator	Nr.			
	TOTAL				
5	**FACILITIES**				
5.1	Provision of ablution facilities	Nr.			
5.2	Service and maintenance of ablution facilities	Nr.			
5.3	Provision of eating areas	Nr.			
5.4	Cleaning of Lay down and other storage areas	Nr.			
5.5	Wash hand basin	Nr.			
5.6	Hot and Cold running water	Nr.			
5.7	Decreasing & Toilet soap	Nr.			
	TOTAL				

6	*FALL PREVENTION / PROTECTION*				
6.1	Safety harnesses with double lanyards	Nr.			
6.2	Lanyard extenders	Nr.			
6.3	Scaffold hooks	Nr.			
6.4	Lifelines and vertical fall arrest systems	Nr.			
6.5	Scaffolding – material, erection and inspection (Estimate for project)	Nr.			
6.6	Temporary hand railing material and kick flats	Nr.			
6.7	Inspection for approval of equipment (AIA)	Nr.			
6.8	Chin Straps/Tool bags/Wrist straps	Nr.			
6.9	Other	Item			
	TOTAL				
7	**VEHICLE / MOBILE EQUIPMENT UPGRADE FOR USE ON SITE**				
7.1	Raised lights	N/A			
7.2	Rotating orange light	N/A			
7.3	Flag as per	N/A			

	procedure				
7.4	Fire extinguisher - 4.5Kg	Nr.			
7.5	First aid box	Nr.			
7.6	Reflector tape	m			
7.7	Danger Tape	Rolls			
7.8	Signage	Nr.			
7.9	Roll over & fall over protection	N/A			
7.10	Safety belts for all passengers (LDV)	N/A			
7.11	Wheel Chockes	N/A			
	TOTAL				
8	**LIFTING MACHINERY AND EQUIPMENT**				
8.1	Annual inspections and load testing as per legal requirement	Nr.			
8.2	Certification of all lifting gear during the course of the project	Nr.			
8.3	Third party inspections	Nr.			
8.4	Inspection for approval of equipment (AIA)	Nr.			
8.5	Slings	Nr.			
8.6	Chains	Nr.			
8.7	Hooks	Nr.			
	TOTAL				
9	**INSURANCES**				
9.1	COID cover for the project	Nr.			

9.2	Liability insurances	Nr.			
	TOTAL				
10	**FIRST AID**				
10.1	First aid boxes	Nr.			
10.2	Rescue equipment and stretchers	Nr.			
10.3	Replenishment of boxes and other supplies	Nr.			
10.4	Hazchem Spill kits	Nr.			
	TOTAL				
11	**TRAINING**				
11.1	SHE Representative	Nr.			
11.2	Supervisor A2 (No cost)	Nr.			
11.3	Management/Safety Officer A3 (No cost)	Nr.			
11.4	First Aid Level 1	Nr.			
11.5	Fire Fighting	Nr.			
11.6	Legal Liability	Nr.			
11.7	HIRAC	Nr.			
11.8	Incident Investigation (R-CAT)	Nr.			
11.9	Scaffolding Inspector	Nr.			
11.10	Scaffolding Erector	Nr.			
11.11	Basic Working at Heights	Nr.			
11.12	Rescue at Heights	Nr.			

	TOTAL				
12	**SIGNAGE**				
12.1	All signage as required by law: regulatory, warning and information	Nr.			
12.2	Posters for awareness	Nr.			
12.3	Admin	Item			
	TOTAL				
13	**ELECTRICAL**				
13.1	Locks required for lockouts	Nr.			
13.2	Tags	Nr.			
13.3	Permit books	Nr.			
13.4	Callipers	Nr.			
13.5	Key safes	Nr.			
	TOTAL				
14	**PLANT & SCAFFOLDING**				
14.1	Telescopic Hoist	month			
14.2	TH - Driver	month			
14.3	Scaffolding	month			
15	**COVID 19**				
15.1	Allow for COVID 19 PPE, Screening, testing sanitizer etc as per the COVID 19 Protocol	Item			
	TOTAL				
	GRAND TOTAL TO BE INCORPORATED TO THE PRELIMINARIES AND GENERAL AS PART OF ITEM 5 PAGE 2 IN THE BILL OF QUANTITIES				

1.5 PENALTIES TO NON-COMPLIANCE

- The client will apply a penalty of R 1 000 FOR EACH documented non-compliance. A fine of R 5 000 will be charged for repeated non-conformances.