PART 3: SCOPE OF WORK

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C3.1: *EMPLOYER'S* WORKS INFORMATION

Contents

1. Description of the *works*

1.1. Executive overview

The Ingula Pumped Storage Scheme (IPSS) is located approximately 23 km northeast of Van Reenen. It straddles the Little Drakensberg escarpment, which forms the border between the Free State and KwaZulu-Natal Provinces of South Africa. The Power Station was commissioned by Eskom between 2016 and 2017 and consists of an upper dam (Bedford) and a lower dam (Bramhoek) approximately 5 km apart and connected by underground tunnels and the underground Powerhouse complex.

The scope includes requirements for an integrated Building Management System (BMS) comprising of an Access Control System and CCTV system that includes Intrusion pre-detection system and alarm system,. The *Contractor* shall design, manufacture, supply, develop user documentation, perform testing at works, deliver, install, and commission the Integrated BMS and associated equipment (hardware/software) at the site according to the associated technical specifications and specified standards.

In addition to the scope, the Works includes the operational CCTV. The operational camera system shall provide the Power Station operators with a visual tool to determine operating conditions at the various camera locations indicated in this works, the *Employer's* 'Marked-up' drawings, and the IO list. The other cameras will be used solely for security. The Station operators in the control rooms shall have viewing access to both Operational and Security cameras

The Works Information includes the installation and commissioning of the electrical reticulation scope for the BMS.

The complete system will be based on an existing a fibre optic back-bone between the cameras and the IPSS security control room where the CCTV monitors will be set up.

The *Contractor* provides all services, plant, material, equipment and resources to fulfil the requirements of this Works Information.

The *Contractor* warrants that the works provided is fit for the intended purpose specified in this Works Information.

The *Contractor* employs and provides a dedicated full time on-site project manager and a full time dedicated Responsible Person (RP).

The *Contractor* ensures commissioning spares are available for the duration of the commissioning period.

The *Contractor* performs the function of co-ordinator and technical leader and takes full responsibility for the provision of all technical interfaces required by the works.

This Works Information defines the work to be performed by the *Employer* and *Contractor*. It also defines the plant, equipment and materials that are to be included in the Works and the specifications to which they must comply with. The *Contractor* carries out all activities and supplies everything necessary to provide the Works in accordance with the requirements of the IAC and CCTV standards and specifications, including clarification and co-ordination with the *Employer*'s plant engineers

1.2. *Employer*'s objectives and purpose of the *works*

The purpose of this document is to describe and outline the required scope of work for the project. The project outcome aims for compliance of Ingula Pumped Storage Scheme (IPSS) with the applicable standards. This document does not describe the scope such that compliance is assured but rather describes the requirements for compliance for which the *Contractor* is to design for.

The *Contractor* is provided with the required *Employer*'s standards for which the design is expected to be fully compliant with. The intent of the *Employer* is to implement measures to render the Site a compliant National Key Point by addressing security control and monitoring, and operational support.

1.2.1. *Employer*'s objectives

The objective of this project is to implement an Access Control System for allowing or denying access to critical plant areas and CCTV Surveillance System as it will serve as a key tool in providing security officers and operators with a visual verification of plant activities.

Management will use the system to prevent sabotage, vandalism and theft of equipment inside and outside plant areas.

Use specific parameters to control access while enhancing the Station's security.

Enhancing the Security personnel's effectiveness in ensuring the safety of the Station and the people.

Enhancing the Operating personnel's effectiveness in ensuring the effective monitoring of the plant Station for the safety of the plant and the people.

The objectives of the project include procurement, design, manufacture, delivery, installation, testing and commissioning of a full BMS that integrates CCTV and IAC system in the following areas of site:

i. Bedford and Bramhoek dams
ii. Admin Building
iii. HV Yard Control Building & Emergency Power Building
iv. Visitors Centre Building
v. New Security building
vi. Perimeter Monitoring and Alarming system
vii. Underground Power-House

There are various other contracts running at the same time as well as *Employer*'s existing structures and systems that need to be interfaced. Other project interfaces include:

i. Access Roads and Security Building. The project is at tender phase.
ii. Permanent Water Supply Project. The project is at tender phase
iii. Security Fence and Lighting System (Perimeter Monitoring & Alarming System). The project will provide the mounting posts for the cameras.

These multiple separate contracts will run concurrently, each project package will procure, design, manufacture, deliver, install, test and commission their respective packages. To ensure a fully functional end-state, all *Contractor*s shall liaise with each other to plan and interface their works accordingly.

Engineering interfaces include:

i. The existing Core Fibre Communication Infrastructure or Back-bone (0.83/50042 IPSS 0 0CYH10, 0 0CYW10 COMMUNICATION CARRIER BLOCK DIAGRAM).

ii. The existing *Employer*'s Business Network (LAN) and Telecommunications system
iii. The existing Time Synchronization (Global Positioning System GPS) System.
iv. The built and operational Plant such as the Dams (Bedford & Bramhoek).

1.2.2. Life Expectancy

The CCTV Surveillance System should conform to the following life expectancy criteria:

i. All new CCTV cameras and associated equipment shall last for a productive use of at least 10 years.
ii. It must be possible to maintain and support the CCTV System for at least up to 10 years after installation with minor hardware and software upgrades

1.3. Interpretation and terminology

1.3.1. Abbreviations

The following abbreviations are used in this Works Information:

Abbreviation	**Meaning given to the abbreviation**
ACP	Access Control Panels
ACS	Access Control System
APB	
ATP	Access Time Patterns
ATPs	Acceptance Test Plans
BMS	Building Management System
CAT	Capability Acceptance Test
CCTV	Closed Circuit Television
CI	Critical Infrastructure
CV	Curriculum Vitae
DB	Distribution Boards
DVR	Digital Video Recorder
EM	Electro Magnetic Door Locks
ESP	Electronic Security Perimeter
FAT	Factory Acceptance Test
GPS	Global Positioning System
GUI	Graphical User Interface
HDD	Hard Disk Drive
HID	Host Intrusion Detectors
HMI	Human Machine Interface
HVAC	Heating Ventilation and Air Conditioning

IO	Input Output
IAC	Integrated Access Control
IACS	Integrated Access Control System
IP	Internet Protocol
IPSS	Ingula Pumped Storage Scheme
IT	Information Technology
ITPs	Installation Test Plans
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LOSS	Limit of Supply and Services
MAT	Main Access Tunnel
MDL	Master Document List
MTBF	Mean Time Between Failures
MTTD	Mean Time To Detection
MTTF	Mean Time To Failure
MTTR	Mean Time To Repair
NKP	National Key Point
NKPA	National Key Point Act
NTP	Network Time Protocol
NVR	Network Video Recorder
OEM	Original Equipment Manufacturer
OT	Operational Technology
PC	Personal Computer
PDU	Power Distribution Unit
PIN	Personal Identification Number
PSU	Power Supply Unit
PTZ	Pan Tilt and Zoom
QC	Quality Control
QITP	Quality, Inspection and Test Plans
RAID	Redundant Array of Independent Disks
RAM	Reliability Availability and Maintainability
RF	Radio Frequency
RFI	Radio Frequency Interference
SHE	Safety Health and Environment

SACPCMP	South African Council for the Project and Construction Management Professions
SIP	System Implementation Plan
SIT	Site Integration Test
SRFU	System Ready for Use
UPS	Uninterruptible Power Supply
VMS	Video Management Software

1.3.2. Definitions of terms used in this Works Information:

A	
Administrative Building	The building where access control and security is administered for the wider plant area. This shall include granting of station access and creating access cards
Auto Iris lens	An auto iris lens automatically adjusts the iris (or aperture) in order to regulate and optimize the amount of light or infrared energy a camera receives. This is ideal for outdoor video surveillance cameras as they often have to deal with changing light conditions and high-contrast situations.
B	
Building Management System (BMS)	Building management systems are basically computerized systems that control and manage the electronic and mechanical equipment used in a building such as lighting, security systems, power, ventilation and fire alarms. The basic functionality of building management systems is to optimize, control and monitor electronic and mechanical facilitation in a building for comfort, efficiency and safety. Such systems are centralized, comprising special hardware and software
Building Management System Server	A central processing and storage capabilities of the system. A server is where all information from a BMS is stored, monitored and maintained
Building Rationalisation	The process of streamlining equipment for Building Management Systems in order to use hardware in the most efficient manner. See sector definition
Bus Coupler	A device that converts binary and analogue inputs to addressable digital signals

Bus	A system that transfers data between computer components which are addressable
C	
Configuration	Includes the programming, engineering and administration of the BMS and its subsystems
Cyber Security	Security measures implemented to protect the IPSS C&I systems and all associated components from unauthorised access or attack
D	
Data Backup	A full backup of the database concerned such that the database can be restored to a fully functioning state as of the date of the backup capture
Date of Backup Capture	The date on which a specific backup was created
Design Freeze	This is where the Engineer accepts the final performance, functional and equipment specifying documents and the *Contractor* shall be authorised to proceed with procurement and production
Disaster Recovery	The automated mechanism or procedure followed in preparing for recovery and continuity of system functionality, without human intervention, in the event of a human induced or natural disaster
Digital Video Recorder (DVR)	A device with the primary function of recording video footage from CCTV cameras. May also include a number of other features. The term 'DVR' is used to refer to a DVR or NVR as both devices perform the same function.
E	
Event	Information generated when a significant occurrence happens in the BMS and its subsystems
F	

Field Device	All detectors, pressure flow switches and any other devices installed to the BMS subsystems
Forward Documentation	Engineering documentation is configured in such a way that any configuration change (hardware and software) is made once and is subsequently reflected in all engineering documentation
G	
GPS Time Sync System	A complete GPS based time synchronisation system used to synchronise the entire Ingula systems according to the local time offset with relation to GPS time
H	
Human Machine Interface (HMI)	The Human Machine Interface (HMI) used for the operation and monitoring of the BMS by the operators. Also known as the interface between the operator and the machine
HMI Faceplate	The interface or window of a particular component in an HMI graphic page through which said component is operated and monitored in detail
HMI Graphic	Refers to all HMI faceplates, HMI trends, and HMI graphic pages
HMI Graphic Page	The graphical page containing the mimic of a specific BMS, its subsystems and their components
Hot-swappable	The capability of being able to disconnect and connect devices while the computer or other device is on and have those devices automatically detected without having to re-boot the computer or device
I	
Integrated Access Control	Eskom's standardised solution to access control and related subsystems
Input/Output Devices of a Workstation	The keyboards, LCD monitors and mouse
L	

Life cycle cost	Support and Maintenance costs associated with the activities, equipment, spares and personnel required during the operation/use of a system
N	
Near Real time data	Data that is updated on a display within 2 seconds of the change in its value
Network Video Recorder (NVR)	A Digital Video Recorder which is connected to a network rather than directly to cameras. The term 'DVR' is used to refer to a DVR or NVR as both devices perform the same function.
O	
Optimised design	This is the design that provides the functionality required by the *Employer*'s requirement with the least number of components
Operator Event	An operator action on an operator workstation
Operating Screen	LCD display monitor used in the operator workstations
Operator Workstation	The primary interface of the operating BMS personnel. It is the computer via which the HMI is accessed with the specified number of operating display units and pointing devices
Operational Technology	OT is the technology that is used to operate, monitor and control the power system. (As opposed to Information Technology (IT) which is the infrastructure used for corporate services). See Eskom Standard 240-55863502
P	
Power Supply Cabling	All the cabling required to power field devices
R	
Report	A formal and structured summary of a sub-set of information produced or stored
S	

Sector	A defined, localised group of buildings and/or power station areas that share BMS services and aid in the design of building rationalisation and system optimisation
Security Control Room	The room in the Admin building that monitors the general access of the plant including perimeter monitoring as well as all CCTV cameras
Station LAN	Station wide LAN at IPSS
Station or Power Station	Ingula Pumped Storage Scheme (IPSS)
T	
Trend	A trend is an X-Y plot in which one axis is time, and the other axis is one or more tag values
Trending	A functionality whereby a trend requested by operating, engineering or maintenance personnel can be displayed
U	
Unit	Turbine, generator, generator transformer and including all auxiliary plant and systems associated with the particular unit
W	
Workstation	The monitoring and control points for key personnel, such as the security operators. Provides the capability of controlling, monitoring, administering, maintaining and configuring of the BMS
Z	
Zone	A designated area distinguished from adjacent regions of a building or location logically defined according to a zoning philosophy
Zoning Philosophy	A set of suggestive, high-level rules based on identified risks, physical constraints, standards and/or best practices to be applied to a building or location in order to designate zones

2. Management and start up.

2.1. Roles of the *Project Manager* and the *Supervisor*

A distinction should be made between reference in standard specifications or any other document (referred to in the Scope of Work) to *Engineer* and between reference in NEC to *Project Manager*. Where mention is made of the Resident Engineer in any of the documents or standards a distinction should be made with *Supervisor* in NEC. In this Scope of Work as well as on the associated Drawings, also read *Supervisor's* representative where *Supervisor* appears.

2.2. Management meetings

2.2.1. General Regular Meetings

Regular meetings of a general nature may be convened and chaired by the Project Manager as follows:

Title and purpose	Approximate	Location	Attendance by:
Kick off meeting implementation strategy	Immediately after contract award. (Time to be announced by Project Manager)	Project Managers office	*Employer (*PM *,* Contracts Manager, Engineer, Planner) *Contractor (*PM *,* Contracts Manager, Engineer, Planner)
Risk register and compensation events	Weekly Risk meetings Compensation Events: As and when required during Contract	Project Managers office	Chaired by PM *Employer (*PM *,* Contracts Manager, Engineer, Supervisor, Risk, Quality, Planner) *Contractor (*PM *,* Contracts Manager, Engineer, Supervisor, Risk, Quality, Planner)
Overall contract progress and feedback to deal with technical, progress, programme and administrative matters at a project management level.	Weekly for the duration of Contract	Project Managers office *Project Manager* and attended by the *Supervisor*, the designers,	chaired by PM *Employer* (Contracts Manager, Engineer, Supervisor, Quality, Planner, Environmental Officer) *Contractor (PM , Contracts Manager, Engineer, Supervisor, Quality, Planner)*

Site meeting: To deal with technical, progress, programme and administrative matters at a work activity level.	Weekly after site establishment	Site	Chaired by the *Supervisor* and attended by the *Contractor*, *Project Manager* and the *Employer's* Environmental Officer.
Commissioning	Weekly during commissioning	Project Managers office & Site	*Employer (*PM, Contracts Manager, Engineer, Supervisor, Quality, Commissioning Manager, Operations) *Contractor (*PM*,* Contracts Manager, Engineer, Supervisor, Quality, Commissioning Manager)
Hand Over	Bi-weekly after Commissioning	Project Managers office	*Employer (*PM, Contracts Manager, Engineer, Supervisor, Quality, Commissioning Manager, Operations) *Contractor (*PM*,* Contracts Manager, Engineer, Supervisor, Quality, Commissioning Manager)

Meetings of a specialist nature may be convened as specified elsewhere in this Works Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the works.

Records of these meetings shall be submitted to the Project Manager by the person convening the meeting within five days of the meeting.

All meetings shall be recorded using minutes or a register prepared and circulated by the person who convened the meeting.

Such minutes or register as in point (3) shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the Conditions of contract to carry out such actions or instructions.

i. The *Contractor* reports the overall progress and as a minimum requirement, the following is addressed:
ii. *Contractor's* current activities progress and planned finish dates.
iii. *Contractor's* planned start and finish dates for the works.
iv. *Contractor's* and Project Manager's programme agenda compared for problematic differences.
v. The progress of any other relevant activities.
vi. To discuss any technical, commercial, quality, and safety issues in the project

Meetings of a specialist nature may be convened as specified elsewhere in this Works Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the works. Records of these meetings shall be submitted to the Project Manager by the person convening the meeting within five days of the meeting.

2.2.2. Monthly Measurement Meetings

A monthly measurement meeting shall be held to deal with the processing of the *Contractor's* invoices, backup documentation, and monitoring of the bill of quantities against the Target Price. The *Contractor* shall present a monthly report at this meeting which will include graphs of actual progress against tendered progress as well as cumulative actual cost against cumulative tendered cost as per the tendered programme. The format of this monthly report as well as the level of detail of its contents shall be agreed with the Supervisor.

Before each successive monthly measurement meeting (i.e. on a weekly basis), the *Contractor* shall submit to the Supervisor all current (or cumulative to that assessment date) backup documentation for acceptance. Backup documentation shall include, but not limited to: all calculation sheets, citing each completed task and item in the Bill of Quantities, drawings, etc.; acceptance of completed work payment purposes, including confirmation of attainment of each criteria set out either in the specification or any other document which this contract prescribes.

Following the monthly measurement meeting, the *Contractor* shall present a detailed final schedule (with revisions agreed to at the monthly measurement meeting incorporated), including the necessary backup documentation, to the Supervisor for final checking. Once accepted by the Supervisor, he will submit it to the Project Manager. This will then be used by the Project Manager to assess the amount due in terms of Clause 50 of the ECC.

The final format and layout of this monthly schedule as well as the level of detail of backup information required are to be agreed between the Project Manager and the *Contractor*.

Clause 52 of the ECC shall apply in terms of accounts to be kept by the *Contractor* to verify the above monthly schedule of actual costs.

All meetings shall be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the conditions of *contract* to carry out such actions or instructions.

2.2.3. Documentation control

2.2.3.1. Documentation to be provided by the *Employer*

The *Contractor* will be provided with one copy of the Contract, i.e., of the signed form of agreement together with the documents which would make up the Contract as identified in the form of agreement.

2.2.3.2. Document Identification

All documents issued shall be numbered, dated and registered in an on-site project document management system, maintained by the *Contractor* and conforming to the *Contractor's* Quality Plan, subject to the acceptance of the Project Manager. All changes to such documents shall be made in writing with such revisions also recorded in the above document management system.

All documents shall be available at their recorded locations as noted in the document management system. Refer to Reporting and Data Requirement specification for *Contractors*.rev2 (240-83561037).

All documents supplied by the *Contractor* are subject to the *Employer*'s acceptance. The language of all documentation is required to be in English. The *Contractor* includes the *Employer*'s drawing number in the drawing title block. This requirement only applies to design drawings developed by the *Contractor* and his *Subcontractors*. Drawing numbers are assigned by the *Employer* as drawings are developed.

2.2.3.3. Document Submission

Within three (3) weeks of the starting date, the *Contractor* submits a comprehensive time schedule for submission of all documentation including drawings, design calculations, schematics, wiring tables/diagrams, manuals, procedures, quality control plans and any other information for the review and acceptance by the *Project Manager*.

All project documents must be submitted to the delegated *Employer's* Representative with transmittal note according to Project / Plant Specific Technical Documents and Records Management Work Instruction (240-76992014). In order to portray a consistent image it is important that all documents used within the project follow the same standards of layout, style and formatting as described in the Work Instruction.

The *Contractor* is required to submit documents as electronic and hard copies and both copies must be delivered to the *Project Manager* or representative delegated by the *Project Manager* with a transmittal note.

2.2.3.4. Email Subject

The *Contractor* submits all documentation to the *Project Manager* in the following media:

Electronic copies are submitted to Eskom Documentation Centre. The email subject as a minimum has the following: (Station_Project Name_Discipline_Subject). Electronic copies that are too large for email are delivered on an ORIGINAL plus one (1) COPY and one (1) USB Memory Stick or Flash Drive, large file transfer protocol and/or hard drives to the Project Documentation Centre. In a case whereby USB Memory Stick or Flash Drive has been submitted, a notification email, with the transmittal note attached, is sent to the project. The *Project Manager* is copied on the email as well.

Hard copies are submitted to the *Project Manager* accompanied by the Transmittal Note.

2.2.3.5. Electronic Data Control

The *Contractor* shall carry out a daily backup of all electronic information contained on the computer system on site. Electronic backup information shall be kept in an appropriate format, suitably labelled, segregated and stored in an environment that will not adversely affect its condition.

2.2.3.6. Incoming and Outgoing Correspondence

The *Contractor* shall number and date all incoming and outgoing correspondence and appropriately register it in the on-site project document management system – refer Section **Error! Reference source not found.**.

2.2.3.7. Daily Records

The *Contractor* must keep daily records of resources (people and equipment employed) and site diaries in respect of work performed on the site. A copy of the previous day's daily record must be provided to the *Project Manager* on a daily basis.

2.2.3.8. Drawings Format and Layout

The creation, issuing and control of all Engineering Drawings will be in accordance to the latest revision of 240-86973501 - Engineering drawing Standard.

Drawings issued will be a minimum of one hardcopy and an electronic copy.

Drawings issued may not be "Right Protected" or encrypted

2.3. Health and safety risk management

Reference is made to Part C3 which contains Eskom's Minimum Requirements for Health and Safety. SHE Specification (202-7883 rev 7) and applicable procedures, policies, guidelines and standards are provided under Part C3- Eskom Health and Safety Management.

The *Contractor* shall comply with the Occupational Health and Safety Act (OHS Act No 85 of 1995) and Regulations. Furthermore, the *Contractor* shall comply with any additional current statutory requirements of any relevant Government Departments regarding health and safety and environmental health.

Only the latest version/ revision of the applicable legislation, acts and regulations shall be deemed to be accepted at the Ingula Pumped Storage Scheme. Not limited to the following below legislation, acts and regulations are complied with:

i. Compensation for Occupational Injuries and Diseases Act 130 of 1993
ii. National Water Act 36 of 1998
iii. Occupational Health and Safety Act and Regulations (85 of 1993)
iv. National Environmental Management Act 107 of 1998
v. Applicable South African National Standards (SANS)
vi. National Road Traffic Act 93 of 1996
vii. Basic Conditions of Employment Act 75 of 1997
viii. National Veld and Forest Fire Act and Regulations 101 of 1998
ix. SACPCMP Act no. 48 of 2000
x. Radiation Protection Act

The *Contractor* shall establish and enforce rules to ensure the health and safety of his own employees and those of its *Subcontractors* so that high standards of personnel health and safety are achieved and maintained. The *Contractor* shall exercise and enforce all necessary care and measures to preclude exposure of personnel, labour and nearby residents (if any) to potential health hazards and environmental pollutants.

The *Contractor* shall ensure that all persons which are employed and or deployed to work on site undergo police clearance and are certified to have no criminal records. This shall be done prior to them being allowed or given access to start work on site. The Contractor is required to provide the full-time health and safety officer onsite to ensure compliance.

The *Contractor* is required to compile a SHE File to comply with the *Employer's* specification, which includes but not limited to the following;

i. Safety, Health and Environmental Plan (SHE Plan)
ii. SHE organization within the Company-Responsibility & Accountability
iii. OHS Incident management Procedure (32-95)
iv. Planning of conduct of work activities including planning for changes and emergency work (Operational Plan)
v. Management of PPE- Personal Protective Equipment (Procedure with the matrix)
vi. Emergency planning and fire risk management
vii. Vehicle and driver behaviour safety (Competency, Traffic Management, etc)
viii. *Sub-Contractor* or supplier selection and management
ix. Design and specifications (Drawings)
x. Key personnel competency, training, appointments
xi. Communication and awareness Plan
xii. Management commitment and visible felt leadership (32-407)
xiii. *Employer's* Baseline SHE Risk Assessment (BRA).
xiv. *Contractor's* Baseline Risk Assessment in line with the *Employer's* BRA (Identification, assessment and management of Safety, Health and Environmental risks related to the scope of work. The methodology used for the risk assessment must be provided together with the BRA.)
xv. Valid Letter of Good Standing (COIDA or equivalent)
xvi. SHE policy signed by CEO/ MD- Comply to OHS Act Section 7 or OHSAS 18001
xvii. Occupational hygiene and health risk assessment
xviii. Medical surveillance
xix. Security Clearance

In addition, reference is to be made to Part C3, Annexures and Health and Safety Specification, for documents and policies which the *Contractor* is to adhere to.

2.3.1. SHE File

The *Contractor* is required to compile a SHE File before the commencement of work. The SHE file must be submitted to the *Employer* for review and acceptance before any work can commence.

2.4. Environmental constraints and management

The mitigation requirements are recorded and attached in Part C3.3.2 and the Environmental Management Plan refers.

The mitigation requirements are recorded in the Construction Environmental Management Plan (CEMP) revision 6 of May 2013. The *Contractor* shall acquaint himself fully with the contents of the CEMP to ensure that the *Contractor* is fully aware of the requirements of the CEMP and its implications on the works. The *Contractor*'s rates tendered shall cover all costs that will be incurred to comply with all requirements of the CEMP. Special attention is drawn inter alia to the following aspects:

Site demarcation: The *Contractor* shall demarcate his camp site, be restricted to that specific area and take full responsibility to restore the area to its original condition before the contract commenced;

Waste management: The *Contractor* shall dispose of all waste off-site at a licensed waste disposal facility and submit proof to Eskom.

Sanitation: The *Contractor* shall provide an appropriate enclosed temporary sanitation facility not a bucket system.

Fire prevention: It shall be the responsibility of the *Contractor* to prevent veld fires at all times during the contract;

The *Contractor* shall take full responsibility for protecting the natural environment and eliminating or minimising the negative impacts of construction on the environment during construction. Nothing specified herein shall relieve the *Contractor* of any obligations or responsibilities in this regard.

The *Contractor* shall implement an Environmental Policy, in line with various statutory regulations, the Construction Environmental Management Plan (CEMP), Ref: Annexures (3.3.2) and the Works Information. The Environmental management plan shall be submitted to the *Project Manager* within 14 days after the awarding of the contract. Upon the *Project Manager*'s acceptance, the *Contractor* shall immediately implement the policy and any amendments and keep it in operation for the duration of the contract.

The *Contractor* shall keep the Environmental management plan updated in accordance with his Quality Management Procedures and make amendments as required by the *Project Manager* and the circumstances prevailing at the time. The *Contractor* shall immediately supply the *Project Manager* with a copy of an updated Environmental management plan which shall clearly indicate the revisions undertaken.

2.4.1. General

The *Contractor* shall conduct his activities so as to cause the least possible disturbance to the existing amenities, whether natural or man-made, in accordance with all the currently applicable statuary requirements. Special care shall be taken by the *Contractor* to prevent irreversible damage to the environment. Disturbance or disruption of the daily lives of local communities shall be avoided.

The *Contractor's* responsibility in terms of water use shall be as prescribed in the latest Ingula Water Use authorisation, ref: annexures C3.3.2.

The *Contractor* shall take adequate steps to educate all members of his workforce as well as his *Supervisor*y staff on the relevant environmental laws and regulations. The *Contractor* shall supplement these steps by prominently displayed notices and signs in strategic locations to remind personnel of environmental concerns.

Safety, Health and Environmental Officer shall be responsible for environmental management, in accordance with the Construction Environmental Management Plan and accepted Method statements. The appointed SHE Officer with at least Environmental Awareness Training by a registered Institution.

The duties of the SHE Officer shall include but not limited to:

i. Liaison with *Employer's* environmental staff.
ii. Monitoring of all the *Contractor's* activities for compliance with the various environmental requirements.
iii. Instituting remedial action in the event of non-compliance.
iv. Implementation and management of environmental protection measures.
v. Reporting of environmental incidents and routine reporting of environmental activities,
vi. Participate in all environmental audits and inspections and
vii. Compile environmental report/s and submit to the *Employer's* environmental staff respectively

2.4.2. Method Statements

The *Contractor* shall submit, before 14 calendar days of commencement of any activity, a Method Statement containing details of all site layouts and environmental protection measures proposed to the Project Manager for review and acceptance.

These shall include but not limited to:

i. Site establishment layout;
ii. Pollution prevention measures;
iii. Waste Management plan;
iv. Chemical and Hydrocarbon Management

In addition, the *Contractor* shall provide detailed method statements on how he intends to carry out the *works*; this shall apply to all, and any part of the *works* as provided in the *conditions of contract.*

2.4.3. Temporary Services and Facilities

All fuel storage tanks shall be bunded to 110 % of the total storage capacity. Fuel dispensing areas and workshop areas shall be provided with concrete hard standing draining to oil separators. This will also apply to other areas with pollution potential.

Vehicle cleaning shall be undertaken in designated wash bays, which have an impermeable floor and are bunded to contain runoff and direct in onto a sump. Oil and diesel will be skimmed off the sump water and recycled or disposed of in the correct manner.

Vehicle / plants with Emergency breakdown fixed outside the workshop or designated area, oil spillage control measures shall be in place such as drip tray and spill kit, to catch oil and diesel which may leak from the vehicles.

2.4.4. Protection of Rivers, Streams and Watercourses

All rivers, streams and watercourses shall be protected from direct or indirect spills of pollutants such as garbage, sewage, cement, oils, fuels, chemicals, aggregate tailings, silt and wastewater or organic material resulting from the *Contractor's* activities. In the event of a spill prompt action shall be taken to clear polluted or affected areas.

The *Contractor* shall not work within river flood lines, streams, water courses and wetlands without the written acceptance of the Project Manager as required for the execution of the work.

The requirements for dealing with waste and polluted water are specified in Section 4 – Dealing with Water.

2.4.5. Refuse and Waste Control

The management of solid waste on Site shall be strictly controlled and monitored. Only licenced waste disposal landfill sites shall be used.

The quantities of waste generated on Site shall be minimised;

Labelled recycling bins shall be used and waste separated where possible. In addition, a recycled-material collection schedule shall be established and the bins shall be collected regularly;

Eating areas for the construction staff shall be designated and supplied with waste bins.

No on-site burying or dumping or unauthorised burning of any waste materials, vegetation, litter, or refuse shall occur;

Bins provided will be sufficient to store the solid waste produced on a daily basis;

The bins should be emptied at least once a day;

Waste from bins may be temporarily stored on Site in a central waste area that is weatherproof and scavenger-proof and which the *Project Manager* has accepted;

All solid waste shall be disposed of off site, at a licenced landfill site. The *Contractor* shall supply the *Project Manager* with a certificate of disposal; and

Waste shall be separated into domestic waste, building/construction rubble, scrap metal, oil and grease and hazardous waste and dealt with in the following manner:

2.4.5.1. Domestic Waste

Metal refuse bins to BS 792 or equivalent plastic refuse bins, all with lids, shall be provided by the *Contractor* for all construction sites. Refuse shall be collected and removed from all facilities on the Site at least twice per week. Domestic Waste shall be transported to the accepted refuse disposal site off site in covered containers or covered trucks.

2.4.5.2. Organic waste

Refuse from food preparation and eating areas shall be collected and removed daily. Organic Waste shall be disposed of as per Domestic Waste.

2.4.5.3. Building/Construction waste

Inert building/construction rubble shall be disposed at a nearest licenced landfill sites. Waste Manifest/s submitted to the *Project Manager*

2.4.5.4. Scrap metal

Scrap metal shall be disposed off-site at a licenced scrap metal recycling facility. Waste Manifest/s or paper trail submitted to the *Project Manager*

2.4.5.5. Used oil and grease

Used oil and/or grease shall be removed from site to a licenced oil recycling company. Waste Manifest/s or paper trail submitted to the *Project Manager*

2.4.5.6. Hazardous waste

All hazardous waste shall be disposed of in a licenced hazardous waste disposal site and safe disposal certificate supplied to the *Project Manager*.

2.4.6. Protection of Flora

The removal, damage and disturbance of indigenous flora are prohibited.

At the commencement of the contract, the *Project Manager* will identify to the *Contractor* indigenous flora or any rare or endangered flora that shall be preserved. The *Contractor* shall thereafter demarcate such and undertake all necessary measures to ensure the protection of such flora, including replanting and any special care required in accordance with the CEMP.

The use of herbicides is prohibited unless accepted by the *Project Manager*.

2.4.7. Protection of the Fauna

The *Contractor* shall protect fauna living within the Site and shall ensure that hunting, snaring, poisoning, shooting, nest raiding, or egg-collecting and disturbance does not occur.

The *Contractor* is to ensure that his employees are instructed not to feed wild animals.

The use of pesticides is prohibited unless accepted by the *Project Manager*.

No domestic pets or livestock are permitted on Site.

2.4.8. Preservation of Topsoil

The *Contractor* shall remove and stockpile topsoil in accordance with the CEMP, Section 3 - Clearing of site, or as directed by the *Supervisor*, in quantities sufficient for reinstatement. Topsoil shall be removed from, inter alia, working areas (including quarry pits) and relevant areas of the Permanent Works, construction, haul, and other access roads and such like, all as directed by the *Supervisor*.

2.4.9. Erosion Control and Stormwater Management

The *Contractor* shall include in the design of the works measures to prevent erosion resulting from his actions on the Site. The *Contractor* shall take appropriate and active measures to prevent erosion resulting from his works, operations and activities which shall be agreed with the *Supervisor* even when such potential erosion may take place or occur beyond the limits of the Site because of the actions of the *Contractor*. Such measures shall include properly constructed watercourses, energy dissipaters, establishment of temporary vegetation as specified in the CEMP, to counter erosion and avoid discharges into water courses, wetlands, agricultural lands, etc.

2.4.10. Dust and Vehicle Emission Control

2.4.10.1. Dust

A dust control programme shall be implemented by the *Contractor* to maintain a safe and healthy working environment, minimise nuisance for surrounding residential areas, prevent damage to the natural vegetation of the area and protect topsoil.

The *Contractor* shall act appropriately to minimise the generation of dust resulting from his works operations and activities.

The *Contractor* shall prepare and submit a Dust Control Method Statement to the *Supervisor* within 14 days after the Starting Date. As a minimum, the statement should address the following:

i. Schedule of spraying water on unpaved roads paying due attention to control of runoff;
ii. Speed limits for vehicles on unpaved roads and minimisation of haul distances;
iii. Measures to ensure that material loads are properly covered during transportation;
iv. Schedule for wheel cleaning and measures to clean up public roads that may be soiled by construction vehicles;
v. Minimisation of the area disturbed at any one time and protection of exposed soil against wind erosion;
vi. Reporting mechanism and action plan in case of excessive wind and dust conditions.
vii. The control measures shall also include regular and effective treatment of gravel access roads and working areas, use of dust extractors on drilling equipment or wet drilling, use of personnel protective equipment, etc.

2.4.10.2. Vehicle Emissions

Vehicles emitting noticeable diesel fumes or smoke will not be permitted to continue working on Site. Vehicle emissions shall be monitored on a regular and on-going basis in order to ensure that vehicles working on Site comply with legislated requirements.

2.4.11. Noise Pollution

Having due regard for local communities and dwellings, the *Contractor* shall restrict any of his operations which result in undue noise disturbance to those communities and dwellings to the hours of 06:00 to 18:00 on weekdays or otherwise as agreed with the *Project Manager*.

The *Contractor* shall not use sound amplification equipment on Site unless in emergency situations.

The *Contractor* shall ensure that environmental awareness and training for all employees includes the need to minimise noise. The *Contractor* shall provide suitable ear protectors to all his staff and *Others* entering areas with high noise levels. Zones of risk shall be clearly identified with warning signs.

The *Contractor* shall provide and maintain equipment to measure noise levels in accordance with SANS 10083.

The *Project Manager* may from time-to-time instruct the *Contractor* to carry out more frequent testing of noise levels. Furthermore, he may require the *Contractor* to carry out testing in other areas of the Site.

The *Contractor* shall keep records of all noise level measurements for the duration of the contract. These records shall be submitted each month to the *Project Manager*, or on the request of the *Project Manager*.

2.4.12. Relations with Local Communities

The *Contractor* shall liaise with the local Communities through the accepted channels or forums as indicated by the *Project Manager* on matters concerning the impact of his operations on local communities and other matters. Any problems which cannot be resolved by the *Contractor* shall be referred to the *Employer* through the *Project Manager*. A senior member of the *Contractor's* staff shall be required to attend the meetings of the Environmental Management Committee as and when requested.

2.4.13. Site Roads

Prior to the construction of temporary site roads, the *Contractor* shall submit a Method Statement for acceptance by the *Project Manager* 14 days before such road is due to be constructed. A photographic record of the proposed route shall be prepared by the *Contractor* prior to the construction of the access roads.

2.4.14. Natural Features and Heritage Resources

The *Contractor* shall not deface, paint, damage or mark any national features (e.g., rock formations) situated in or around the Site for survey or other purposes unless accepted by the *Project Manager*. Any contravention of this Sub-Clause will require the item to be restored/ rehabilitated at the *Contractor's* cost. The *Contractor* shall ensure that should any archaeological finds be made during the construction excavations; the *Contractor* shall inform the *Project Manager* immediately to reach agreement regarding proper procedures to minimise damage and or effect salvage operations of the findings.

All heritage resources to be affected by the project shall be treated and managed in accordance with the National Heritage Resources Act 25 of 1999 and the National Monuments Act 28 0f 1969.

i. Remedial action in the event of non-compliance.
ii. Implementation and management of environmental protection measures; and
iii. Reporting of environmental incidents and routine reporting of environmental activities.

No measurement or payment will be made against any items for the rehabilitation of the *Contractor's* working and accommodation areas (including the areas designated for the *Supervisor's* use) or for rehabilitation of areas used for temporary roads. No overhaul will be paid for work within the Site.

2.5. Quality assurance requirements

2.5.1 QUALITY REQUIREMENTS

2.5.1.1 OVERVIEW

2.5.1.1.1 The fundamental objective of the set of quality requirements stated within this contract is to ensure that the *Contractor* produces goods/products/services that the *Employer* are wholly satisfied with whilst ensuring that work is done right the first time. To achieve this, the *Contractor* shall ensure that three approaches are taken. These are as follows:

a) Ensuring that the *Contractors* Quality Management System (QMS) is set up and maintained
b) Quality Assurance
c) Quality Control

These are broad areas each with numerous requirements.

2.5.1.1.2 The *Contractor* is fully responsible and wholly accountable for Quality of their work. An example of this is that the *Contractor* has its own Quality Controllers performing formal inspections/intervention according to the Quality Control Plans.

2.5.1.1.3 The *Contractor* shall comply with all requirements specified in the Eskom standard, 240-10565800 “Supplier Quality Management: Specification” [1]. It is of utmost importance that this standard be complied with.

2.5.1.2 CODES, STANDARDS AND DOCUMENTS TO BE COMPLIED WITH

The Contractor shall comply with the following documents as well as all documents referenced therein:

[1] 240-105658000 “Supplier Quality Management: Specification” (QM 58)
[2] ISO9001:2015 “Quality Management Systems – Requirements” (Take note that the level of compliance to this standard are determined by [1] above and section 1.3 below)
[3] ISO10006:2003 “Quality Management Systems – Guidelines for Quality Management in Projects”
[3] 240-81256435 “Coal & Clean Technology Portfolio NC Process”

[5] 240-134232676 “Data book Review and Final Submission Process”
[6] ISO 10005 – Quality Management – Guidelines for Quality Plan
[7] 240-106628253 “Standard for Welding Requirements on Eskom Plant” (if applicable)
[8] 240-83539994 “Standard for Non-Destructive Testing (NDT) on Eskom Plant” (if applicable)
[9] Pressure Equipment Regulations (PER) (if applicable)
[10] SANS 347 “Categorization and conformity assessment criteria for all pressure equipment” (if applicable)

2.5.2 QUALITY MANAGEMENT SYSTEM REQUIREMENTS

1) Category 3 The supplier shall submit objective evidence of a developed QMS that complies with ISO 9001 (or the latest applicable revision). The Contractor shall comply with the requirements of 240-105658000 “Supplier Quality Management: Specification”. Compliance to Category 3 requirements is mandatory. The following documents (approved/signed copies) shall be submitted:
    a) Quality management system manual or a document that have defines and describes the QMS and its scope
    b) Quality Policy

c) Quality Objectives
d) Control of documented information
e) Records required by ISO 9001 standard (List of Records)
f) Internal audit procedure
g) Control of nonconformity outputs
h) Nonconformity and Corrective action procedure
i) Documented information for Control of Externally Provided Processes, Products and Services Processes, Products and Services
j) Information for roles, responsibilities and authorities

2) The Quality Management System shall drive the *Contractor's* business management processes to ensure that all of the *Employers* requirements are fully met on a consistent basis.
3) The *Contractor* shall comply with all requirements specified in section 3.1 of the Supplier Quality Management Specification.
4) The *Employer* has the right to conduct formal audits on any or all parts of the *Contractor's* Quality Management System as well as any documentation, materials, or equipment associated with the work, at any time and at any project work location.
5) The *Employer* also has the right to carry out assessments and audits on the *Contractor's* sub-contractors at planned intervals.
6) In the event that the *Employer* is dissatisfied with the *Contractor's* work for any reason, the *Employer* has the right to conduct additional audits of the *Contractor*.
7) The *Contractor* shall address all audit findings to the satisfaction of the *Employer* within a time frame acceptable to the *Employer*.

2.5.3 QUALITY ASSURANCE REQUIREMENTS

1) The *Contractor* shall ensure that Quality Assurance is performed at all levels and phases of work carried out for the *Employer*.
2) The *Contractor* shall use processes to ensure that quality is built into their products/services i.e. its business processes are organized such that quality is built into the process of producing goods and rendering services. The *Contractor* shall work according to processes.
3) The *Contractor* shall ensure that it can be relied on to deliver quality goods and services without the need for the Employer to have to inspect all the time.
4) The Contractor shall provide a proposed Quality Table of Payments (Quality Payment Schedule) showing the relationships between Bill of Quantities/Activity Schedule Items, Client Acknowledged Programme Items, Inspection & Test Plans/Quality Control Plans (ITPs/QCPs), Sign off by the Employer's Quality department and proposed Payment (Proforma Invoices) which will attest to the works having been done to required quality. This table shall be reviewed, Employer comments addressed by the Contractor and approved by the Employer within 30 days of contract award.
5)
6) The Contractor shall keep the Quality Table of Payments (Quality Payment Schedule) updated with progressive Employer sign-off (as the work is done and payments applications are submitted). This means that as the Contractor completes an activity and has the related ITP/QCP signed by the Employer, the Contractor shall bring the Quality Table of Payments to the Employer's Quality representative to sign off for that activity.
7) The updated Quality Table of Payments shall accompany all payment applications (proforma invoices). The Contractor shall attach the signed (or partially signed if applicable) ITPs/QCPs to the payment application. Payment will only be made if the ITPs/QCPs are signed by the Employer.

2.5.4 QUALITY CONTROL REQUIREMENTS

1) Quality Control is a product oriented set of activities for ensuring quality in products/services. These activities focus on inspection and identifying defects before these reach the *Employer*.

2) The *Contractor* shall ensure that Quality Control is performed at all levels and phases of work carried out for the *Employer*.
3) The *Contractor* shall comply with all requirements specified in section 3.4 of the Supplier Quality Management Specification [1].
4) The *Contractor* shall complete Quality Control Plans (QCPs) and Inspections and Test Plans (ITPs) (at a check sheet level) before contract award. These shall be reviewed and *Employer* comments addressed (by the *Contractor*) and signed off by the *Employer* within 30 days after contract award.
5) The QCPs and ITPs must include those for sub-contractor work.
6) The QCPs and ITPs shall be reviewed and signed off by the *Contractors* Engineering, Construction and Quality personnel. There shall be three review and sign off sections. These are at pre-work, during work (interventions) and post work (final sign off).
7) The QCPs and ITPs show each activity/requirement of the Works Information.
8) One of the earliest/first activities on the QCP/ITP shall be “Approval of the QCP/ITP” and this is a hold point hence if it is not signed by the *Employer* then work cannot continue.
9) The *Contractor* shall submit a QCP/ITP register which includes columns for Programme item, Related QCP/ITP, Date of Submission and Completion/Sign-off Date of QCP/ITP.
10) All QCPs/ITPs may be reviewed and modified by the *Employer* at any time.
11) The project programme shall show all quality intervention points such as witness, hold, verification, surveillances and review points. These shall be updated if changes are made to the programme.
12) The *Contractor* shall make use of the Kusile Project RFI/PA001 Process to request the *Employers* personnel to perform inspections. The *Contractor* shall ensure that all inspections have been “Passed” by their in house quality control representative prior to requesting the *Employers* personnel to perform any inspection.
13) In the event of poor quality, re-work or incidents where products inspected by the *Employer* fail to meet requirements, the *Contractor* shall receive a Non-conformance (NCR) if deemed so by the *Employer*. The *Contractor* shall be liable for the *Employers* costs of re-inspection as well as be liable to pay penalties as specified in this contract.

2.5.4.1 Inspections

1) The *Contractor* shall be responsible for the inspection of all the Works that is performed and the *Employer* only verifies that the Works is acceptable.
2) The *Contractor* conducts all inspections in accordance with the accepted QCP / ITP.
3) The *Contractor* provides suitably qualified personnel to conduct on-and-offsite inspections
4) The *Contractor* ensures that all Works are inspected and approved before the *Employer* is invited for the inspections.
5) The *Contractor* provides a minimum of 5 working days’ notice for local inspections (onsite and offsite) and 21 working days’ notice for foreign inspections. The notice contains copies of the Contractor’s inspection reports.
6) For onsite inspections, the *Contractor* shall send a Request for Inspection (RFI) reminder 4 hours prior to the inspection so that the Quality Department may mobilise to perform the inspection. This shall be done via the Communication Interface Memorandum. This is over and above the aforementioned 5 working days’ notice period.
7) Damages as a result of the *Contractor’s* failure to comply with the inspection requirements as specified in this section will be borne by the *Contractor* and no compensation event or variation order will arise out of this.
8) The *Contractor* shall provide all tools and equipment required by the *Employer’s* inspectors/Quality Controllers to perform any verification during the inspection for example measuring equipment etc.

2.5.5 QUALITY PLAN

1) The *Contractor* shall submit a Quality Plan within 30 days of contract award for acceptance by the *Employer*.

2) The *Contractor* shall comply with all requirements specified in sections 3.2, 3.3 and 3.4 of the Supplier Quality Management Specification.
3) The *Contractor* shall submit a detailed contract organogram showing the quality personnel to be used in the Contract. The *Contractor* shall provide CVs of the quality management employees who will be responsible for quality on site.

2.5.6 QUALITY DOCUMENTATION REQUIREMENTS

1) For all products and services, the *Contractor* shall submit the following quality documents as a minimum:
   a) Data book Index for acceptance by the *Employer*
   b) List of data books
   c) Method statement (describing how work will be executed)
   d) Equipment list
   e) Drawings
   f) ITP/QCP Register
   g) ITPs, QCPs and check sheets
   h) Inspection notifications accompanied by their inspection report
   i) Updated onsite, off site and offshore inspection schedules
   j) Inspection and or factory acceptance test dates as applicable
   k) Inspections completed / outstanding.
   l) Inspection and test reports
   m) Weekly and monthly contract quality progress report
   n) Materials used
   o) Material certificates
   p) Data sheets
   q) Equipment list
   r) Welding documents (if applicable) include Welding Procedure Specification (WPS), Procedure Qualification Record (PQR), welder qualifications, Welding Procedure Qualification Record (WPQR), welding consumables and all other documents required by relevant welding standards
   s) Quality Plan (as earlier described)
   t) Non-conformance and Defects registers and reports

2) The *Contractor* shall submit a Quality file with 30 days of contract award. The Contractor shall maintain this file throughout the duration of the contract. This file shall contain all Quality documentation and records.
3) The *Contractor* shall submit data books for all work for acceptance by the *Employer* if applicable. These are defined as follows:
   H1 – Fabrication
   H2 – Construction
   H3 - Commissioning

4) The *Contractor* shall submit data books in accordance with the *Employers* requirements. The *Employers* requirements vary depending on the type of component or system hence the *Contractor* shall modify the data books to meet the requirements of the *Employer*.
5) The *Contractor* shall submit 2 hard copies of data books and one software copy (on a DVD/CD).
6) Components may only be released for delivery to site once the H1 data book(s) has been accepted by the *Employer* if applicable.
7) Commissioning may only commence once the H2 data book(s) has been accepted by the *Employer* if applicable.
8) The *Contractor* shall ensure that all data book(s) have been submitted to and accepted by the *Employer* as per the *Employers* requirements and meet the time frames specified by the *Employer*.

9) Failure of the *Contractor* to submit data book(s) and obtain the *Employer's* approval at 100 % work completion shall affect payment.
10) Failure of the *Contractor* to submit H1 data book(s) and obtain the *Employer's* approval prior to construction will affect payment.
11) Failure of the *Contractor* to submit H2 data book(s) and obtain the *Employer's* approval prior to Commissioning will affect payment.
12) Failure of the *Contractor* to submit H3 data book(s) and obtain the *Employer's* approval prior to takeover will affect payment.
13) Failure of the *Contractor* to submit all data book(s) and obtain the *Employer's* approval will prevent take-over of the Works by the Employer.
14) The *Employer* has 21 days to review a data book from the time the *Contractor* transmits the data book to the document controller until feedback is received.
15) The *Contractor* shall specify the review status and discipline on the transmittal when transmitting data books to the Employers Doc control.

2.5.7 CONTRACT EXECUTION

1) Correspondence shall be directed to the *Employer*, and periodic quality review meetings shall be convened by *Employer* with the *Contractor*.

2) The mandatory quality review meetings are to be convened by the nominated project quality manager or his/her representative for the *Contractor*.

3) Quality Management employee's responsibilities shall include but are not limited to the following:
   a) Implementation of the QMS on site
   b) Administration of QA/QC systems on site
   c) Verification of approval status of Subcontractor's QCP and procedures
   d) On-and -offsite inspections
   e) Co-ordination, inspection and verification of the *Employer's* intervention points
   f) Review of *Contractor* testing and inspection documents (procedures, test results)
   g) Weekly and monthly progress reporting on quality performance

8) The *Contractor* shall comply with section 5 of the Supplier Quality Management Specification.

9) Monthly quality performance and management reports shall be prepared by the *Contractor* during contract execution. The content of these reports shall be agreed by the *Employer* when submitted to the *Employer* on a monthly basis.

2.5.7.1 Quality Reporting

1) The *Contractor* shall submit a monthly quality report, on the last working day of the month. The report includes but not limited to the following:
   a) A register of NCRs and defects
   b) Updated QCP / ITP register
   c) QA monthly report summary
   d) Planned and completed local inspection dates
   e) Completed and outstanding Inspections
   f) Audit findings report

2.5.8 SUPPLIER QUALITY PERFORMANCE MONITORING PHASE

1) During the contract execution phase, the *Contractor* shall be monitored by the *Employer* for performance on quality-related aspects. The outcomes of such monitoring will enable the *Employer* to take any appropriate actions pertaining to the *Contractor*.

2) The monitoring shall be carried out periodically by the *Employer* or at predetermined intervals during the execution of a contract.

3) The monitored key performance areas include the following:
   a) Quality
   b) Delivery
   c) Design
   d) Cost
   e) Management system

4) Subsequent key performance indicators associated with these areas will include the following:
   a) Nonconformity monitoring
   b) Audit and assessment evaluation scoring
   c) Management system compliance and accreditation
   d) Achievement of delivery targets as per contractual agreements
   e) Process improvements
   f) Corrective and preventive action response and closure

2.5.9 PRESERVATION, SHIPPING AND TRANSPORTATION TO BE ADDRESSED

1) The *Contractor* is responsible for ensuring that all products are preserved in their appropriate manner as described in their specifications or in Eskom preservation, shipping and transportation procedures as applicable.
2) The *Contractor* shall submit the preservation, shipping and transportation procedures to the *Employer* for review and acceptance.
3) The *Employer* may choose to witness the packaging, loading and offloading of the products depending on their criticality, this will be indicated in the intervention points on the QCP / ITP document.
4) The *Contractor* shall ensure that all storage requirements for products are properly implemented to preserve the products against adverse conditions, deterioration, damages, etc. Storage and preservation procedures for the different products must be submitted to the *Employer* for review and acceptance.
5) The *Employer* may request to inspect the stored products at any given point during the storage period of the product.
6) Requirements for preservation, shipping and transportation are addressed in 240-105658000 [1].

2.5.10 GENERAL QUALITY REQUIREMENTS

1) The *Contractor* shall comply with all requirements specified in section 6 of the Supplier Quality Management Specification.
2) All documents shall be approved by the *Employer*. If the *Employer* is dissatisfied with a document then it is the *Contractors* responsibility to ensure that the *Employers* requirements are met.
3) All planning Quality Assurance and Quality Control documents shall be submitted for approval by the *Employer* within 30 days of contract award.
4) The *Contractor* shall make use of qualified and experienced Quality Controllers to ensure that products/services are of a high quality prior to inspection by the *Employers* quality representative(s).

5) The *Contractor* shall ensure that all defects and NCRs are addressed correctly and timeously.
6) Defects and NCRs shall be closed within a time frame or period specified or accepted by the *Employer.*
7) When NCRs and Defects notifications are issued, the Contractor shall acknowledge receipt within (5) working days and include the Root cause(s), Correction(s) and Corrective action(s) and proposed implementation dates to the *Employer* as per the contract response period.
8) The corrective actions will include the implementation and completion dates. Progress on all NCRs and Defect notifications issued to the *Contractor* must be reported to the *Employer* on weekly basis.
9) The Contractor's quality manager keeps a register of all NCRs and Defect notifications issued.
10) Deviations from the Contract are treated as a non-conformance.
11) Records of NCRs and Defect notifications are kept and form part of the data book records.
12) During the contract execution phase, the *Contractor* will be monitored by the *Employer* for performance on quality related aspects. The monitoring will be in the form of audits and assessments. The *Employers* quality department will be involved in every assessment to ensure that all NCRs and Defects raised are closed or the necessary penalties are implemented as stipulated contractually.
13) The *Contractor* is accountable for the quality of the output and liable for any failures.
14) The interventions points include all witness, hold, verification, surveillances and review points required by the Employer. The Contractor's failure to allow the intervention points will constitute a non-conformance. The *Employer* has the right to approve or reject intervention points and may add or remove these points as desired.
15) The *Contractor* shall only be paid subject to meeting and *Employer* approval of all quality requirements and three copies of the data books accepted by the *Employer*.
16) The *Contractor* shall provide all information, material and records required to comply with the Eskom Quality Management System and such further information, material and records as may be requested by the *Employer* from time to time.
17) The *Contractor* shall ensure that no inspections are missed and all schedules are observed.
18) The *Contractor* shall comply with all relevant Eskom governance documents (codes, standards etc.) whether specified in this contract or not.
19) The *Contractor* shall make use of an Authorised Certification Authority such as SABS to certify *Contractor* QMS if applicable.
20) The *Contractor* shall make use of Recognised International Accreditations such as SANAS which accredits the Authorised Certification Authority if applicable.
21) The quality requirements shall be met by the contractor and all sub-contractors.
22) The *Contractor* shall ensure that all measuring and test equipment is calibrated at all times and proof thereof must be readily available.

Penalties to be communicated to the contract manager to be included in contract terms (contract data and agreements)

1) To ensure reduction of non-conformances, the Employer will implement a penalty to the value of R50 000.00 for every five (5) NCRs issued during the contract period.
2) To ensure reduction of defects, the Employer will implement a penalty to the value of R50 000.00 for every five (5) defects issued during the contract period.
3) In the event of poor quality, re-work or incidents where products inspected by the Employer fail to meet requirements, the Contractor shall receive a Non-conformance (NCR) if deemed so by the Employer. The Contractor shall be liable for the Employers costs of re-inspection as well as be liable to pay penalties as specified in this contract.
4) Damages as a result of the Contractor's failure to comply with the inspection requirements as specified in this section will be borne by the Contractor and no compensation event or variation order will arise out of this.
5) The Contractor shall only be paid subject to meeting and Employer approval of all quality requirements and three copies of the data books accepted by the Employer.

2.6. Programming constraints

2.6.1. General

The *Contractor's* work programme shall be submitted to the *Project Manager* in terms of Clauses 31.2 and 31.3 of the ECC, and Part C1.2 Contract Data – Part One. The *Contractor* submits a level 4 programme that incorporates all work to be performed including project key dates. The *Contractor's* work programme shall be submitted in Primavera P6 (XER) or MS Project (mpp) format for ease of transfer and presentation.

The *Contractor* submits a single integrated programme that incorporates the programmes of all his *Subcontractors*, Suppliers etc. The interface points between his different *Subcontractors* as well as the interface points between the individual *Subcontractor's* and the *Contractor* are to be clearly identified.

The *Contractor* shall be responsible to manage all interfaces between him and other *Contractors*, who are expected to work within the same vicinity of the *works.* No extension of time shall be granted for any delays due to the *Contractor* not timeously managing interfaces,

In order for the *Employer* to fulfil his internal requirements for reporting and performance measurement, the *Contractor* is required to comply with the *Employer's* standard 240-85065548, Project Controls Specification for *Contractor* Integration.

The *Contractor* is to note that, other *Contractors* are working in the same area as the work of this contract. In this regard, the *Contractor* co-ordinates his work with the *Project Manager* to maintain harmonious working conditions on Site.

The *Contractor* reports the overall progress and as a minimum requirement, the following is addressed:

i. *Contractor's* current activities progress and planned finish dates.
ii. *Contractor's* planned start and finish dates for the works
iii. *Contractor's* and Project Manager's programme agenda compared for problematic differences.
iv. The progress of any other relevant activities.
v. To discuss any technical or commercial issues.

No extra payment or claim of any kind on account of providing reasonable access is allowed.

2.6.2. Computerised Planning and Reporting

The *Project Manager* does not intend duplicating the *Contractor's* programming and planning; however, portions or high-level extractions of the Accepted Programme may be used in the *Employer*'s internal master project programme for control purposes.

The *Contractor* submits updated computer files monthly, or at any other time as required by the *Contractor* or as instructed by the *Project Manager*.

The updated computer file shows the logic and all filters and layouts used in the programme. Primavera P6 software has been adopted by the *Employer* for all planning, progress monitoring and reporting on the Ingula Pumped Storage Scheme project.

The *Contractor* obtains this software and applies it for the planning and control of the works in line with the accepted Work Breakdown Structure.

Any changes that are required to be made to the Project/Programme i.e., scope changes, delays, and such, will be recorded through the Eskom change process and documentation, where all parties agree to the changes and sign.

2.6.3. Sequencing of the works

The *Contractor* shall liaise with other *Contractors* and the *Employer* to optimise the planning, scheduling and execution of his works. It is preferred that the *Contractor* execute his works on already as-built buildings and underground works. This works interfaces with the Fencing and Lightning, Security Building and Access Roads contract packages and thus is essential to determine an optimised integrated schedule.

For the purposes of planning, scheduling and execution of the works, the *Contractor* shall plan his work considering that non-working days which are applicable in the contract are weekends and Public Holidays only.

2.6.4. Additional Programme Requirements

The *Contractor* uses the Critical Path Method (CPM) technique for programme and planning. The programme shows the actual critical path clearly

The preparation of the programme contains a programme basis document. This basis document describes the programme and planning methodology, format, project execution philosophy, resource assumptions, qualifications and any other items that may have a substantive impact on the schedule.

The programme layout considers the accepted WBS (Work Breakdown Structure), reflecting the manner in that the works are to be performed and how control data are summarised, reported, and monitored. The minimum requirements for the WBS for the Access Roads and Security Building Project are as per the Works Information.

The following levels of programme are to be used for this project for dynamic integrated project control:

i. Management level programme (Level 1)
ii. Project level programme (Level 2)
iii. Control level programme (Level 3)
iv. Discipline speciality programme (Level 4)

The *Contractor* submits the level 2 programme with the tender documentation. The level 3 programme is to be submitted within one month of contract award.

2.6.4.1. Management Level Program (Level 1)

The management level programme is used to establish work goals and overall periods for the works. It is a statement of project objectives recorded in graphic form.

The management level programme defines:

Established goals or major milestones key dates,

The duration of major operations and their relationship to one another,

Identified Long Lead material items,

Responsibility assignments for accomplishing project objectives.

2.6.4.2. Project Level Program (Level 2)

A "rolled up" programme from the control level programme is produced. It is separated by each work activity and by Phase (for example: Engineering, Procurement, Construction and Commissioning).

2.6.4.3. Control Level Program (Level 3)

The project level programme is prepared representing the significant work activities and deliverables associated with the works. The product is a time scaled bar chart schedule developed through use of a logic network. This programme is separated by work areas, by Phase and by WBS.

The work within each work area is broken down by Engineering Discipline, Procurement of Tagged equipment and Bulks, Construction by *Contractor*, and Commissioning & Start-up. The control level programme is resource-loaded. It forms the basis for progress measurement, progress curves and histograms for each discipline within a work area.

2.6.4.4. Discipline Speciality Program (Level 4)

The need for supplemental or discipline speciality programme is dependent upon the requirements and/or circumstances of the contract.

The discipline speciality programme developed and maintained by the *Contractor* is generated for tracking and control of various activities and deliverables for all phases of the contract. This programme is usually formatted as a spreadsheet or database report utilising the WBS structure.

This programme typically represents day-to-day tasks which are work activity based and become summarised in the Level 3 activities. Resource information for labour, Plant, Material and Equipment and reflected in the resource histograms is to be provided by the *Contractor*.

Staffing Histograms are to be submitted based on “equivalent personnel.” Available work hours consider 4- and 5-week months and statutory holidays that may occur. Staffing histograms is updated with actual data for each reporting period and re-forecasted as required should significant deviations occur.

2.6.4.5. Submission of Revised Programmes and Progress Reporting

The *Contractor* submits two hard copies and one electronic copy in Primavera or MS Project (mpp) format, of each revised programme and progress report to the *Project Manager* for acceptance. All formally issued reports are to follow the progress reporting requirements as stated below.

2.6.4.5.1. *Weekly Status Reports*

A weekly status report is submitted by the *Contractor* to the *Project Manager*. This report is less formal than the monthly report and is used as a tool for the day-to-day management of the project. Contents of a weekly report may include the following items:

i. The updated Primavera programme
ii. Programme summary narrative
iii. Progress and performance summaries
iv. Schedule rolling horizon
v. Sectional Completion and Key Milestone status

2.6.4.5.2. *Monthly Progress Report*

The contents of the report may vary from month to month depending upon the phase of the project and/or the items of management focus. However, the basic framework of the report consists of the following:

i. Executive summary (narrative identifying major movement within the reporting period).
ii. Revised Programme indicating, actual progress of work against last Accepted Programme.
iii. A one-month look ahead work window.
iv. Activities completed during current reporting period per discipline, including the activities of the *Employer* and *Others*.
v. Activities in progress during current reporting period per discipline, including the activities of the *Employer* and *Others*.
vi. Activities undertaken during next reporting period per discipline, including the activities of the *Employer* and *Others*.
vii. Status overview by work activity, by work area, by phase.
viii. Key issues / Items of concern and corrective actions.
ix. Progress curves and tabular progress reports.
x. Cost and Cash flow.
xi. Cost curve 'S-curve'.
xii. Early warning log.
xiii. Compensation event log.
xiv. General planning report (computer generated).
xv. Critical activities report.

xvi. Updated summary of hammocked report (computer generated).
xvii. Key event report (computer generated).
xviii. Report selecting all the activities of the *Employer* and *Others* - (computer generated).
xix. Updated bar charts.
xx. Updated resource schedule and histogram (If changed).
xxi. Updated programme showing work activities.
xxii. Forecast rate of payment schedule updated with actual progress.
xxiii. Statement and report on work ahead and behind progress.

The monthly progress reporting cycle is based on a month end “cut-off.”

The *Contractor* uses the CPM technique for programme and planning. The preparation of the programme contains a programme basis document. This basis document describes the programme and planning methodology, format, project execution philosophy, resource assumptions, qualifications and any other items that may have a substantive impact on the schedule.

The programme layout considers the functional group breakdown or WBS reflecting the way the works are to be performed and how control data is summarised, reported, and monitored. All activities of the WBS are linked to the deliverables.

Calendars are clearly defined and accepted by the *Project Manager*.

Activity numbers clearly define the level of the WBS and considered the functional groups.

The construction schedule is a resource loaded schedule.

The *Contractor* provides an excel table that shows the construction plant and equipment mobilisation per month, work force teams to be mobilised per month and a materials and equipment per month table for the period of the construction contract. The schedule resourcing will provide adequate information (Bill of Activities, man hours, Machine hours, tons of material erected. etc.) to allow the linking of progress measurements on items.

The progress measurements method will be agreed with the *Contractor*.

The *Contractor* submits a Division of Responsibility (DOR) table between the *Employer* and the *Contractor*.

The *Contractor* submits a procurement plan for all Resources (labour, material equipment, construction plant etc.) in excel format to the *Employer*.

The *Contractor* submits the schedule technical checklist for ensuring that the schedule meets best practice scheduling criteria and supports CPM. The schedule complies with the ***Employer’s*** technical checklist.

The schedule also contains sufficient detail for Earned Value Analysis (EVA).

The *Contractor* submits a copy of the schedule (in Primavera P6 electronic format or MS Project (mpp) format), with sufficient detail (levels 1-4) for inclusion in the ***Employer’s*** Project Master schedule.

The ***Contractor’s*** schedule is coded with integration codes, supplied by the *Employer* that will enable the integration with the Master schedule. The *Contractor* maintains the integration codes in the ***Contractor’s*** schedule.

The prefix to be used for all calendars, resource, activity, and cost codes will be specified by the *Employer* after contract award. The prefix will be used in the programme to assist with the import of schedules into the ***Employer’s*** centralised environment.

The *Contractor* utilises the agreed calendars and hours per period. This will be agreed within 2 weeks of contract award.

Interim milestones or interface dates between milestones will be clearly identified and documented.

The schedule includes allowance for weather delays, consequences of weather delays, vacation days and other non-working periods.

The *Contractor* ensures that the schedule clearly shows the interrelationship of all activities and includes logic - linked annotated bar charts (Gantt charts). In relation to each activity the following minimum information is presented:

i. Identification number.
ii. Description.
iii. Duration in working days which should correspond to the project overall durations as appropriate.
iv. Early start and early finish dates.
v. Calendar.
vi. Bar indication early start date, early finish date and duration.
vii. Total float.
viii. Periods of inactivity.

The detailed activity comprises of the following:

i. Contain sufficient information such as activity duration and description to be able to measure accurate progress within the required update period.
ii. A clear description of the activity to be performed

2.6.5. Monthly/ Weekly Progress Status Reports and Planning Meetings

The *Contractor* submits schedule updates every two (2) weeks and weekly planning reports.

The monthly report is submitted one (1) week before the monthly project progress meeting. The project will determine whether the reports need to be submitted more frequently, e.g., daily during commissioning.

The *Contractor* submits weekly, two (2) weeks look ahead schedule updates, at the beginning of each week, indicating the past weeks progress and the next 2 weeks planned work.

The Planning & Scheduling monthly progress report contains the following:

Planned Dates vs Current Dates for main, agreed activities, percentage complete, physical percentage complete and remaining duration.

Variances, explanations for variances and proposed corrective actions, time impact analysis of each variance (change or delay)

Completed activities but not yet assessed, if any

i. A bi-weekly Look Ahead schedule report for main, agreed activities, longest path activities, full schedule of outstanding work, milestone status report, resource histogram, report on calendars used
ii. Earned Value Management report
iii. Cost Performance index and Schedule Performance Index.
iv. Progress for Engineering, Procurement, Commissioning, Construction, and the *Contractor* Document Submission Schedule.
v. The reports are in PDF and native format.
vi. The XER program file of the schedule (monthly).
vii. The baseline in PDF format.
viii. Narrative report of all changes and movement within the schedule.
ix. Equipment and labour resource schedules and the spread of Resources.
x. Printout presenting calendar information in PDF format.
xi. Commissioning schedule.

The *Contractor* attends the following schedule review meetings:

i. Monthly Project review meetings with the Project Manager, where the progress of the works as indicated on the detailed schedule, will be reviewed.
ii. Weekly progress meetings, where the *Contractor* will provide a two-week look-ahead report as well as the progress achieved over the preceding week that is submitted 1 workday before the meeting.
iii. Any ad-hoc scheduling meetings that the *Employer* deems necessary to track the progress of the works, such as integration interfacing management meeting.

2.6.6. Inclusion of Activities by Others in the Programme

The *Contractor's* programme and any subsequent revisions shall be deemed to be considering all public holidays and all non-working times. When the *Contractor* deems any period a calendar year as a non-working time, e.g., pay weekends, etc. all such shall be declared up front and agreed with the *Project Manager* in the first construction program for acceptance, failing which shall render any later declaration as invalid. In addition, the *Contractor* shall deliver his first programme as stated in the Contract Data, and it shall be accompanied by the detailed schedule basis or schedule narrative, which details how the *Contractor* has derived each activity detail, duration, resources, and method of working (method statements).

2.6.7. *Contractor*'s management, supervision, and key people

The appointment of key personnel shall be in terms of Clause 24 of the ECC and as a minimum, the *Contractor* shall nominate a *Director* / *Senior Manager*, a *Contract Manager,* and a *Site Manager*, subject to the acceptance of the *Project Manager*, refer Part C1.2 Contract Data– Part Two.

The *Contractor* is also required to submit a preliminary organogram of all key persons including their *Subcontractor's* at tender stage and after contract award.

The organogram submitted at tender stage is required to contain the following persons as a minimum:

i. Project Manager
ii. Site Construction Manager
iii. Site Manager
iv. SHEQ (Safety, Health, Environment, and Quality) Manager

Refer to Tender Schedule for detailed information.

2.6.8. Invoicing and payment

Within one week of receiving a payment certificate from the *Project Manager* in terms of core clause 51.1, the *Contractor* provides the *Employer* with a tax invoice showing the amount due for payment equal to that stated in the *Project Manager's* payment certificate.

The *Contractor* shall address the tax invoice to Eskom Holdings SOC Ltd and include on each invoice the following information:

i. Name and address of the *Contractor* and the *Project Manager.*
ii. The contract number and title.
iii. *Contractor*'s VAT (Value Added Tax) registration number.
iv. The *Employer*'s VAT registration number 4740101508;
v. Description of service provided for each item invoiced based on the Price List;
vi. Total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT;
vii. (Add other as required)

2.6.8.1. Details on how to submit invoices and additional information:

Ensure that the Eskom order number is clearly indicated on your invoice together with the line number on the order you are billing for.

All Electronic invoices must be sent in PDF format only.

Each PDF file should contain one invoice; or one debit note; or one credit note only as Eskom's SAP (System Application and Products) system does not support more than one PDF being linked into workflow at a time.

Your E-mail may contain more than one PDF file (e.g., 2 invoices on 2 separate PDF files in one e-mail).

For Foreign invoices, suppliers will still be required to physically deliver hard copies of original documents to the respective documentation management centres even though you have e-mailed those invoices

Tax Requirement

i. A PDF file that was created directly from a system meets the definition of original document and is allowed (including saving documents from excel to PDF, word to PDF etc.)
ii. An Invoice that was printed and then scanned to PDF by the Vendor is not acceptable as this is not an original tax invoice by SARS (South African Revenue Service) definition but a copy.
iii. The following wording needs to appear on the invoice: "Your invoice is encrypted in order to comply with SARS requirements that invoices and statements sent electronically are tamperproof."

If there is Cost Price Adjustment (CPA) on your invoice, we recommend that you issue a separate invoice for CPA so that if there are any issues on the CPA the rest of the invoice can be paid while resolving the CPA issues.

Introduction of electronic invoicing does not guarantee payment but will ensure visibility of all invoices and ensure that no invoices get lost. If the goods receipt is not done, the invoice will be parked, and the system will automatically send an e-mail to the end user to do the goods receipt. This is also tracked by Eskom through the park invoice report.

Your company can request a park invoice report from the Finance Shared Services (FSS) contact centre, which can then be followed up and corrected. You are welcome to forward the details of invoices corrected to the FSS contact centre.

Email addresses for invoice submission:

Group Capital Kusile & Peaking: **invoicesgrpcapitalKCT@eskom.co.za**

You do not require a goods receipt (GR) number to submit your invoices. When the GR number is received you can then send the GR number to the FSS contact centre at FSS@eskom.co.za or 011 800 5060

2.6.8.2. Schedule of Actual Costs and Accounts

The *Contractor* shall submit a detailed monthly schedule of his actual costs with all the necessary backup information at the monthly measurement meeting, for review by the *Supervisor*. The various schedule items as detailed in the Schedule of Cost Components, shall be submitted in a spreadsheet format, itemized in terms of People, Equipment, Plant and Materials, charges, and manufacture and fabrication. Schedule items shall be grouped into work area activities as outlined in the *bill of quantities*, with such work area activity groupings referenced against the *bill of quantities* item numbering.

Before each successive monthly measurement meeting (i.e., on a weekly basis), the *Contractor* shall submit to the *Supervisor* all current (or cumulative to that assessment date) backup documentation for acceptance. Backup documentation shall include, but not limited to all calculation sheets, citing each completed task and item in the Bill of Quantities, drawings, etc.; acceptance of completed work payment purposes, including confirmation of attainment of each criterion set out either in the specification or any other document which this contract prescribes.

Following the monthly measurement meeting, the *Contractor* shall present a detailed final schedule (with revisions agreed to at the monthly measurement meeting incorporated), including the necessary backup documentation, to the *Supervisor* for final checking. Once accepted by the *Supervisor*, he will submit it to the *Project Manager*. This will then be used by the *Project Manager* to assess the amount due in terms of Clause 50 of the ECC.

The final format and layout of this monthly schedule as well as the level of detail of backup information required are to be agreed between the *Project Manager* and the *Contractor*.

Clause 52 of the ECC shall apply in terms of accounts to be kept by the *Contractor* to verify the above monthly schedule of actual costs.

2.6.8.3. Records and Returns

This Section relates to the preparation and submission of records and returns by the *Contractor*, to be submitted to the *Supervisor* in a form that is acceptable to him.

i. At Start Up of the works
ii. Prior to First Commencement of a Particular Work Activity
iii. On Completion of a Work Activity or Part Thereof
iv. Daily
v. Weekly
vi. Monthly
vii. On Completion of the works
viii. Payment Arrangements
ix. Part C1.2 Contract Data – Part One, Clause 5 refers.
x. Insurance provided by the *Employer*
xi. Part C1.2 Contract Data – Part One has reference
xii. Contract change management
xiii. ECC Clause 6 – Compensation Events shall refer.
xiv. Provision of bonds and guarantees

The form in which a bond or guarantee required by the conditions of contract (if any) is to be provided by the *Contractor* is given in Part 1 Agreements and Contract Data, document C1.2, Sureties.

The *Employer* may withhold payment of amounts due to the *Contractor* until the bond or guarantee required in terms of this contract has been received and accepted by the person notified to the *Contractor* by the *Project Manager* to receive and accept such bond or guarantee. Such withholding of payment due to the *Contractor* does not affect the *Employer*'s right to termination stated in this contract.

Records of Defined Cost, payments & assessments of compensation events to be kept by the *Contractor*

The NEC ECC3 Defined Cost shall apply; precisely the Shorter Schedule of Cost Components shall apply as provided thereon.

2.6.9. Training workshops and technology transfer

The *Contractor* is required to train the staff at the sites dependent on the tasks. Training will include, but is not limited to the following:

i. Building Management System (BMS)
ii. Integrated Access Control System (IACS).
iii. Closed Circuit Television (CCTV) cameras and monitoring systems.

The *Employer* will allocate operators and maintenance staff to participate in the manufacture, erection and commissioning of the plant as provided in this contract. It shall be the responsibility of the *Contractor* to train these personnel during the execution of the Contract in the manufacturer's works and on the Site to develop the standard of competence required for their subsequent employment on the operation and maintenance of equipment included in the works. The *Contractor* shall provide training to the *Employer's* staff, covering the following regarding the *Contractor's* Plant:

i. to operate,
ii. to maintain,

iii. to perform disassembly and assembly,
iv. to test,
v. to recommission.

The *Contractor* shall accordingly take into the works an agreed number of members of the *Employer's* staff for an agreed period. The *Contractor* shall give the staff workshop hands-on training as fitter-erectors on the plant and shall give instruction in the assembly, adjustment and works testing of main items of plant.

Subsequently the *Contractor* will have the assistance of *Employer's* staff in commissioning of the plant and shall give appropriate instruction during these periods. Whilst the personnel allocated by the *Employer* can be expected to contribute in some measure to the erection work, the *Contractor* shall, in the Tender and when determining the programme, consider that these personnel are involved only for training purposes.

The *Contractor* shall include attendance of the *Employer's* staff during testing and witnessing and for key works inspections.

The *Contractor* shall provide detailed proposals setting out the key aspects of training which will be provided for the *Employer*'s personnel, both in the manufacturers' works and, on the Site, including the proposed training programmes.

2.6.9.1. Operational Training

For a period of 1 month (or otherwise agreed) following Operational Acceptance of the plant the *Employer* will allocate operators for training, during which period the *Contractor* shall provide one skilled engineer shift who will give operational training.

Training shall be done after systems have been installed and commissioned. The instructors shall be available for a total period of one (1) working day (eight hours per day) per system, after the system has been commissioned and handed over to the *Client*. The *Contractor* shall train the *Client* for every hour as stipulated above and the contract shall ensure that a certificate of training is signed by the *Client*, the *Contractor,* and the engineer.

The draft operating and maintenance manuals shall be made available to the engineer at least 4 weeks prior to the training. A full set of manuals, including drawings in hard copy and soft copy, shall be ready at handover. Drawings shall be marked up to as built status.

3. Engineering and the *Contractor*'s design

3.1. *Employer*'s design

A Building Management System will be setup as an umbrella system that will integrate seamlessly CCTV and IAC systems into a network to enable monitoring and control station wide.

3.1.1. General

The CCTV, perimeter monitoring interfaces and IAC systems will be seamlessly integrated to form a BMS to provide coverage as outlined in the *Employer's '*Marked-up' drawings and the Input-Output List (IO List).

The relevant Eskom standards (240-102220945 Specification for Integrated Access Control System (IACS) for Eskom Sites) and (240-91190304 Specification for CCTV Surveillance with Intruder Detection) provide the basis of the *Contractor's* design.

The *Contractor* shall consider the site-specific requirements to provide a site based BMS, which integrates the CCTV, IAC and perimeter monitoring systems.

Existing power and data communication infrastructure, such as the electrical power distribution, and fibre optic core backbone(0.83/50042 IPSS 0 0CYH10, 0 0CYW10 COMMUNICATION CARRIER BLOCK DIAGRAM) is

utilised for these systems. The infrastructure is from either the new NKP related security building and three tier fence or the existing power station infrastructure, where required.

3.1.2. Building Management System (BMS) Overall Requirements

An integrated CCTV-IAC purpose made control and monitoring system (BMS-Building management system) will be installed locally at IPSS site. The IAC, Perimeter Monitoring and CCTV systems will be the subsystems of the Building Management Systems

The BMS shall provide monitoring, configuration, programming, and maintenance functionality for all its subsystems on its network via shared Human-Machine Interfaces (HMI).

The BMS shall perform the following general functions:

i. Control and manage the CCTV and IAC systems
ii. Perimeter Monitoring System
iii. Monitoring and control of of its peripheral controllers, remote devices and programmable logic controllers including sensors, access control relays, DVR's, etc.
iv. Alarm management.
v. Event report generation.
vi. Network integration.

The *Contractor* is responsible for setting up and networking the BMS including its peripheral Control panels to ensure proper communication is possible throughout the Power Station site.

The BMS shall be capable of communicating via industry-accepted standard protocols, including BACNet, LONWorks, Modbus, TCP/IP, and Industrial Ethernet TCP/IP. The supporting hardware equipment must be able to withstand the harsh power station environment.

In the case of BMS failure, the system shall alert the Operator of the BMS failure. The relevant data archiving shall resume in the backup server as soon as the connection with the BMS network is re-established.

During a building/ Power Station emergency condition (e.g., personnel evacuation), the BMS shall avail the building occupancy information.

Information from CCTV (that are monitoring buildings/perimeter fence) and Access Control systems shall be sent to the workstations located in the respective control rooms. This Security Control room workstation shall have the following capabilities:

i. Alert the authorised personnel
ii. Display the details of the alarm
iii. Save the relevant logs
iv. Initiate programmed activities
v. Print reports

The BMS design for Server rooms and Data centres shall comply with the recommendations, specifications and requirements set out in Eskom documents:

i. 32-894 Rev 0 Eskom Server Room and Data Centre Standard
ii. 240-56355808 Rev 2 Ergonomic Design of Power Station Control Suites Guideline as found in Part 2 C3.2

Where any conflict arises between the above-mentioned standard and this works, the *Contractor* shall identify the conflict and recommend a solution to the *Employer*.

3.1.2.1. BMS Network

The Building Management System shall use the existing backbone Fibre network (0.83/50042 IPSS 0 0CYH10, 0 0CYW10 COMMUNICATION CARRIER BLOCK DIAGRAM).

The CCTV system shall have a dedicated network to cater for bandwidth requirements.

3.1.2.2. Operational Strategy

The configuration and control of the BMS shall be from a centrally located server in the Security control centre at the Administration Building.

The data retrieved from the central server will be for Security and Operational purposes as well as information processing.

3.1.3. Specific Client Requirements

3.1.3.1. Access Control System

The ACS shall have a minimum of the following functionality:

i. User definable zone groupings and access levels
ii. Access control provided for selected buildings / process areas.
iii. Interfaces to the CCTV system and Eskom SAP HR (Human Resources) system but not dependent on the CCTV system to perform its core functions. The reason for this interface is to:
   a. Track Multiple Entries
   b. Comparison of the person's picture on the CCTV camera to the picture on the person's access card
   c. Aid with Emergency Preparedness
   d. SAP HR system is the source of employee data to ACS
   e. Interface to two GUIs (Graphical User Interfaces) in the Powerhouse and Administration building control rooms is required to provide the status of the access-controlled doors on the security personnel's computer screen.
iv. The status of the door/s displayed shall be:
   a. Open
   b. Closed
   c. Malfunction

3.1.3.2. CCTV System

The CCTV system shall have as a minimum the following functionality:

i. Video surveillance for Pumped Storage Scheme entrance, selected process areas and critical equipment areas (e.g., turbines)
ii. CCTV system is interfaced to the ACS system but not dependent on the ACS system
iii. The cameras provide video streams at night without the use of excessive lighting
iv. The system stores the video stream for at least 30 days. In the event of an incident, the system allows for a backup of the video footage pertaining to the incident

CCTV is required for the following buildings as per the "Marked-up drawings' and the IO List:

i. Bramhoek dam wall
ii. Bedford dam wall
iii. Administration building 00UYC
iv. Security control room, entrances at MAT, Administration parking (South and North) and Visitors Centre parking areas.
v. Road Approaches
vi. Visitors Centre Outside (no fencing)
vii. Visitor Centre
viii. Switchyard

ix. Emergency power building
x. Intake structure
xi. Surge shaft
xii. Construction access tunnel
xiii. Main access tunnel
xiv. Main inlet valves
xv. Drainage gallery
xvi. Drainage sump
xvii. Oil storage area
xviii. Machine hall including all floors
xix. Transformer hall
xx. Auxiliary plant level (Lower machine hall)

Perimeter monitoring controls will be in the following buildings:

i. Administration building with fencing
ii. Visitor Centre with fencing
iii. Bedford dam
iv. Bramhoek dam
v. Intake structure
vi. Surge shaft

3.1.4. Performance Management of CCTV & ACS

The CCTV & ACS is required to meet high performance standards. This high performance is categorised as follows:

i. Supportability: *Employer* recommends use of local suppliers to support the CCTV & ACS system.
ii. Expandability: The *Contractor* provides a CCTV & ACS system design that is expandable without requiring redesigning. The design makes provision for future modifications and/or upgrades.
iii. Training: *Contractor* to provide Operating and Maintenance training required for the system.

3.2. Parts of the *works* which the *Contractor* is to design

3.2.1. Scope Overview

The scope of work for the *Contractor* for the Integrated Building Management System for the identified processes and plant areas as detailed in the *Employer's* "Marked-up" drawings and the IO list will include the following services and tasks:

i. Produce basic and detailed designs for the Integrated Security and Operational System. The detailed design must include detailed designs for the Access Control System, Security and Operational CCTV system, Intruder detection system and its associated alarm system, based on the existing IT Infrastructure.The design must also cover integration of these different systems and the Non-Lethal Energized Perimeter Detection System (NLEPDS) (done by *Others*) into an Integrated BMS;
ii. Present the proposed designs to the *Employer's* Design Review Team (DRT) for acceptance;
iii. Installation, configuration and commissioning of the CCTV system in totality on site as per Eskom standard (Specification for CCTV Surveillance with Intruder Detection 240-91190304);
iv. Installation, configuration and commissioning of the Integrated Access Control System (IACS) in totality on site as per Eskom standard (Specification for Integrated Access Control System for Eskom sites 240-102220945);
v. Installation, configuration and commissioning of intruder detection system in totality on site as per Eskom standard (240-91190304,240-86738968 & 240-170000096);
vi. Installation, configuration and commissioning of alarm system in totality on site as per Eskom standard (Specification for Integrated Security Alarm System for Protection of Eskom Installations and its subsidiaries 240-86738968);
vii. Installation, configuration and commissioning of intrusion pre-detection system in totality on site as per Eskom standard (Standard for Intrusion pre-detection systems used at Eskom sites 240-170000691);
viii. Integration of the Access Control System (ACS), CCTV system, Intruder detection system, alarm system, into an integrated security system (Physical security integration standard 240-170000096);
ix. Installation of the Integrated BMS for data collection, incidents management, data correlation, controlling functionality (CCTVs, IACS systems, Perimeter monitoring) and provision of real-time dash board and reports.
x. Conduct FAT and SAT tests before commissioning the complete integrated system;
xi. Compile site "As built drawings" with electrical and engineering detail; and,
xii. Create a Graphical User Interface (GUI) and behaviour models for the site.
xiii. Produce a detailed design report for the system
xiv. Seamless interfaces with identified 3rd party systems.
xv. Refer to Annexture B for product design and Engineering guide

The *works* furthermore include:

i. The validation of completeness and accuracy of information for the design basis;
ii. The engineering and design;
iii. The complete technical clarification;
iv. The manufacture, fabrication, assembly and supply;
v. The packaging of Equipment, Plant and materials, transport and delivery to Site;
vi. The off-loading at Site;
vii. The quality control and assurance during all phases and stages of the project;

viii. The installation;

ix. The commissioning;

x. The performance testing;

xi. The Completion; and

xii. The correction of Defects.

To ensure full functionality, the above systems shall be supported by the following scope:

i. Analogue and binary input/output modules for monitoring and control purposes.
ii. All the required infrastructure and peripherals, hardware / software / components / devices, for a fully completed BMS.
iii. Software licenses and copyright agreements.
iv. Training for Operating, Maintenance and Engineering staff.
v. Documentation as per the supplied C&I Documentation Requirements from Vendors.
vi. Power supplies and necessary power distribution, earthing and lightning protection.
vii. All necessary cabling, cable racking, cabling supports, labelling, trenching and associated infrastructure.
viii. All conduits, racks, and equipment outside and from the core fibre network.
ix. All equipment which is required to fulfil all the functions specified in the *Employer*'s requirement, but which is not specifically covered by the *Employer*'s requirement.

3.2.2. Project Execution General

The *Contractor* shall be responsible for carrying out all activities and supplying all services and equipment necessary to provide the *works* in accordance with the ***Employer's*** Requirements.

This includes clarification and coordination with the ***Employer's*** multi-disciplinary teams as well as with Other Project *Contractors.*

In general, the project execution shall follow the same process for all areas across the power station according to the contract key dates as follows:

i. The *Employer* shall provide applicable existing drawings and information to the *Contractor*.
ii. The *Contractor* shall request clarifications and submits optimised designs to the *Employer*.
iii. The *Employer* shall review and accept the *Contractor*'s design.
iv. The *Contractor* shall conduct presentations and clarification meetings on the design with the

Employer and Other Project *Contractors*. The *Employer* shall take records of these proceedings. After clarifications and the ***Employer's*** review, the *Contractor* shall submit the final design drawings for acceptance.

After the ***Employer's*** acceptance of the design documents, the *Contractor* shall procure equipment and material and performs production, assembly, installation, and commissioning.

The *Contractor* shall develop and submit relevant Test and Commissioning procedures for acceptance by the *Employer.*

The *Contractor* shall arrange and conduct the FAT for the *Employer* to witness and evaluate.

The *Contractor* installs systems and equipment on site, in accordance with the ***Employer's*** master programme to which the *Contractor* aligns his own program and schedule.

The *Contractor* performs Site Integration Tests and Commissioning.

The *Contractor* completes handover certification with *Employer*.

The *Contractor* shall perform this process in sections according to the Key Date Schedule.

It shall be the responsibility of the *Contractor,* as the design authority, throughout the execution of the Contract activities to address the following and obtain acceptance from the *Employer*:

i. Make recommendations and proposals for the detailed design for BMS equipment for all buildings across the site.
ii. Recommend the optimised solution that would provide the lowest life cycle cost.
iii. Recommend solutions and alternatives that maximise the standardisation of equipment and software throughout the power station.

The *Contractor* shall consider options to optimise and prioritise the work across the power station.

The *Contractor* shall submit all documentation according to C&I Documentation Requirements from Vendors document in Part 2 C3.2 and shall update and maintain any changes to the documentation for the duration of the *works*.

3.2.3. Building Management System

3.2.3.1. General

The BMS shall consist of the following subsystems for which the *Contractor* shall provide the full scope:

i. CCTV
ii. Access Control
iii. Perimeter Monitoring System

The *Contractor's* design shall make provision for future interfaces to the following:

i. Fire Detection System
ii. Heating Ventilation and Air Conditioning (HVAC) Control Systems

The *Contractor* shall interface to the following systems:

i. Perimeter Lighting System
ii. Time Synchronization (GPS) System
iii. Business IT Network (LAN) and Telecommunications. Backbone Fibre network(0.83/50042 IPSS 0 0CYH10, 0 0CYW10 COMMUNICATION CARRIER BLOCK DIAGRAM) is provided by the *Employer*

The *Contractor* shall ensure that the individual BMS subsystems (i.e., access control, CCTV and Perimeter protection monitoring systems) shall be integrated seamlessly into the BMS network

This includes the ability to operate (when required), maintain, engineer, and configure all BMS subsystems from the identified workstations at various points on the power station.

The *Contractor* shall also ensure that these BMS subsystems can operate as standalone systems.

The *Contractor* shall be responsible for providing power cabling from the distribution boards of the buildings/ Power Station to the various equipment supplied in this contract.

The CCTV system shall be capable of acting on information gathered from the Integrated Access Control system.

The *Contractor* shall interface all the BMS sub systems (i.e., access control, CCTV and Perimeter protection monitoring systems) via a bus network.

The BMS shall be capable of communicating via industry-accepted standard protocols such as BACNet, LONWorks and Modbus protocols. The equipment supporting the protocol used must be able to withstand the harsh power station environment.

For the interfaced BMS subsystems (where the *Contractor* only provides interface scope) that are not compatible with the BMS protocol/s, the *Contractor* shall be responsible for converting signals from these subsystems to a protocol that is compatible with the protocol/s used on the BMS.

3.2.3.2. Building and System rationalisation

Once the Contract is awarded the *Contractor* shall conduct a building rationalisation process during the basic engineering phase. The BMS subsystem and hardware used shall be optimised without compromising the functionality of the BMS.

The rationalisation shall be based on:

i. The unitised concept followed at IPSS.
ii. The grouping of buildings into sectors.

The Power Generation plant is subdivided into sectors that separate critical functions down to a level where the total plant is not affected by the loss of individual systems.

Part of this is the concept of unitising the Turbine and Generator sets.

There shall be four Turbine and Generator sets at IPSS and each set operates independently of the *Others*.

The rest of the plant is broken up into common and unit auxiliary subsystems that service these units (e.g. water cooling system, drainage and dewatering system, emergency diesel generators, etc.).

The entire BMS shall mirror this Unitised and Common plant philosophy. This includes all the individual BMS subsystems

3.2.3.3. BMS Spare capacity

The *Contractor's* design shall also provide for later expansion of the BMS such that future changes and enhancements can be readily incorporated.

The spare capacity shall be demonstrated to the *Employer* at design freeze.

The *Contractor* shall cater for the spare capacity in his design, measured at Design Freeze, without the necessity for reconfiguring the design:

i. 20% reserve physical space in all cubicles, field panels and cable racks.
ii. 10% spare installed inputs and outputs.
iii. 20% spare installed capacity in all multi-core cables (rounded up).
iv. 20% reserve power availability at full load use.
v. 30% spare memory capacity for software expansions.
vi. 30% spare hardware and software capacity for engineering and operating workstations.

3.2.3.4. BMS Performance

3.2.3.4.1. BMS Life Expectancy

The entire system is an IP based solution, which is subject to technology advancements that can cause components to become obsolete. In the event of a subsystem component failure that has been designated as obsolete the *Contractor* shall propose a replacement part that meets or exceeds the specifications. The *Contractor's* software shall be supported and maintainable for the duration of 15 years.

The *Contractor* shall provide the latest proven technology. No unproven technology shall be allowed.

The quality of the design and installation shall be based on reference plants that the *Contractor* has nominated.

During tender stage, the *Contractor* shall nominate reference plants upon which the quality of the design and installation shall be based.

The *Contractor* shall provide design, installation and “as-built” documentation including photographs demonstrating the quality.

3.2.3.4.2. BMS Reliability

The architecture shall be designed to minimise the effects of equipment failure on the overall BMS. This applies to aspects of the scope that fall under the *Contractor’s* responsibility.

No single failure of any part of the *works* shall lead to a condition that endangers the safety of the plant personnel or compromises the ability to monitor and control the BMS and its subsystems and their components.

No individual fault shall cause the loss of workstation functionality, monitoring of equipment, or availability of information supplied to the operator.

3.2.3.4.3. BMS Availability

The BMS structure shall minimise the effects of equipment failure on the overall BMS. This applies to aspects of the scope that fall under the *Contractor*’s responsibility. The *Contractor* shall provide the availability calculations during the detailed design phase of the project including the availability of the fibre ring network.

The system is considered unavailable when the failure impacts the correct operation of the functional elements or reduces the information that the functional elements provide the BMS.

3.2.3.5. BMS Time Synchronisation

The BMS shall accept a NTP time synchronization signal at a single point on the BMS which the *Contractor* shall use to synchronize all systems within the *Contractor’s* scope.

The NTP signal shall be made available by the *Employer’s* master clock via the Business LAN. The *Contractor* to liaise with the *Employer* and interface to the *Employer’s* Business LAN on-site.

The *Contractor* shall provide for this interface according to the Limit Of Supply and Services (LOSS) diagrams agreed with the *Employer.*

3.2.3.6. BMS Redundancy

The *Contractor* shall design all components of the system to ensure high availability and reliability.

The system shall be redundantly configured such that failure of a component shall not result in the loss of functionality or information.

Switching from one server to another shall be automatic, bump less and seamless. Switchover shall be automatic on failure of one server, while switchovers can also be manually initiated to support maintenance activities.

3.2.3.7. BMS Servers

The *Contractor* shall supply rack mounted site servers that are physically capable of performing the tasks required of a server machine. This includes the rack cabinets.

The detailed specification of the server machine shall be submitted to the *Employer* for acceptance.

3.2.3.7.1. Functional Requirements

A site BMS server shall be defined as being any computer on which one or more of the following are hosted:

i. Operating server application
ii. Engineering server application(s)
iii. Operating database
iv. Engineering database(s)

v. Central update system server application
vi. Backup and restore system server application, including disaster recovery for all software and firmware.
vii. Historian server application(s)
viii. Historian data collectors
ix. Historian database(s)

The health and status of each sub server in the cluster shall be continuously monitored.

The total downtime of a server application or database hosted on a BMS server – including both scheduled and unscheduled maintenance – shall be less than 5 minutes per year.

No data corruption shall occur in the event of a server crash or restart.

3.2.3.7.2. Physical specifications

The minimum specifications for each BMS server shall be as follows:

i. Redundant connections to each applicable network
ii. Use of dedicated server hardware
iii. Hot-swappable redundant power supplies
iv. Hot-swappable redundant hard drives via a suitable RAID configuration
v. 19” Rack mounted
vi. Redundant CPU
vii. Redundant case fans

3.2.3.7.3. Locations

The following functional locations are identified for consideration for the scope with regards to the servers and operating stations associated with the BMS:

i. Control suite: with CCTV and IAC for Security purposes located in the Admin Building – Security Room
ii. Control suite: with CCTV for Operational purposes located in Admin Building – Plant Control Room
iii. Control suite: with CCTV for Operational purposes located in Plant Control Room (underground)
iv. CCTV Servers: in the Admin Building and Underground Plant Server Room

3.2.3.7.4. Remote management

Each BMS server shall be remotely managed, monitored and alarmed via the network management system.

The remote management, monitoring, alarming and diagnostic facilities provided for each server shall be defined at detail design phase.

3.2.3.7.5. Network management system

A network management system shall be provided for the BMS to remotely manage, monitor, analyse, configure, and diagnose the status of the following components within in the applicable BMS:

i. All workstations
ii. All servers
iii. All network equipment
iv. All networks

The network management system shall be a single software package with a single interface via which all functionality is accessed.

The functionality provided by the network management software shall include – but is not limited to – the following:

i. Component configuration
ii. Component monitoring
iii. Automatic detection of network devices and changes in any network
iv. Visualisation/mapping of the network topologies
v. Individual alarming for each component fault
vi. Trending (Where applicable)
vii. Event handling, logging and analysis
viii. Server application monitoring
ix. Network performance monitoring
x. Network baselining and thresholding
xi. Network and server availability monitoring
xii. Management of the HIDS on all workstation and server computers
xiii. Hardware and software inventory system

The network management system shall use a GUI.

As a minimum, components shall be monitored and alarmed for the following:

i. Device state
ii. Link and connection state of each connection
iii. Power supply
iv. Fan state
v. Internal temperature
vi. CPU utilisation
vii. Memory utilisation
viii. Disk utilisation
ix. Interface/bandwidth utilization
x. Network traffic statistics (latency, jitter, throughput, errors, dropped packets)

Network loads, malfunctions and failures of the network components shall be detected promptly, and countermeasures shall be initiated automatically in time using the network management system.

All hardware and software used shall be listed in an inventory.

The hardware and software shall be identified with a clear inventory number which is issued by the inventory system.

Inventory software that scans the network shall be used for the inventory system.

3.2.3.8. BMS Workstations

3.2.3.8.1. *General*

The workstations shall provide the capability of controlling, monitoring, administering, maintaining and configuring the BMS and its subsystems where applicable.

There shall be two types of workstations:

i. Operator stations
ii. Engineering stations

The Operator stations shall primarily be used for operating, monitoring and the configuration functionality as a backup.

The Engineering station shall be used primarily for configuration, administration and the operating and monitoring functionality as a backup.

The following functions shall be possible through the BMS workstations, as a minimum:

i. Configuration and programming of all subsystems within the scope.
ii. Alarm and event management.
iii. Report generation.
iv. CCTV database (DVM) interrogating for downloading, writing to media and replaying historical video.
v. Trending of historical information.
vi. Operator administration (access).
vii. Operator station communication status.
viii. Configuration of system and subsystems.
ix. Programming of system and subsystems.
x. Printing of screens, logs and reports.
xi. Execution of External Applications.
xii. Graphics Creation Tool.
xiii. Exporting and importing of data.
xiv. Diagnostics and Maintenance functions for all subsystems in scope.
xv. Customizable dead-man timer for operators.

The Engineering Station shall have the functionality to configure user permissions for control and monitoring as well as link these permissions to a list of BMS subsystems.

Printers on the workstations shall be provided as part of the *Contractor's* scope of the *works*.

The workstation shall be made available via the station LAN firewall to be viewed through a web browser interface at Power Station staff members' personal computers.

The *Contractor* shall cater for not less than 20 simultaneous web browser workstation clients.

The web interface shall be password protected and no loss of functionality or operability shall exist when using it.

All local BMS servers shall be capable of storing information up to three months.

During Basic Engineering the *Contractor* shall propose configurations for Operator stations that take into consideration the following:

i. Operator loading.
ii. Overall monitoring of BMS functional elements across the power station.
iii. Incident response and investigations.
iv. Maintenance of BMS and its subsystems.
v. Engineering of BMS and its subsystems.

All workstations shall be fully redundant with seamless switchover to the redundant processor when one fails.

The *Contractor* shall propose screen/monitor configuration to match the processor redundancy during system engineering.

The *Contractor* shall cater for four LCD/LED monitors per operator workstation, except for photo ID workstation, Engineering workstations and card holder database workstation. The *Contractor* shall provide stands for mounting the workstations.

Monitors shall be 24" in size with a black frame such as to maintain Eskom's corporate identity

The workstation shall be able to monitor, generate reports and retrieve event logs at any given point of time.

The *Contractor* shall provide Operator / Engineering workstations for the following areas as follows:

i. Underground control room
ii. Administration building control room
iii. Guardhouse
iv. Photo ID and Cardholder

The *Contractor* shall provide rack-mounted equipment, except where specified otherwise in the section to follow.

This is done by integrating various BMS subsystems namely:

i. Access Control
ii. CCTV
iii. Perimeter Protection Monitoring Systems.

This integration allows the Engineering and Maintenance staff to programme, interrogate alarms, diagnose BMS functional elements located in different buildings and process areas across the power station.

BMS equipment shall exist throughout Ingula Pumped Storage Scheme.

The BMS shall be designed to interface all its functional elements within a specific sector (zone).

The *Contractor* shall provide all equipment and services and execute all work necessary to fulfil the requirements specified in this document.

The BMS shall be configured as a fully operational system that is implemented in a consistent and integrated manner.

The BMS shall include all hardware, software, network infrastructure, licensing, control, monitoring and local monitoring facilities to enable the operators to execute their tasks safely, reliably and consistently as well as providing the maintenance engineers the ability to maintain, modify and optimise the system.

All *works* shall comply with professional engineering practice and local and international standards, including design for the prevailing Safety, Health and environmental conditions, outlined in Section 4.

3.2.3.8.2. *Workstation Functional locations*

3.2.3.8.2.1. Underground Control Room

This Operator workstation shall form the primary central operating point for the operational monitoring of BMS subsystems for the entire Power Station.

This Operator workstation shall be in the underground control room in the powerhouse.

This Operator workstation shall also be able to authorise “requests for permits”

3.2.3.8.2.2. Administration Building Control Room workstation

This Operator workstation shall form the central operating point for the operational monitoring for the entire Power Station.

This Operator shall be in the control room on the first floor of the administration building.

This Operator shall also be able to authorise “requests for permits”

3.2.3.8.2.3. Administrative Building Security Room workstation

This Operator workstation shall form the central operating point for security and access control on the entire power station.

This operator shall focus on security areas but shall have the capability to view the power station operational areas as well.

This workstation shall be in the Administration building security control room.

This Operator workstation shall be manned 24 hours a day, 7 days a week and shall therefore require an ergonomic study to be completed by the *Contractor*.

The ergonomic study shall be completed in line with 240-56355808 Rev 2 “Ergonomic Design of Power Station Control Suites”, as applicable to a security control room, and Eskom best practices from other power stations.

The ergonomic study shall cover, as a minimum, the following:

i. Operator loading.
ii. Suggested shift durations.
iii. HMI colours to be used.
iv. Eskom’s corporate identity for finishings.
v. Operator comfort and furniture requirements.
vi. Services and facilities required for a 24 hour, 7 days a week control room.

The ergonomic study shall, as an outcome, suggest the supply of ergonomically designed equipment to be supplied by the *Contractor*.

The following ergonomic designs shall be submitted to the *Employer* for acceptance and subsequently supplied by the *Contractor*, as a minimum:

i. Several options for a workstation console including desks, chairs and workstation mounting.
ii. Storage for operator’s personal effects (e.g., lockers).
iii. Suggested shift roster.
iv. Additional lighting and the control thereof.
v. Any equipment necessary for 24 hour 7 days a week manned workstation inside the control room.
vi. Suggested improvement to any other services, to be supplied by *Others*, outside of the control room but inside the access control building (e.g., ablution facilities, HVAC and rest areas).

All conduits inside the control room are to be flush mounted.

The ergonomic design shall standardise as much as practically possible to Eskom’s corporate identity and other control rooms at IPSS.

3.2.3.8.2.4. Photo ID and cardholder management system workstation

This workstation shall consist of redundant processors, redundant screens, a card printer, a suitable digital camera, design software, database software, access cards and plastic cardholders.

This workstation shall be capable of managing the access control database for new personnel, departing personnel, service providers and visitors.

It shall also be capable of capturing photographs and printing access cards.

The workstation shall be supplied with enough consumables (cards, ink, badge clips, etc.) to support an initial user database of not less than 20000 users.

This workstation shall be located at the Guardhouse located at the entrance of the Main Access Tunnel.

3.2.3.8.2.5. Maintenance / Engineering workstation

This Operator workstation shall form a central operating point for all Maintenance and Engineering functions for the and all its subsystems of the entire power station.

The Engineering workstation shall have full access and rights to all connected equipment up to the local control panel level.

The engineering workstation shall provide advanced reporting and capability to diagnose, alert, configure and modify specific areas of the BMS.

The engineering workstation shall be located in the Administration building server room.

3.2.3.8.3. *Operating server application*

The Operating server application is the software or interface via which communication occurs between the BMS subsystems and the HMI.

The operating server application must be hosted on BMS servers

3.2.3.8.4. *HMI*

The HMI shall be the human interface for the operating and monitoring of the BMS and their subsystems.

A fully functional HMI shall be provided. The functionality provided by the HMI shall include – but is not limited to – the following:

i. Operating functionality
ii. Indication
iii. Alarming
iv. Event viewing (including operator and configuration action events linked to the user)
v. Viewing of the reports
vi. Access to historical data

The HMI shall present an integrated and standardised set of displays and facilities which are designed to conform to ergonomic principles and modern power plant practice.

The design approach of the HMI shall reflect the underlying functionality of the BMS and its subsystems and their subcomponents.

Uniformed signal descriptions and standard abbreviations shall be used throughout the HMI in conjunction with 202-7180 Ingula Pumped Storage Scheme KKS manual.

The HMI is designed according to the principles provided in 240-56355728 Human Machine Interface Design Requirements Standard.

Any incorrect operation shall be indicated to the operator by audible signal or suitable text message.

All operator actions shall be logged and linked to the user's profile.

Selection of any HMI graphic shall not require more than two operator actions (e.g., keystrokes or mouse clicks).

In alarm or abnormal conditions, not more than one operator action shall be required to access the relevant HMI graphic.

Individual users shall configure, save and restore the arrangement of the HMI graphic pages on the operating and overview screens.

Operating procedures/manuals shall be available online from the HMI.

All information available to the operator from the HMI system shall be printable when required.

A trending functionality, pre-configured trends shall be provided on the HMI to trend certain BMS subsystem measurements/signals.

3.2.3.8.4.1. GUI requirements

As a minimum, the principles in this subsection shall be used in the design of the graphical user interface look and feel.

3.2.3.8.4.2. Navigation

The GUI shall be designed in a manner that allows the operator to navigate to the BMS, its subsystems and their components (i.e., field devices) with minimum number of mouse – clicks and or keystrokes.

3.2.3.8.4.3. Menu

The order of the menu options shall be fixed.

Menus shall clearly indicate which options are selectable.

When the same options appear on several different menus, consistency of wording and ordering on all of the menus shall be maintained.

When menu selection is made from a long list, and not all options can be displayed at once, a hierarchical sequence of menu selections shall be provided rather than one long multi-page menu.

When hierarchical menus are used, the user shall have some indication of the current position in the menu structure.

Users shall be able to return to the highest-level menu in the hierarchical menu structure by a single key action.

3.2.3.8.4.4. Windows

Windows are identified by a label consistently located and displayed at the top of the window's border.

Windows shall be visually separated from each other and from their background, preferably by borders or similar demarcation.

Users shall be able to select separate windows that share a single display screen.

When multiple windows are opened simultaneously, the user shall be able to tile, layer, or sequentially view the windows. Tiling refers to a configuration in which windows are positioned beside one another. Layering refers to moving one window, so it appears to be positioned on top of another one.

Under normal operating conditions, active windows shall be frontmost on the display.

Caution and warning windows shall be frontmost on the display when they are issued.

The user's control of windows shall be consistent from one display to another for each type of window.

Users shall be able to close windows with a single action.

It shall not be possible to position windows such that they obscure menu bars, access to the command area, or caution and warning messages.

The action that opens a window automatically shall make that window active.

Windows shall have a default location on the display screen.

The default location at which each window opens is fully configurable. The exact screen and relative position of the window in the screen concerned can be configured.

Users shall be able to change the horizontal and vertical dimensions of a window independently and together.

The user shall be able to scroll through the contents of a window both horizontally and vertically.

Display data that is temporarily obscured by a window object shall reappear when the object is removed.

3.2.3.8.4.5. Alarms

A comprehensive and integrated alarm handling system shall be employed.

The alarm handling system clearly shall distinguish between different alarm types and provide alarm filtering functionality.

Alarm information shall not be lost or inaccessible whilst navigating through displays.

Alarm presentation is dynamically provided to the operator with information matched to the current situation and its criticality.

An Alarm Response Procedure is provided by the *Contactor* according to the *Employer's* template "240-48623131 Alarm Response Procedure Template". The Alarm Response Procedure is provided before operator training or handover of the workstation commences - whichever occurs first.

An alarm log is required which links the operator ID with the event for investigation purposes.

3.2.3.8.4.6. HMI faceplates

HMI faceplates shall emulate all the components of the BMS and their subsystems.

HMI faceplates shall be provided with KKS codes and equipment descriptions.

3.2.3.8.4.7. HMI response times

The maximum time taken to completely populate an HMI graphic or trend with dynamic data shall not exceed 1 second.

The average time taken to completely populate any HMI graphic or trend with dynamic data shall be less than 0,5 seconds.

The maximum time taken for an operator command to be transferred to the field device shall not exceed 0,5 seconds.

The maximum time taken for any HMI graphic to update with any change in a component status/value does not exceed 0,5 seconds.

3.2.3.9. Operator login

Each operator that is configured on the system shall be assigned a user profile that contains, as a minimum, the username, password, area of responsibility and the security level.

All operator actions shall be logged.

The system shall support configurable levels of operator security.

The following levels shall be catered for as a minimum:

i. Operator.
ii. Maintenance.
iii. Engineer.

Furthermore, each operating station shall be configurable to service power station operational areas and/or security areas.

3.2.3.10. Graphic mapping system detectors

All instruments shall be represented in multi-layered graphics on the BMS human-machine interface (HMI). The *Contractor* shall provide the graphics to the *Employer* for acceptance. The graphics should be able to indicate a healthy or unhealthy status of a device:

i. Green - Healthy
ii. Red - Alarm
iii. Yellow – Trouble (This can be any alarm other than the two above)

3.2.3.11. Printers

The *Contractor* shall supply and install A3/A4 colour LaserJet printers per Operator area.

3.2.3.12. Reporting

The system shall support a flexible reporting package to allow easy generation of report data.

The reports shall include pre-configured standard reports and customizable report templates. Reports shall be available from any of the BMS subsystems.

All information that resides within the subsystem databases shall be reportable by the BMS.

The *Contractor* shall develop templates for reporting during system engineering and submit them to the *Employer* for acceptance.

3.2.3.13. Alarm management

The *Contractor* shall develop and implement an Alarm Rationalisation philosophy to reduce the number of errant alarms.

The Alarm Management philosophy shall follow the principles highlighted in Eskom policy document 240-57859210 Alarm System Performance of Digital Control Systems Applied in Fossil Plant and 240-56355466 Alarm Management System Guideline in Part 2 C3.2 which are more process based. The *Contractor* shall consider principles that are applicable to the BMS.

The system shall cater for all system-related (hardware status) and process (functioning system) related alarms.

The Alarm Management system shall support the following functionality:

i. Flexible alarm priorities and associated colours.
ii. Filterable alarm lists per column, time and priority.
iii. Alarm suppression.
iv. Individual alarm acknowledgement.
v. Curves, trends, reports and logs.
vi. Associated with each alarm: help with the alarm and possible operator action.
vii. Configurable alarm analysis.
viii. Alarm annunciation.
ix. Alarm summary.
x. Configurable alarm displays.
xi. Viewing of recorded video captured through an alarm triggered video recording.
xii. Operator action log.
xiii. Exporting of alarm information.

3.2.3.14. Standard system displays

The following displays as a minimum, shall be included as part of the system:

i. Configuration displays showing plant layout.
ii. System status displays.
iii. Alarm summary display.
iv. Event summary display.
v. Communications status displays.
vi. Overview interactive displays for each subsystem with the ability to navigate to the detailed views.

The *Contractor* shall develop the displays during system engineering and submit them to the *Employer* for acceptance.

3.2.3.15. System database

The system shall provide a real-time database incorporating data from BMS and its subsystems including generated data e.g., logs, alarm.

The database shall be configurable by the end-user (engineering function not operator) without the need for any programming and shall be able to be modified online without interrupting the operation of the system.

This information shall be accessible by all facilities of the system such as custom displays, reports, trends, user-written applications, etc.

Event and Alarm logs shall be retained in the database.

A minimum of 3 months of data is stored in the operating database and available to plant operators via the HMI on the workstation.

The system database shall be capable of being fully integrated into Eskom's IAC system both currently and in the future.

3.2.3.16. Historical data archiving

The system shall support archiving of historical data to allow a continuous record of history to be built up over a period.

Archived data may be stored on the local BMS server or on external storage media. It can also be transferred to external storage media (DVD/Blue-ray writer) automatically and manually.

The *Contractor* shall propose methods to minimise the size of the archive during system engineering e.g. only storing analogue values when they change.

The data for all BMS subsystems (except DVM video recordings which shall be archived on the local DVM) shall be archived for a period of 3 months after which the oldest information shall be overwritten.

3.2.3.17. 3rd party interface systems

The BMS shall interface seamlessly with other 3rd party systems as per LOSS diagrams in Part 2 C3.2.

During detailed system design, the *Contractor* shall create a Virtual signal list that shall define all the signals that will be provided on the BMS that support this interface requirement.

The BMS shall support as a minimum the following communications protocols:

i. LONWorks.
ii. BACNet.
iii. Modbus.
iv. SOAP.

Each connection shall operate independently of the other and facilities shall be provided to monitor these connections.

The *Contractor* shall supply any isolation required to protect the BMS.

The *Contractor* shall supply any hardware and software necessary to seamlessly integrate into Eskom's IAC system.

3.2.3.18. Network switches

All network switches shall be managed network switches.

All network switches shall support the backup and restoring of all configuration settings.

All network switches shall be remotely configurable.

All network switches shall be SNMPv3 compatible.

All network switches shall be IPv6 compatible.

All network switches shall have redundant power input ports.

Any network switch not located in a network cabinet is of industrial Ethernet type and suitable for uncontrolled and harsh environmental conditions.

3.2.3.18.1. Remote management

Each network switch shall be remotely managed, monitored and alarmed via the network management system.

The remote management, monitoring, alarming and diagnostic facilities shall be provided for each network switch.

3.2.3.18.2. Locations

All network switches shall be securely mounted in either the network cabinets or automation cubicles.

Redundant network switches shall not be in the same network cabinet.

Room locations shall be confirmed during the detailed engineering phase.

3.2.3.19. Cabinets/Cubicles and Enclosures

3.2.3.19.1. General

The *Contractor* shall supply and install cabinets/cubicles for all equipment supplied as part of the *Works*.

The *Contractor* shall take into consideration the available space for cabinets and propose locations to install cabinets if allocated locations are not suitable and expose the system to unnecessary risks.

The *Contractor* shall assess the risk and submit the suitable IP rating of the cabinets and enclosures to the *Employer* for acceptance.

The following types of equipment and features shall be installed in cabinets:

i. BMS servers
ii. Workstations Servers
iii. Network equipment
iv. Operating and engineering network equipment
v. ESP equipment
vi. Digital video recorders and/or Network Video Recorders.
vii. Network storage hard disks.
viii. Optic fibre and Ethernet patch panels.
ix. Communications and control equipment.
x. Access control Panels if a cabinet/cubicle is furnished in the area.
xi. Lockable panels and doors.
xii. IP ratings appropriate for the environmental conditions, but not less than IP42.
xiii. The *Contractor* shall recommend suitable IP rating to the *Employe*r for cabinets placed outside air-conditioned rooms (equipment/control/ switchgear rooms).
xiv. Environmental control in cases where cabinets are placed in uncontrolled environment.
xv. Welded frame construction with powder coated accessories.

Each cabinet/cubicle shall have the following characteristics:

i. Front access only via cabinet doors for cabinets situated with the rear facing a wall. Front and rear access via cabinet doors for all other cabinets.
ii. There shall be no open spaces between the rails and sides of the rack enclosure. This ensures the cabinet air flow is managed correctly.
iii. Blanking panels shall be installed on all unused slots to manage air flow efficiency and reduce hot spot temperature in the cabinet.
iv. Flexible brushes or shields shall be used to prevent air leakage from cables via cable entries.
v. Internal cable management systems shall be used for both horizontal and vertical cable management.
vi. Redundant intelligent rack mounted power distribution units (PDU) shall be used.
vii. A single rack mounted LCD and keyboard per cabinet for access to all servers and workstations shall be contained in the cabinet concerned.

Cabinets inside of server rooms shall have the following characteristics:

i. Cabinets shall be 900mm deep, 1000mm wide and 2200mm (for a 42U cabinet) or 1400mm (for a 24U cabinet) in height.
ii. No cabinet shall exceed a mass of 500 kg, including all equipment therein and a 20% spare capacity (i.e., net mass of 416 kg).

iii. Cabinet doors shall be double doors with the ability to open 120° or more.
iv. The total heat load expelled by cabinets per building located outside of the auxiliary bay (including all equipment therein) shall not exceed 2000 W.
v. The total heat load expelled by the cabinets per unit located inside the auxiliary bay (including all equipment therein) shall not exceed 3700 W.

Cabinets and equipment located outside of Server rooms shall strictly adhere to 240-56355731 Rev 2 Environmental Conditions for Process Control Equipment Used at Power Stations Standard and thus be appropriate for the environment in which they are installed. Verification of mass, dimensions and heat load constraints shall be required.

The number of different cabinets across the plant should be minimized and therefore standardized in the same way to cabinets in the server rooms and C&I equipment rooms.

The cabinets shall be ventilated (considering the IP rating).

There shall be an adequate number of power distribution points to support the equipment mounted within supporting a fully redundant power supply to all the equipment in the cabinet.

Blocking diodes shall be provided as part of the internal power distribution system within the cabinets.

There shall be a mechanism to lock and unlock the doors.

Where there is higher risk to the network equipment a tamper-proof switch shall be connected to the door to monitor the status of the door.

The tamper-proof switch shall generate an alarm in the BMS if the door was forcefully opened.

The *Contractor* shall provide the following colour coding for cabinets and enclosures:

i. The enclosures for fire panels and fire related equipment shall be red.
ii. All other enclosures shall be RAL 7035 colour coded.

All cabinets/cubicles shall be labelled with the relevant coding as defined in Plant Labelling Standard (240-71432150 Rev 3) and 0.83-00013-0J-A IPSS General Labels & Nameplate Details Arrangement Diagram Cover sheet.

The equipment room floor mounted cabinets shall have bottom cable entry.

All electrical and C&I cabinets shall conform to the Ingula guidelines provided in the drawings 0.83/00013 Cover sheets C, D, E, G, H and J.

All Fibre Optic (FO) cabinets shall conform to the Eskom standard 240-46264031 Rev 3 Fibre Optic Design and Installations Substations

3.2.3.19.2. Physical Specifications

For easier cable management, all connectors on rack mounted components shall be rear facing in the network cabinet if it does not compromise the efficiency of the airflow through the network cabinet or devices themselves or hinder accessibility.

Any cable cut-outs beneath the network cabinet shall be sealed to prevent air leakage using raised floor grommets.

3.2.3.19.3. Remote Monitoring and Alarming

Each network cabinet shall be remotely monitored and alarmed to the workstations via the common network management system

As a minimum, each network cabinet shall be monitored and alarmed for the following:

i. Health and status of the cabinet PDU’s
ii. Health and status of the cabinet ventilation system

iii. Internal environmental conditions

The internal environmental monitoring and alarming provided for each network cabinets shall include the following:

i. Temperature
ii. Humidity
iii. Pressure

3.2.3.20. Cabling and racking

The cabling for the entire BMS (including subsystems) falling within the *Contractors* scope of the works shall be part of these works.

The *Contractor* shall provide the source and destination information of all cabling using the *Employer's* Cable Schedule Instrumentation and Cable block diagram Template.

When interfacing to the systems provided by the *Employer*, the *Contractor* shall assess and design his cabling to achieve such interfacing.

Primary racking is defined as the main servitudes running throughout the station. The *Contractor* shall use the primary racking where available.

Conduits within buildings shall be used where practical.

Furthermore, the *Contractor* shall provide any additional racking, conduits and trenching required as well as the routing design, outside of what is supplied by the *Employer*. Such racking is defined as secondary racking.

3.2.3.20.1. Cable schedules

Accurate records shall be kept in Cable Schedules for all cabling forming part of the *works*.

The *Employer's* Cable Schedule Instrumentation and Cable block diagram Template shall be provided, inclusive of origin, target, type, size, and termination details.

The *Contractor* will develop Termination schedules for all cables.

All cable schedules are provided using the *Employer's* Cable Schedule Instrumentation and Cable block diagram Template that shall be completed by the *Contractor*.

3.2.3.20.2. Cable management system

A Cable stock schedule shall be kept recording all cables delivered to and removed from IPSS site.

The installed cabling shall be reconciled with the cable stock schedule.

3.2.3.20.3. Network cabling and associated infrastructure

The network cabling and associated infrastructure shall be provided in accordance with the following specifications:

i. ANSI/TIA-942-2005 and addendum ANSI/TIA-942-2-2010
ii. ANSI/TIA 568-C.0-2009 and addendum ANSI/TIA 568-C.0-1-2010
iii. ANSI/TIA 568-C.1-2009
iv. ANSI/TIA 568-C.2
v. ANSI/TIA 568-C.3
vi. ANSI/TIA 569-B and addendum ANSI/TIA-569-B-1-2009
vii. ANSI-J-STD-607-A-2002

3.2.3.20.4. Racking

Racking shall form part of the scope of the *works*.

The scope of primary racking is defined as all main racking including racking supports for multiple cables for the BMS.

The scope of secondary racking is defined as all racking / conduit for trunking and network cabling including the racking supports from the field devices to the controllers and network interface points.

Racking within buildings shall be used where possible.

3.2.3.21. Standardisation

The purpose of standardisation of BMS equipment is:

i. Reduced life cycle cost / cost of ownership cost,
ii. Interchange ability of equipment,
iii. Reduce the number of diverse types of equipment installed on site, thereby also reducing spares holding requirements,
iv. Reduced maintenance skills required to maintain the system,
v. Reduced training requirements on different systems.

The *Contractor* shall develop a standardisation strategy for acceptance by the *Employer* as in Part 2 C3.2– C&I Documentation Requirements from Vendors.

The standardisation strategy shall address the following aspects for all plant and equipment forming part of the *works*, including, but not limited to the items listed below:

i. HMI Screens (make, model and size)
ii. Input devices.
iii. Processor units.
iv. Computers and Servers (make, model and mounting options).
v. Cameras.
vi. Access control equipment.
vii. Video recording equipment.
viii. Network equipment (make and model)
ix. Switches and hubs.
x. Fibre optic cable (type of cable and termination style).
xi. Cubicles and enclosures (make, size, construction, and colour).
xii. Cabling (routing, make, size, type, number of conductors, terminations).
xiii. Conduits and racking.

Integrated Access Control (IAC) and BMS interface equipment shall be standardised.

Standardisation shall not compromise the system performance.

During detailed design, the *Employer* shall provide the cable naming criteria to the *Contractor*. The Contract shall adopt this cable naming criteria into his design.

The *Contractor* shall create and provide all necessary documentation at the times/project phases indicated in the C&I Documentation Requirements from Vendors included in Part 2 C3.2

The *Contractor* shall standardise on all hardware / equipment (e.g., same supplier / brand / type etc.) provided for the BMS and its subsystems in accordance with the purpose stated in (i).

3.2.3.22. *Equipment coding and labelling*

The *Contractor* shall code and label all equipment that is supplied as part of these Works. Coding and labelling shall be performed according to the *Employer's* 202-7180 Ingula Pumped Storage Scheme KKS manual.

Due to complexities in assigning KKS identifiers, all *Contractors* assigned KKS shall be submitted to the *Employer* for acceptance.

All documentation shall include KKS coding to the acceptance of the *Employer*.

3.2.3.23. *Cabling*

The *Contractor* shall ensure that electrical interference/noise does not occur between the power distribution network and the BMS signal wiring.

Power distribution conductor sizes shall be determined by the power consumption of the devices. Wiring sizes shall be determined in accordance with SANS 10142-1.

The *Contractor* shall use the existing *Employer* plant wide Fibre Optic infrastructure passing through most buildings (refer to the 0.83/50 042 Ingula Pumped Storage Scheme 0 0CYH10, 0 0CYW10 Communication Carrier Revision 10 drawing)

The *Contractor* shall provide all the additional cabling, wiring, conduits and racking for the BMS functional elements to function efficiently including any additional fibre optic infrastructure that is supplemental to the fibre optic infrastructure provided by the *Employer*.

Wiring shall comply with SANS 10142-1. When intended for direct burial in earth trenches, all cabling including communication, co-axial and/or power cables shall be constructed with steel wire armouring and outer PVC sheath.

The primary cable racking shall be supplied by the *Employer* for the completed Ingula project. The *Contractor* shall provide additional cable racking wherever required.

The *Contractor* shall provide systems that are capable of interconnecting networks that are redundant for the BMS and its subsystems to maximise available and reliability.

The *Contractor* shall also recommend any cost-effective methods or networks available for the interfacing of BMS and its subsystems.

The *Contractor* shall design the cables for the works to comply with the following Eskom standards included in Part 2 C3.2:

i. 240-46264031 Rev 3 Fibre Optic Design Standard – Part 2: Substations
ii. 240-56227443 Rev 1 Requirements for Control and Power Cables for Power Stations Standard

The *Contractor* shall apply the Eskom standards, as found in Part 2 C3.2 to all Fibre Optic cable installations:

i. 240-46264031 Rev 3 Fibre Optic Design and Installations Substations
ii. 240-140642648 Rev 1 Fibre Optic Design Standard Part 1_ Lines and Cables
iii. 240-46263618 Rev 3 Standard for Labelling of Fibre-Optic Cables
iv. 240-102220945 Rev 2 Specification for IACS for Eskom Sites

3.2.3.24. Environmental conditions

The *Contractor* is required to select suitable equipment and field devices, appropriate cabling infrastructure, termination equipment and panels that are suitable for a typical power plant.

The power plant is exposed to extreme dust, vibration, water ingress, noise and elevated temperature conditions and the proposed equipment must operate under these environmental factors.

The *Contractor* shall provide equipment with the appropriate IP rating to properly match the conditions in which the equipment shall be used.

The *Contractor* shall consider the recommendations made in 240-56355731 Rev 2 Environmental Conditions for Process Control Equipment Used at Power Stations Standard in the *Employer'*s requirements for environmental conditions for process control electronic equipment.

The *Contractor* shall design the system to match the requirements described in the *Employer's* requirements.

3.2.3.25. Cyber and information security

The *Contractor* shall design the information security to comply with:

i. 32-85 Information Security Policy
ii. 32-370 Information Security – System Development and Maintenance
iii. 32-351 Information Security – Logical Access Control
iv. 240-55410927 Cyber Security Standard for Operational Technology

The BMS shall have a dedicated network.

The *Contractor* shall provide necessary hardware and software that is required to provide a firewall to the BMS network.

Every network switch's unused port shall be blocked via the network management system and can be activated when required.

Access to the network switches shall be possible via workstations within the IPSS BMS.

USB ports on all the servers and workstations shall be software locked to prevent data access via USB storage devices.

Host Intrusion Detection Sensors (HIDS) shall be installed on all workstations and servers.

The individual HIDS for each BMS shall be centrally managed from the network management system.

Antivirus software shall be installed on all workstations and servers until handover, after which the responsibility of antivirus software shall be the *Employer*'s.

All servers and workstations shall be installed and regularly updated with the latest OEM approved security patches on all servers and clients.

OEM approved updates for firewalls and Unified Threat Managers (UTM) shall be installed regularly and promptly to maintain the required protective functionality.

Unauthorised access shall be denied on all servers and clients' BIOS through password protection.

Only applications and services that are necessary shall be activated on servers such that communication and potential points of attack are restricted to an absolute minimum.

All users with extended access rights such as administrators, Engineers, etc. shall be automatically logged off after a pre-defined idle time.

All access to data and systems shall be recorded in the access logs.

All workstations and servers shall be booted from the hard drive only, no booting from removable storage media shall be allowed.

3.2.3.26. Power supplies

The *Contractor* shall design, procure, supply, install, commission and handover all the cabling works and necessary protection.

The *Employer* has allocated points of supply which are 220 V DC fed from battery backed supplies. The points of supply are as follow:

i. 220V DC Station Board A (0 0BUA) – main supply for the powerhouse CCTV.
ii. 220V DC Emergency Power Building Board B (0 0BUD01) - main supply for the administration building CCTV.
iii. 220V DC Emergency Power Building Board A (0 0BUC01) - main supply for the administration building IAC

The *Employer* has allocated points of supply which are from essential supplies. The points of supply are as follows:

i. 400V Essential Board 1B (0 2BFA) – alternative supply for the powerhouse CCTV.
ii. 400V Administration Building Board 1A (0 1BGA) – alternative supply for the administration building CCTV.
iii. 400V Administration Building Board 1A (0 1BGA) – alternative supply for the administration building IACS.

The *Employer* has allocated points of supply which are from non-essential supplies. The points of supply are as follows:

i. 400V Bedford Dam Outlet House Distribution Board (00BKA03) – supply for the Bedford Dam Outlet House CCTV.
ii. 400V Bedford Dam Outlet House Distribution Board (00BKA03) – supply for the Bedford Dam Outlet House ACS.
iii. 400V Bedford Dam Intake Tower Distribution Board (00BLA02) – supply for the Bedford Dam Intake Tower CCTV.
iv. 400V Bedford Dam Intake Tower Distribution Board (00BLA02) – supply for the Bedford Dam Intake Tower ACS.
v. 230V Bramhoek Dam Generator Room Distribution Board (00BKD01) – supply for the Bramhoek Dam CCTV.
vi. 230V Bramhoek Dam Generator Room Distribution Board (00BKD01) – supply for the Bramhoek Dam ACS.
vii. 230V Bramhoek Dam Wall Crane Distribution Board (00BLC01) – supply for the Bramhoek Dam Wall CCTV.
viii. 230V Bramhoek Dam Wall Crane Distribution Board (00BLC01) – supply for the Bramhoek Dam Wall ACS.
ix. 400V Exploratory Tunnel Non-Essential Distribution Board (0 0BHG) – supply for Cable Access Tunnel CCTV

The *Contractor* requests the *Employer* for other points of supply for the systems during design acceptance.

The *Contractor* provides a changeover switch within the cabinets to cater for main and alternative supplies.

The *Contractor* makes provision for voltage monitoring on the incoming supply and configure the loss of supply to alarm at the control room.

The *Contractor* shall be responsible for providing power cabling. The estimated cable length for the admin building is 50 m and that of the powerhouse is 245 m. Provision of power cabling shall be in accordance with 240-56227443 Rev 1 Requirements for Control and Power Cables for Power Stations Standard.

The *Contractor* shall calculate the cable sizes based on load requirements, terminate from the switchgear to the security cabinet changeover switch and provide power cabling from the security cabinet MCBs (Miniature Circuit Breaker) to various equipment supplied in this contract.

All BMS and its subsystems shall be protected against over/under voltage and transient voltage/frequency conditions.

The *Contractor* shall provide any equipment necessary to provide the power required by his equipment, in IP rated enclosures.

Protection devices shall be provided by the *Contractor* on all supplied equipment in order to protect the equipment from lightning or surge damage.

The *Contractor* shall provide the external connection point (earth stud) and connect all supplied BMS panels to the earth-mat (available throughout the station). The *Contractor* shall comply with 240-56356396 Earthing and Lighting Protection Standard and 240-91190304 Specification for CCTV Surveillance with Intruder Detection.

The power installation shall comply with the standard SANS 10142-1.

3.2.4. Closed Circuit Television System

3.2.4.1. General

A CCTV system shall be installed and at the identified areas for the site to provide the Security personnel and Control room Operators with a single point from where they can view and verify alarm events from the Intrusion detection system and energized fence triggers without having to physically respond to the alarm event in the case of a false/nuisance alarm and correctly assess and verify positive alarm events in the event of an attempted or successful intrusion attempt.

The offered system shall comply with requirements of Eskom standard for CCTV system (Specification for CCTV Surveillance with Intruder Detection 240-91190304).The Closed-Circuit Television (CCTV) System shall be provided by the *Contractor* and shall be integrated into the BMS.

Operational and Security cameras shall share a common video circuit, where viewing access to cameras can be restricted to specific staff. The Station Operators in the control rooms shall have viewing access to both Operational and Security cameras.

The Operational camera system shall provide the Power Station Operators with a visual tool to determine operating conditions at the various camera locations. The other cameras will be used solely for security.

The *Contractor* shall provide all hardware, software and cabling required for the CCTV system as part of the *works*.

The CCTV system shall consist of the following:

i. CCTV cameras
ii. PTZ CCTV cameras
iii. CCTV camera lens
iv. CCTV camera housings
v. CCTV camera housing mountings
vi. CCTV camera brackets
vii. Poles for fitting CCTV cameras where no poles are provided for by *Others*
viii. Digital Video Recorders (DVRs/NVRs)
ix. Necessary peripherals such as Mouse / joystick
x. Power supplies

The CCTV system shall be fully integrated into the BMS.

All indoor cameras shall be ceiling mounted where possible. If not possible, they shall be wall mounted.

Outdoor cameras can be wall mounted where applicable with the necessary cooling system (preferably natural cooling).

All CCTV cameras shall require minimal maintenance.

Where cameras are required to be pole mounted in outdoor locations and no mounting structures are provided by *Others*, the *Contracto*r shall design, supply, and install all necessary structure equipment to satisfy the requirement. The *Contractor* shall consider wind loading and the subsequent vibration caused thereby, including the pole and its fittings as well as cooling system where required. Housings and poles should be designed to provide a suitable stable platform for the CCTV.

If the pole mounted outdoor cameras require external power, the *Contractor's* scope shall include furnishing and installing an armoured power cable, suitable for direct burying, from the camera to a substation distribution board, furnished by the *Employer*.

The *Contractor* shall also design and install the cabling system from the camera location to the applicable access point, which shall include direct-buried cable.

Any devices required between the *Contractor's* CCTV Control panel and the BMS shall be provided and installed by the *Contractor*.

The *Contractor* shall provide trenching if necessary.

Where any conflict arises between the above-mentioned standards and these works, the *Contractor* shall identify the conflict and recommend a solution to the *Employer*.

3.2.4.2. CCTV System devices layout and purpose

The purpose of the cameras are defined as per the Eskom standard 240-91190304 Specification for CCTV Surveillance with Intruder Detection section 3.10.1.

Table 1: IPSS CCTV Cameras allocation

Ingula Pumped Storage Scheme CCTV System	**Secutity CCTV**		**Ops CCTV**	
Area	**No.**	**Camera type**	**No.**	**Camera type**
Admin Building: To view all Buildings and surrounding within Core area				
Admin Building - Basement	2	Indoor IP Mini dome camera	0	
Admin Building - Ground Floor	4	Indoor IP Mini dome camera	0	
Admin Building - 1st Floor	4	Indoor IP Mini dome camera	0	
Admin Building – Locality	5	PTZ camera covering the area	0	
	2	Outdoor type	0	
Visitors Centre: To cover Buildings and surrounding area				
Indoor IP Mini dome camera	5	Indoor IP Mini dome camera	0	
Visitors Centre - Parking	1	PTZ camera covering the area	0	
Guard House: To cover Buildings and surrounding area				
Reception	2	Indoor IP Mini dome camera	0	
Turnstiles	2	Indoor IP Mini dome camera	0	

Gun safe areas	1	Indoor IP Mini dome camera	0	
Emergency Power Building: To cover Buildings and surrounding area				
Emergency Power Building locality	2	Outdoor type	0	
Emergency Power Building	2	Indoor IP Mini dome camera		
Intake Structure: To cover the surrounding area				
Bridge access	2	Outdoor type	0	
Surge shaft access	1	Outdoor type	0	
Dam level monitor	0		1	OutdoorType
Outlet Structure: To cover the surrounding area				
Outlet bridge	1	Outdoor type	0	
Radio Tower	1	PTZ camera	0	
Main Access Gate & Main Access Tunnel (MAT): To cover the Entrances and the surrounding area				
Main Access Gate	1	Outdoor type	0	
MAT Entrance	1	PTZ camera	0	
Cable Access Tunnel (CAT) Portal Extension: To cover the Entrance to the area				
Tunnel entrance	1	PTZ camera	0	
Exploratory Tunnel (ET): To be provided at Access Gate and Entrance Point				
ET Door	1	Indoor IP Mini dome camera	0	
Powerhouse				
Transformer hall: Operator floor	1	Indoor IP Mini dome camera	2	Outdoor type
Transformer hall: Battery room	0		2	Outdoor type
Machine hall: Turbine Floor	0		8	Outdoor type
Machine hall: Gen Floor	0		2	Outdoor type
Machine hall: Operator floor	0		3	Outdoor type
Bedford Dam				
CCTV covered from Intake Structure	2	Outdoor type		
Dam Level			1	Outdoor type
Bramhoek dam				
Bridge access	1	Outdoor type		
Gate access	1	Outdoor type		

Building area	1	Outdoor type		
Dam level monitor			1	Outdoor type
Surge Shaft				
CCTV covered from radio tower	1	Outdoor type		
Perimeter Detection & Monitoring				
CCTV covering the Perimeter Fence	25	PTZ camera covering the perimeter	0	
Totals				
Indoor IP Mini dome camera	23		0	
Outdoor type	14		23	
PTZ Camera	34		0	
Total number of Cameras	**71**	**Security**	**23**	**Operational**

3.2.4.3. Lens

The *Contractor* shall provide CCTV camera lenses that are suitable for each situation / environment in the power station environment.

These lenses shall be easy to install and easily maintainable with minimum maintenance.

Auto Iris functionality shall also be considered during the design of the CCTV system.

The lens selection must consider the type of camera in which it shall be installed (i.e., pressurized cameras).

3.2.4.4. Cameras

The *Contractor* shall supply IP cameras dependant on the *Employer's* requirements at various locations. The design of the camera system by the *Contractor* shall provide sufficient coverage to the locations shown as a guideline by the *Employer's* concept Marked-up drawings and the IO List. These concept drawing locations are provided in the following drawings:

Electrical fence: 0.83/79 400 sheet 6. Cameras are located as per the *Contractor's* recommended design on the lighting poles or other permanent structures.

i. Surface buildings, dams and underground: 0.83/79 700 sheets 1 to 22.
ii. Two additional cameras are to be installed to monitor the two access gates at each end of Bedford Dam
iii. CCTV Coverage required for the gallery entrance and access gate for Bramhoek Dam
iv. Inclusion of CCTV coverage at Outfall on outlet bridge and gate
v. Additional CCTV coverage on the side of the Emergency Power Building (located within Core area)
vi. The cameras and camera housings shall be suitable for the harsh operating conditions typically found in power stations (extreme temperatures, dusty conditions, and water ingress).

The IP cameras shall be capable of supporting Power over Ethernet (PoE).

The camera shall be capable of producing a colour video image with as little as 0.24 lux of scene illumination and a monochrome image, when in the night mode, with as little as 0.038 lux scene illumination.

The *Contractor* shall recommend to the *Employer*, areas where additional lighting is required.

3.2.4.5. Thermal Imaging

The *Contractor* shall provide a thermal imaging system option that must be able to deter, detect and delay intruders.

The thermal imaging cameras shall recognise and detect a target. On detection of an intrusion, the images shall be visually displayed at the security control workstation.

The thermal imaging system shall have the ability to minimise false alarms by distinguishing between intruders and natural variations (such as weather, animals, and normal human traffic).

The thermal imaging cameras shall graphically track the intruder (displaying at monitoring station) until the intruder has left the field of view.

The *Contractor* shall zone the thermal imaging cameras according to the perimeter protection zoning done by *Others*. The perimeter detection & monitoring system shall be divided into multiple alarm zones (approximately 25). All accessories such as zone resistors shall be done by *Others*. Each zone shall be no more than 100m measured along the fence line. The zones shall be so designed such that the failure of the fence energiser shall not result in any single zone being unprotected.

The *Contractor* shall provide for the functionality to switch perimeter lights, provided by *Others*, per zone on detection of an intruder. The *Contractor* liaises with the Fence and Lighting *Contractor* to, together, design the ultimate solution by matching the proposed camera technology with the supplied light technology.

On detection of an intruder, automated recording shall commence. A buffer shall be used such that footage can be retrieved that spans from a predetermined time before the intrusion event until a predetermined time after the intrusion event.

The thermal imaging cameras shall have pan tilt zoom (PTZ) functionality controllable from the security control workstation.

All cabling required for the option shall be provided by the *Contractor*.

The *Contractor* shall provide all poles (where no poles exist), lightning protection, anti-tamper protection and enclosures (IP 55) required for a full installation.

All equipment required to complete the design shall be provided by the *Contractor*.

3.2.4.6. Digital Video Recorders (DVR/NVR)

3.2.4.6.1. General

All equipment and materials shall be industrial based and able to be operated in the harsh power station environment.

All equipment and components shall have been thoroughly tested and proven in actual use. Accreditation shall be an added advantage.

A reference list of where the equipment was installed by the *Contractor* shall be submitted.

The digital video manager (DVM) shall be capable of recording whilst playing back archived footage.

All software and firmware upgrades shall be made available for the life of the system.

Any software and firmware upgrade shall not impair the recording of footage from cameras.

All DVRs shall be integrated into 19” rack mount and or wall mounted cabinets depending on the space availability and environmental conditions.

The *Contractor* shall recommend the relevant image and video compression method in order to manage storage space for DVM efficiently.

3.2.4.6.2. Video Management Software

The VMS shall be a highly scalable enterprise level software solution.

The VMS shall offer a complete video surveillance solution that shall be scalable from one camera to multiple cameras.

The VMS shall be capable of the following functions:

i. Configuration of system components
ii. Configuration of cameras and monitors
iii. Multiple live video connections
iv. Configuration of graphics screens
v. Programming of alarm-triggered automatic events (e.g., in case of the CCTV camera registering video motion detection in a restricted area, the DVM shall alert the operator with the camera footage).

The BMS shall allow the following as a minimum:

i. Live display of cameras and their identification.
ii. Control of PTZ cameras.
iii. Retrieval and playback of archived video (without affecting live recording).
iv. Instant Replay of live video.
v. Graphical representation of plant and camera location.
vi. Configuration of system settings.
vii. Search function.
viii. Priority recording.
ix. Activity detection.

The BMS shall support IP network connectivity.

The BMS shall support PTZ functionality on all PTZ cameras on the CCTV system.

Each camera shall be configured independently from other cameras in the system, and altering these settings shall not affect the recording and display settings of other cameras.

3.2.4.6.3. Recording and Playback

The digital video manager (DVM) shall maintain the specified recording quality (resolution) irrespective of the size of the screen image as specified in the CCTV / IAC applicable Standards.

The operator shall have the ability to remove connected cameras from the DVM without affecting the ability to display other cameras.

The digital video recorder shall provide a user-programmable twelve-character title for each camera and shall record time, date and title with each video image.

The DVM shall be capable of recording and playing back in full screen or ‘quad’ multi-screen display.

The DVM shall have an event log feature, displaying every event which is recorded on disk.

The event log shall be searchable by time, date, camera number, event type, and the state of the event.

3.2.4.6.4. Graphics

The BMS shall be used to generate the Graphical User Interfaces (GUI), e.g., site maps, floor layouts. The *Contractor* shall submit proposals for the GUI for acceptance by the *Employer* during Basic Engineering.

A map shall represent the area of activity of the user, including position of the cameras and map of situation.

The system must cater for integration of various modules into this GUI. Readers, controllers, access points, cameras, intrusion detection system and other security and BMS related hardware devices must be mapped/displayed on the GUI. The user should be able to select from a dropdown list of various components to get a dynamic view of the same, e.g., if “Readers” were selected then the floor plan should only display the readers on that floor

An instant replay function shall be available.

3.2.4.6.5. Event Driven Monitoring

The DVM shall have the intelligence to monitor events and record images accordingly. The system shall also be able to retrieve the recorded information as required by the authorised personnel using passwords.

The DVM shall be capable of prioritizing recordings from cameras which are in alarm conditions.

The DVM shall have the ability to move telemetry cameras to a pre-set position on alarm.

The DVM shall be capable of forcing individual or groups of cameras into alarm recording condition.

The DVM shall provide alarm and event logs for all the alarms/activity. The capability for geofencing alarms and motion detection to form part of the software.

3.2.4.6.6. Archiving

The DVM shall be capable of storing video and audio, online, for a period of 3 months at the originally recorded resolution. This information can be further archived onto external storage media for long term storage.

The online storage capacity shall be scalable.

The DVM shall encrypt information copied to external storage and shall be capable of detecting modifications in this information. This information may represent video, audio or still images.

The DVM shall archive the information such that there is no loss of quality or content. Such information shall have 100% availability.

The DVM shall allow for both local and remote archiving.

3.2.4.6.7. Passwords

The digital video manager (DVM) shall have operator, maintainer, and *Employer* access. Furthermore, the operator access shall be divided into process (power station operational) areas, security areas and both.

3.2.4.7. CCTV system and BMS interface

The BMS shall be capable of automatically switching/viewing cameras based on information received from the access control system.

The BMS shall be include the DVM in the CCTV System

3.2.5. Integrated Access Control System

3.2.5.1. General

The Integrated Access Control system will be used to manage access rights of Eskom employees, visitors and *Contractor*s in and out of different areas at site.

The system will also be used to grant and limit access permissions in and out of areas such as secure and non-secure areas.

The system should support a tiered architecture which will allow monitoring of the site and will comprise of field devices (biometric & card readers) at site level and system management servers at the remote security control rooms.

The Access Control System (ACS) and associated software forms part of the fully integrated system and should be fully compatible with the BMS

The *Contractor* is required to design, install and commission access control systems as defined in the LOSS diagrams in Part 2 C3.2 and The *Employer's* requirements.

The ACS shall be integrated with the other subsystems of the BMS network, namely the CCTV and Perimeter monitoring systems.

The ACS shall support time periods, scheduling, embedded zoning and access levels.

The Administrative Building and Visitor Building require alarms on all doors leading to the outside of the building and all fire doors should have a door status.

Emergency Power Building (located within Core area) to have door status on external doors to switchgear room.

The access controllers shall be non redundant and shall fail in a safe condition (door open) state.

The *Contractor* shall submit the zoning philosophy to the *Employer* for acceptance.

The *Contractor* shall develop the philosophy and coordinate the zoning for Access Control and CCTV system.

In instances where no access card is required, simple alarms systems to be installed. These alarm systems include doors, windows, and interior motion detection. The possibility to link these alarm systems with the IAC to be explored by *Contractor* and proposed to *Employer*.

IACS to be included for the Diesel Generator Area at Bramhoek dam Outlet Building.

The access control system design for server rooms and data centres shall comply with the recommendations, specifications and requirements set out in Eskom document 32-894 Rev 0 "Eskom Server Room and Data Centre Standard" as found in Part 2 C3.2.

The access control system shall conform to the Eskom standard 240-102220945 Specification for Integrated Access Control System (IACS) for Eskom Sites.

A high-level system architecture is provided in 240-102220945 Specification for Integrated Access Control System (IACS) for Eskom Sites.

Where any conflict arises between the abovementioned standards and these works, the *Contractor* shall identify the conflict and recommend a solution to the Engineer.

3.2.5.2. System Classification.

The *Contractor* is to provide a Class 4 Access Control system in accordance with document "240-102220945 Specification for Integrated Access Control System (IACS) For Eskom Sites".

This class of access control system shall incorporate a central control and monitoring system whereby the central processor software can be used to generate reports on the status of any card.

3.2.5.3. IACS devices layout

The envisaged Integrated Access Control devices for the site and their locations are shown in Table 3 below:

Table 3: IACS devices positioning

Area	Point	Device	Status Contact	Lock	Evacuation Device	Bypass
Main Gate (Inbound traffic)	Exterior Perimeter Fence (Gooseneck Mount)	Card Reader	Gate Status Contact	Electro Mechanical Lock	None	Mechanical Bypass

Area	Point	Device	Status Contact	Lock	Evacuation Device	Bypass
	Energized Fence Gate	Integrated with exterior gate automation	Gate Status Contact	Electro Mechanical Lock	None	Mechanical Bypass
	Inner Perimeter Fence (Gooseneck Mount)	Card + Biometric Reader	Gate Status Contact	Electro Mechanical Lock	None	Mechanical Bypass
Outbound Traffic	Exterior Perimeter Fence (Gooseneck Mount)	Card + Biometric Reader	Gate Status Contact	Electro Mechanical Lock	None	Mechanical Bypass
	Energized Fence Gate	Integrated with interior gate automation	Gate Status Contact	Electro Mechanical Lock	None	Mechanical Bypass
	Inner Perimeter Fence (Gooseneck Mount)	Card Reader	Gate Status Contact	Electro Mechanical Lock	Emergency Exit Button	Mechanical Bypass
Guard House	Entrance Door	Card + Biometric Reader (In) & Card Reader (Out)	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass
	Equipment Room Door (Inside)	Card + Biometric Reader (In) & Card Reader (Out)	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass
Control Room Buildings	Office Door	Card Reader (In) & Card Reader (Out)	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass
	Control Room Entrance Door	Card + Biometric Reader	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass
	Control Room Back Door (Emergency Exit)	Emergency exit break-bar	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass
	Control Room Double Door	Card Reader (Inside only)	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass
	Battery Room	Card + Biometric (In) & Card Reader (Out)	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass
	Carrier Room	Card + Biometric (In) & Card Reader (Out)	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass

Area	Point	Device	Status Contact	Lock	Evacuation Device	Bypass
Office buildings & store rooms	Main entrances	Card + Biometric (In) & Card Reader (Out)	Door Status Contact	Magnetic Lock	Emergency Exit Button	Mechanical Bypass

Note: Ideally the existing Eskom approved cards should be used for the new access control system. Eskom's approval shall be obtained before deciding on the access cards for the system.

3.2.5.4. IACS high level devices positioning and architecture philosophy

The contractor is required to submit a detailed design depicting the proposed architecture and narratives of how the IACS functional requirements will be achieved. The implemented architecture for IACS should comply with principles outlined in the technical standards for IACS [2].

3.2.5.5. Access Control for Main Gate and Entrances

The *Contractor* is to:

Design the access control system in consideration of all main entrances and Access points. Reference is made to the marked-up drawings series of documents and the Input-Output list (IO List) provided by the *Employer* for Tendering purposes.

Take special consideration of the main Security entrance to the IPSS Powerhouse, namely the Main Security Building.

Design the access control systems that handle enormous quantities of people entering and leaving the site. Reference is made to the 0.83/79 601 drawing provided by the *Employer* for Tendering purposes.

Design the access control system at the Surge Chamber access road gate (MAT road off-ramp) leading to the Surge Chambers area. To be integrated with ACS to ensure accountability/monitoring of personnel accessing the Surge Chambers area. The automated gate shall be installed by *Others.*

Design the access control systems at Main Access Tunnel (MAT) and Cable Access Tunnel (CAT) entrances. Use of the portable mobile card readers to be considered. To be integrated with ACS to ensure accountability/monitoring of personnel underground.

Where required, provide all components including, card readers, turnstiles, and any other equipment necessary for allowing quick access while maintaining the security integrity.

3.2.5.6. System Requirements

The access control system shall consist of the following as a minimum:

i. Access control servers.
ii. Access control panels.
iii. Field devices including any miscellaneous hardware (e.g., connectors, relay's etc.).
iv. Software components including the ACS database and an interface to site's centralised database.
v. CCTV interface.
vi. Provide functionality at site level for the role players/actors as defined in "240-102220945 Specification for Integrated Access Control System.

The above access control elements are integrated independently at every identified building as well as at the Power Station areas and connected to the BMS network. This shall enable monitoring of the entire station from a central location on site.

The ACS shall provide the option to implement Daylight Savings Settings.

The ACS shall provide the ability to configure up to 1024 Areas.

The ACS system shall provide support for vehicle control using RF and infrared technology.

The ACS shall provide 3rd party terminal ports on specific door controllers whereby multiple technologies can be connected to the ACS. These technologies shall include, but not be limited to: Biometrics Devices, MI fare Readers, Wiegand Readers, Bar-code readers and Radio frequency (RF) devices.

The *Contractor* shall take accountability for the interface to the Integrated Access Control (IAC) to comply with the standardisation of the Access Control System Eskom wide and in accordance with “240-102220945 Rev 2 Specification for Integrated Access Control System”.

The ACS shall be centrally monitored and managed at the IPSS site wide level and forming part of the Integrated Access Control (IAC) System.

3.2.5.7. Access Control Panel (ACP)

Each ACP shall be an intelligent component of the distributed intelligent access control system.

The ACS updates the user access information from the ACS database and records all the access related events for at least a period of three months.

Each ACP shall independently monitor and control its associated access readers, door monitoring sensors, electromagnetic locks, request to exit devices, reader tamper alarms, system faults, etc.

The events shall be automatically archived into the backup server periodically as required by the *Employer*.

The ACP shall functionally integrate with the CCTV system (via BMS), in order to reliably perform required inter-system control.

Video recording may be initiated by ACS events and alarms.

The ACP shall operate the door control circuit within one second of presentation of a valid access card at a connected card reader.

The one second response time shall not be exceeded regardless of the number of simultaneous requests at its controlled doors.

The ACS shall accommodate up to (but not limited to) 20,000 active users.

The ACP shall accommodate multiple card and card reader technologies.

Cards are exclusively available through HID and serial number ranges specifically allocated to Eskom are to be utilised with the CORP1000 cards only.

The compatible technologies for ACS shall include, but not be limited to, Biometrics, Keypad, Smartcard and Proximity.

The *Contractor* shall procure, design, supply, install, commission, and optimise the ACS with the necessary power supplies and standby batteries where not provided (compliant to Eskom standards provided) to operate the ACP and all connected card readers and electromagnetic locks.

Standby batteries for door locks and panels shall be sized to provide a minimum of six hours of normal (intermittent) reader/door operation.

These batteries shall be locally situated on a building level.

Every access control door shall have two readers (one for entrance and one for exit).

The ACP shall identify both readers (one for entrance and one for exit) as belonging to a single door.

The ACP shall be able to do the following:

i. To verify the status of every reader connected to the ACP.

ii. To update the access control reader with any updated user data from the ACP and ACS database.
iii. To download access events from all readers to the ACP.

Should the communication link be lost between the ACS central database, that is an integral part of the BMS, and an ACP, the ACP shall automatically operate in offline mode, as an independent system with full integrity and security maintained.

When off-line, the ACP shall store up to 500 transactions and shall automatically transmit them to the central access control database when communication is restored.

All security transactions shall be date and time stamped as of their occurrence.

Off-line operation shall be transparent to the access registered user but shall indicate to the BMS operator stations dedicated for access control that communication has been lost.

The ACP shall be capable of accommodating readers that are equipped with keypads or standalone keypads for user-entered Personal Identification Number (PIN).

For purposes of admittance under duress, a special PIN number shall grant normal access but signal a duress alarm to the ACP. Use of special keys for duress is not acceptable.

The ACP shall be capable of implementing user definable rules that define the access protocols that cardholders may be required to follow.

These rules shall include anti-pass-back, zone control (people entering and exiting zones must be recorded as such even if they enter through via one door and exit through another), guard tours and card holder path control as a minimum.

The ACP shall recognize a range of events that include, but are not limited to the following categories:

i. Tag transactions – Allowed, Denied, APB, Zone, location, Time, suspended, and blacklisted, Special, Reason code, Duress etc.
ii. Zone monitoring Transactions – Zone Full, Empty, Not Empty, etc.
iii. Location monitoring Transactions – Location locked.
iv. Input Alarm transactions – Input triggered.
v. Door sensing transactions – Door Forced, not opened, opened normally, open too long, closed, etc.
vi. ACS hardware transactions – timeouts, power ups, etc.
vii. Time based events.

3.2.5.8. System Hardware

The central Access Control department located in the Ingula Administration Building Security Control Room and shall house the following equipment:

i. LCD/LED monitors.
ii. Operator workstation for CCTV (for security areas) and access control.
iii. Photo ID workstation.
iv. Photo ID printer.
v. Keyboards.
vi. Mouse / joystick for controlling PTZ cameras.

3.2.5.9. Access Card Readers

Access cards readers shall preferably be SAGEM for main entry points and critical access points. If other readers are used, they should be a proximity type for internal doors and proximity, keypad and biometric fingerprint type for main entry and critical access points. The readers shall have a read time of no greater than 30 milliseconds.

The access control readers shall be of the following type:

i. ABS plastic
ii. Metal alloy
iii. ABS plastic with keypad
iv. Metal alloy with keypad
v. RF receivers
vi. Infrared receivers

All readers except for the RF receiver and Infrared receiver shall have the following or a combination of the following components:

i. Software configurable buzzer
ii. Software configurable bi-coloured LED

The ACS shall provide the option of multiple reader types at each location. These options shall include, but not be limited to:

i. Tag readers
ii. Keypad readers
iii. Harsh environment metal readers
iv. Biometric devices

The ACS shall provide the option of setting individual reader modes at each access control reader. These modes shall include, but not be limited to:

i. TAG only mode
ii. TAG + PIN mode
iii. TAG + REASON CODE mode
iv. Personal access code mode
v. Locked mode
vi. Unlocked mode
vii. Emergency mode

The ACS shall provide the option of single tag use, or multiple tag use per location.

The ACS shall support the following reader modes across all locations, or in multiple combinations:

i. Tag only
ii. Tag + PIN
iii. Tag + PIN + reason code
iv. Tag + reason code
v. PIN access only
vi. Door entry code (general, single, low security code)
vii. Supervisors unlock
viii. Locked
ix. Unlocked
x. Dual tag requirement
xi. Specified allowed tag transaction recording
xii. Paraplegic special entry
xiii. APB override
xiv. Blacklist tag
xv. Suspend tag

xvi. Date-selectable auto validate and delete

The reader shall be capable of downloading and storing user information locally.

Should the communication link be lost between the ACP and the readers, the readers shall automatically operate in offline mode granting access to authorised persons.

The event log shall be updated to the local ACP as soon as the communication link is restored.

3.2.5.10. Access Cards

Smart Cards or HID Cards may be used. The card type must have a minimum storage capacity of 4KB for e-wallet functionality and use at any other Eskom sites.

Tags are passive electronic devices containing a unique code. A tag code is transmitted when it is within range of a suitable reader. The ACS must support the following tag types:

i. 125 kHz Slim and Omega tags (ISO standard Manchester encoded)
ii. 125 kHz WriTag 128 bit
iii. 125 kHz WriTag 2048 bit
iv. 13.56 MHz MI fare
v. HID
vi. RF 433 MHz Infrared

The ACS shall provide for smart cards with read and write capabilities.

The ACS smart cards shall be compatible with adding features such as electronic purse/wallet capability for canteen, transport services, etc.

The ACS smart cards support shall be locally available in South Africa. The smart cards shall have no duplicate cards numbers and related programming from the supplier.

The smart cards provided to Eskom shall be unique to Eskom. This shall be managed and ensured by the supplier.

The *Contractor* to ensure that direct printing on the cards by the *Employer* is required.

3.2.5.11. Biometric Readers

Where biometric readers are to be used, all biometric readers shall comply with the requirements as specified in “240-102220945 Specification for Integrated Access Control System”.

3.2.5.12. Electromagnetic Door Lock

Recommended door locks shall be electromagnetic (EM).

The *Contractor* shall procure, supply, install and commission the electromagnetic door locks that are compatible with the proposed technology.

The *Contractor* shall liaise with the *Employer* or *Others* for the details of the doors where EM locks are to be fitted and ensure that fire door ratings are not diminished when installing EM locks.

The *Contractor* shall make sure that all wiring for the EM locks is concealed.

Door EM locks shall be rated for a minimum of 225 kg.

Door EM locks used on Fire doors shall be rated for a minimum of 360 kg. It shall not be possible to force a door open.

Each EM lock shall have its own PSU.

The *Contractor* may not drive any other devices from the PSU that is connected to the EM lock.

The *Contractor* shall supply power to all components of the access control system to ensure operation of the system for 6 hours after loss of equipment main power supply.

3.2.5.13. Cardholder Database

It shall be possible to define labels, field types and drop-down lists for each of the user definable fields.

The *Contractor* shall supply templates of the database fields to the *Employer* for acceptance.

Manipulation of user data fields shall be possible in the cardholder database.

It shall be possible to define which fields in the cardholder database can be searched, sorted and filtered.

Batch editing of user data shall be possible within the cardholder management system.

The cardholder management system shall be capable of capturing and storing the cardholder's biometric data such as fingerprints in a database.

The *Contractor* shall supply all necessary equipment to capture biometric data.

User profile templates shall be configurable, to assist in adding multiple users with the same profile with relative ease.

Once the user profile is terminated (e.g., when a visitor leaves or an employee resigns) the profile shall be reset to be used for future visitors and employees.

The history of access shall not be lost or reset.

All configurations of user profiles shall be done from a central workstation located on site with the ability to upload and download profiles from Eskom's central database.

Database downloads to the access control panels shall be user definable.

The system shall be capable of a time based and manually initiated downloads, without causing any interruption to the normal operation of the system.

The cardholder database shall be capable of supporting information exchange with 3rd party systems.

The cardholder databases shall provide all data required by Eskom's access control system.

These systems shall be allowed to access the data in a secure and controlled manner.

The database shall be archived in safe and secure manner that provides for easy information retrieval.

The database shall be backed-up on the BMS backup server located at the Administration building.

The database shall synchronize with Eskom's centralised database automatically at customizable time intervals without the loss or corruption of any data.

The database shall provide time and attendance access control data to 3rd party enterprise systems.

3.2.5.14. Visitor Access Management System

The Visitor Access Management System shall form a standard function of the access control System.

Visitors shall be added to the access control system and be issued with Visitor Access Cards.

The system shall be equipped to capture the visitor's picture and store it with the rest of the visitor's information.

These cards shall clearly indicate that the holder is a visitor.

Visitor cards shall be configurable for a variety of access permissions, dependant on the type of visitor and the nature of the visit.

Visitor transaction report shall display a detailed report on all transactions made by visitors. This must be filtered by site, date and time, person, tag code, department, event and vicinity.

All relevant visitor information shall be captured in the Visitor Access Management System that forms a part of the ACS database in the power station.

The Visitor Access Management System shall be equipped to capture the visitor's picture and store it with the rest of the visitor's information.

Visitor validity periods shall be user definable.

Retrieval of visitor cards shall be using a "Drop Box" exit reader.

The VMS shall reset the user profile once the visitor card has been returned and acknowledged by the operator.

3.2.5.15. Time and Attendance

The ACS shall provide the option of limiting the number of users in an anti-pass back zone.

The ACS shall provide an interface for the administration of tag holders.

The ACS tag holder interface shall provide the ability to assign up to 8 tags per tag holder.

The ACS tag holder interface shall provide the option of linking up to 10 access groups to a single tag.

The ACS tag holder interface shall provide the option of assigning access groups across multiple sites.

The ACS shall provide the ability to configure up to 10 000 access groups.

The ACS shall provide the ability to configure up to three combinations of time pattern and allowed access doors (areas) per access group.

The ACS shall provide the ability to configure up to 512 Access Time Patterns (ATP).

The ACS shall provide the ability to generate multiple time triggered actions.

The ACS shall provide the option for defining holidays whereby access rights can be denied or granted based on a tag holders individual access group.

The ACS shall cater for access time patterns - the ATP node shall enable adding of access time patterns, and editing of the following parameters for each time pattern:

i. Time pattern name
ii. Start time
iii. Duration
iv. Days of the week

At minimum, the ACS reports feature shall include the following:

i. The message board report shows the latest in and out transaction for each person.
ii. Last access report shows where the employee is now and must be filtered by name, door and date.
iii. Employee transaction report displays a detailed report on all transactions made by employees. Must be filtered by site, date and time, Person, tag code, department, event and vicinity.
iv. Transaction report displays all tag holders' transactions on a specific date and must be filtered by name, door and date.
v. Audit trail report displays all the audit transactions of what the system administrator has done and must be filtered by date and type.
vi. First access report displays all tag holders first access transaction for a specific day and must be filtered by name, door and date.
vii. Last access for day displays all tag holders last access transaction for a specific day and must be filtered by name, door and date.

3.2.5.16. 3rd Party Interfaces

The access control system shall be required to interface to the BMS, as well as other 3rd party systems. These systems shall include the following, as a minimum:

i. SAP System: With the appropriate controller and other necessary hardware and software, the system shall include a certified SAP interface; this interface shall be bi-directional and allows personnel data from SAP to the BMS and vice versa.
ii. Microsoft Active Directory System.
iii. Eskom's Integrated Access Control (IAC) system.

3.2.5.17. Other Access Control Functionality

In the event of an emergency, the access control system shall provide muster points where people can gather, and an electronic register can be taken.

The *Contractor* shall provide the functionality to check the muster register against building occupation data and report any on discrepancies.

All hardware and software necessary for muster point functionality shall be supplied by The *Contractor*.

The number of access transactions per card shall be recorded by the ACS.

3.2.6. Perimeter Protection Monitoring & Detection System

The Perimeter Protection Monitoring System (PPMS) consists of an electric fence and climb detection system and is provided by the *Others* according to the LOSS diagram in Part 2 C3.2

The Eskom standard is applicable, 240-78980848 Rev 4 Specification for Nonlethal Energized Perimeter Detection System (NLEPDS) for Protection of Eskom Installations and its Subsidiaries.

The *Contractor* shall provide the Perimeter detection system and provide the status and alarm information to the BMS.

This shall also alert the Operator / Security department of an intruder accessing unauthorized areas. This activity shall be recorded as an event in the BMS event log.

The PPMS interface shall have the capability to operate via Modbus, BACNet or dry alarm contacts.

The *Contractor* shall be responsible for converting signals from the PPMS to the abovementioned protocols if required.

The electric fence and climb detection system shall be zoned by the *Others*. The *Contractor* shall zone the Perimeter CCTV cameras according to this zoning philosophy.

3.2.7. Fibre Optic Network

The *Contractor* shall design, procure, supply and install a Blown Fibre network necessary for integration of all the BMS components as well as make provision for other network users (passive equipment only).

The fibre network shall interface to BMS equipment where necessary in order to achieve a fully functional BMS. As a minimum, the fibre network shall interface to each BMS cabinet, workstation and server.

The existing *Employer* fibre optic network backbone shown on 0.83/50 042 Ingula Pumped Storage Scheme 0 0CYH10, 0 0CYW10 Communication Carrier Revision 10 shall be used to interface between the surface buildings and Powerhouse where dedicated services are required. The *Contractor* provides interfaces to this system by installing Fibre Optic Patch panels in the cabinets to terminate the *Contractor* supplied fibre optic cables. This is in order to provide dedicated "dark fibre" paths between all the *Contractor's* supplied equipment. The *Employer* provides the relevant patching of the services on the *Employer* equipment between destinations with patch leads provided by the *Contractor*.

A Blown 24 core Fibre Optic cable between the *Employer's* Security building and Emergency Power building where dedicated services are required shall be provided by *Employer.* The *Contractor* shall liaise with the

Employer to execute the *works,* see drawing 083/50 042 Ingula Pumped Storage Scheme 0 0CYH10, 0 0CYW10 Communication Carrier.

The network shall meet the necessary redundancy and topology requirements in order to achieve 99.99% reliability and 99.9% availability as a minimum.

The trenching, conduits, racking, fibre blowing, and any other infrastructure, tools or skills required for the installation of the fibre optic cable shall be the responsibility of the *Contractor*.

The *Contractor* shall investigate whether armoured fibre optic able is required for each section in order to meet reliability and availability requirements. Assumptions, risk assessment and/or cost benefit analyses are to be submitted to the *Employer* for acceptance.

The *Contractor* shall apply an optimisation strategy when designing the network in order to minimise cost, maintenance effort and installation time.

The *Contractor* shall supply single mode, 9/125-micron fibre optic cable with a maximum attenuation of 0.25 dB/km at 1550 nm and 0.35 dB/km at 1310 nm.

The *Contractor* shall supply Blown Fibre Optics with armoured micro ducting in existing buried sleeves already installed at IPSS.

The *Contractor* shall supply armoured and unarmoured (with a shorter bending radius) fibre optic cable from the blown fibre infrastructure to patch panels and any other equipment requiring fibre optics.

All splicing, joining, terminations, slack boxes, patch panels and any other equipment required for a full installation shall be supplied by the *Contractor*.

All equipment installed outside of buildings (including those installed in manholes) shall be IP65 rated.

The *Contractor* shall apply the following national and international standards:

i. IEC 60793-1 - Generic Specifications, Optical Fibre
ii. IEC 60793-2 - Product Specifications, Optical Fibre
iii. IEC 60794-1-2 - Generic Specifications, Optical Fibre cables – Basic Optical Cable Test Procedure
iv. IEC 6087 - Connectors for Optical Fibre and Cables
v. IEC 61300 - Fibre optic Interconnecting Devices and Passive Components
vi. IEC 61282 - Fibre Optic Communication System Design Guides
vii. IEC 61755 - Fibre optic Connector Optical Interfaces
viii. ITU-T G.650 - Definition and test method for the relevant parameters of Single-mode fibre
ix. ITU-T G.652 - Characteristics of a Single-Mode Optical Fibre
x. ITU-T G.655 - Characteristics of Non-Zero Dispersion-Shifted Single-Mode Optical Fibre
xi. EIA 445 - Fibre optic test procedure
xii. EIA 492A - Generic Specification for Optical Waveguide Fibre
xiii. EIA/TIA 598 - Colour code for fibre optic cable

The *Contractor* shall apply the following Eskom standards, as found in Part 2 C3.2, to all Fibre Optic cable installations:

i. TSP41-586 revision 0 - Optical Distribution Frame Standard.
ii. 39-116 revision 0 - Fibre Optic System Acceptance Testing Procedure.
iii. NRS 088-1 Duct and Direct-Buried Underground Fibre-Optic Cable Part 1: Product Specification
iv. NRS 088-2 Duct and Direct-Buried Underground Fibre-Optic Cable Part 2: Installation guidelines
v. NRS 081 Single-Mode Non-Dispersion Shifted Optical Fibres

All fibre optic cable connectors are of the SC-APC type, where possible.

3.3. Procedure for submission and acceptance of *Contractor*'s design

The *Employer* follows the 240-53113685 Eskom Design Review Standard found in Part 2 C3.2 as well as CCTV / IAC Applicable Standards when reviewing the designs. The *Contractor* shall prepare his designs for review in line with this procedure providing all details required by the procedure.

3.3.1. Documentation and software control

3.3.1.1. General

The documentation requirements cover the various stages of the project, from the engineering stages through installation and commissioning and most importantly for the operating, maintenance and training stage of the project.

As a minimum, the *Contractor* shall provide, as part of the *works*, the documentation specified in the C&I Documentation Requirements from Vendors document under Part 2 C3.2.

i. The C&I Documentation Requirements from Vendors document specifies the following:
ii. The limits of supply of the documentation, i.e., whether the documentation is provided/maintained by the *Contractor* or the *Employer.*
iii. The type of documentation provided.
iv. The software format (where applicable) in which the documentation is provided.
v. The stage in the project execution during which the documentation is provided as a deliverable.
vi. The *Contractor* shall be responsible for planning the supply of the documentation during the various project stages and to provide the documentation in accordance with the C&I Documentation Requirements from Vendors.

3.3.1.2. Drawings

The *Contractor* shall supply relevant drawings and documents according to the following Eskom documents found in Part 2 C3.2:

i. 240-86973501 Rev 3 Engineering Drawing Standard Common Requirements
ii. SANS 10111, Engineering Drawings
iii. 36-944 Rev 0 General Drawing Standard Work Instruction.
iv. 36-945 Rev 0 Work Instruction for Process (P&ID, PFD, PPFD and SPFD), Hydraulic and Pneumatic Drawings.
v. 36-946 Rev 0 Work Instruction for Electrical Drawings and Documentation.
vi. 36-947 Rev 0 Work Instruction for Control and Instrumentation Drawings and Documentation.

3.3.1.3. Documentation synopsis

The documentation synopsis is a summary and general view of the entire documentation package which shall be provided by the *Contractor*.

The documentation synopsis provides a clear indication of its content and consists of documentation that is specific to this project.

The document synopsis includes the format and layout of each document in the documentation package.

The C&I Documentation Requirements from Vendors shall be incorporated and updated as necessary in the *Contractor's* documentation synopsis and submitted to the *Employer* for acceptance.

In addition to the typical documentation referenced in the table of documentation requirements, the *Contractor* shall include the standard documentation and procedures in the documentation package:

i. Design standards, codes of practice, design guidelines, installation, commissioning and optimisation procedures.
ii. Drawing system description and index.
iii. Document management procedures.

iv. Quality assurance documents and requirements (refer to Eskom Standard QM-58 Revision 0 Supplier Contract Quality Requirements Specification).
v. Design modification procedure.
vi. Safety, health and Environment documents.
vii. Datasheets of equipment.

3.3.1.4. Operating, maintenance and training manuals

The *Contractor* shall provide operating, maintenance and training manuals in the English language.

The manuals shall be produced based on the agreed manual synopsis. The manual synopsis is a separate document from the documentation synopsis.

The *Contractor* shall submit the manual synopsis to the *Employer* for acceptance.

The *Contractor* shall provide the system manuals that describe the design, operating and maintenance philosophies of the BMS, their subsystems and components as part of the *works*.

3.3.1.5. Documentation control

The *Contractor* shall implement comprehensive document control of all documents including a comprehensive documentation register.

The documentation register contains the following information and shall be submitted monthly, in a Microsoft Excel format, to the *Employer*:

i. Documentation number (*Employer's* and makers number).
ii. Revision.
iii. Approval status.
iv. Location of documentation at that stage.
v. Documentation description.

All documentation submittals shall be affected via a documentation transmittal advice accepted by the *Employer*.

The *Contractor* shall provide a Master Document List (MDL) on a monthly basis that shows the latest status of expected documentation for the duration of the project.

The format of the MDL shall be provided after Contract Award.

3.3.1.6. Project completion documentation and software

3.3.1.6.1. Documentation

At the completion of the last stage of the works, the *Contractor* shall supply a copy of uncompressed data files reflecting all latest revisions of all documentation.

The *Contractor* shall also supply three hard copies of this documentation.

Any program software licenses and agreements for software packages that are used for the *works* form part of the *works* and shall be handed to the *Employer*.

The documents shall be reviewed by the *Employer* for correctness and conformance to the accepted design and agreed modifications.

The *Contractor* shall provide all information developed for the Project in electronic native format as editable files and databases.

Where data is supplied in database format, the *Contractor* shall ensure that fully populated and verified databases (and their associated archives, where relevant) are handed to the *Employer*.

The data provided by the *Contractor* shall include as a minimum (but is not limited to):

i. Cable schedules.
ii. Equipment datasheets.
iii. Product catalogue numbers.
iv. Reference data pertaining to catalogue equipment.
v. Equipment serial numbers.
vi. Trip alarm schedules.
vii. Field connection/wiring diagrams.
viii. Maintenance strategy.

The plant instrumentation data package (which constitutes the Equipment Schedule, Limits of Supply and Services, Cable Schedules) shall be appropriately configured and integrated to provide the *Employer* with a fully populated, auditable equipment database, with all necessary integration links to facilitate data exchange, handling, and reporting.

The *Contractor* shall ensure that necessary electronic native diagrams can be created in the required (Eskom) standard format for the following types of diagrams:

i. Termination diagrams.
ii. Wiring diagrams.
iii. Junction box layout.

Acceptable database file formats shall include Microsoft Access, Oracle and SQL Server.

3.3.1.6.2. Configuration management

The *Contractor* shall employ a comprehensive configuration management program in compliance with ISO 10007.

The Tender shall comply with the following configuration management specification in Part 2 C3.2:

i. 202-7180 Ingula Pumped Storage Scheme KKS manual

In addition, the *works* “As-Built” physical and functional characteristics shall be accurately reflected in documents and databases, including those for design, procurement, construction, operation, testing and training.

The configuration program shall be applicable for use throughout all phases of the project life cycle, including that of management of spare parts, replacement parts and product upgrades, and is part of deliverables at hand-over to the Engineer for use during the operation and maintenance phases of the plant.

3.3.1.6.3. Software and firmware

The *Contractor* shall on completion of all the BMS and its subsystems, update all the systems interfaced, with the *Contractor’s* latest system software versions including bug fixes or Service Packs of the system software.

The *Contractor* shall, on completion of all the BMS, ensure that all application software is consistent throughout the scope and have had the latest bug fixes applied to them.

The *Contractor* shall manage the configuration of all software and firmware throughout the project engineering phases until the completion of the project.

The management of the software and firmware shall include bug fixes and changes to the software.

The *Contractor* shall, on completion of all the BMS, hand over a backup of all software and firmware on a suitable storage medium.

The *Contractor* shall ensure compatible integration of all the BMS to the *Employer’s* IAC servers.

3.4. Other requirements of the *Contractor*'s design

3.4.1. Responsibility for Design

All designs, design reports and Construction drawings prepared by the *Contractor* are signed off by their ECSA Professionally registered Technologist or Engineer who takes full professional accountability for the designs.

The *Contractor* is mandated in terms of Construction Regulations 2014: Duties of Designer, 6(1) a - j and 6(2) a – d, to fulfil the duties described therein for the detailed and temporary works designs done by the *Contractor*. Any risk associated with the *Contractor's* design is highlighted to the *Project Manager* together with mitigation measures.

The *Contractor* is responsible for construction monitoring at the level required to certify that the *works* have been constructed in accordance with the *Contractor's* design.

3.4.2. Plant Coding Allocation

Coding of the design will be based on the KKS coding system, and the *Employer* will undertake the coding in line with IPSS Label Specification and Plant Codification Procedure.

The KKS coding shall be applied during the design review stage(s) and cross referenced to all arrangement drawings, schematics, wiring diagrams, instructions and manuals and where practical to spare parts list/manuals.

The *Contractor* will be required to include allocated coding to the electronic design drawings

3.4.3. Configuration change control

Any changes to the design baselines will be formally managed according to the *Employer* Project Engineering Change Procedure (240-53114026).

All design reviews will be conducted according to the Design Review Procedure (240-53113685)

3.4.4. Erection/Installation and SIT

The *Contractor* shall be responsible for the erection and installation of the *works*.

Site Integration Testing (SIT) shall take place at the Ingula Pumped Storage Scheme site after the equipment is delivered to site and has been installed and in line with the 2.6.3Key Date Schedule.

SIT shall be carried out to ensure the correct performance of the BMS equipment, to ensure compliance with the *Employer's* requirements.

The *Contractor* shall prepare a detailed test procedure in preparation for SIT.

The proposed test procedure, together with test dates, shall be prepared by the *Contractor* and submitted to the *Employer* for acceptance during the basic engineering stage.

The final test procedure shall be prepared by the *Contractor* and submitted to the *Employer* for acceptancel at least 8 weeks prior to the test. A final SIT report shall be prepared by the *Contractor* inclusive of the following as a minimum:

i. Test procedures used during SIT;
ii. Detailed test results;
iii. Discrepancies identified during the tests;
iv. Resolution of the discrepancies;
v. Retests conducted and results thereof;
vi. SIT certificate of compliance.

When all tests have been successfully carried out and the final SIT report is accepted by the *Employer*, the system shall be classified as 'ready for use' thus Sectional Completion.

3.4.5. Optimisation and hand over

The *Contractor* shall be allowed to optimise the system in a manner that suits the operating staff.

Full integrity of the system shall be agreed at Completion when the *Employer* shall sign off the system.

The *Contractor* shall ensure that all as built documentation is available and updated for:

i. Operation;
ii. Engineering/configuring;
iii. Maintenance.

All documentation shall be presented to the *Employer* for acceptance.

3.4.6. Basic engineering and design freeze

Basic Engineering is defined as all the activities to ensure that the individual parts of the BMS as well as its subsystems is designed and operates as an integrated and consistent system.

As a minimum, basic engineering shall consist of the following activities:

i. BMS Engineering Philosophies and Concepts – during which the rules, philosophies and concepts followed in the various engineering and design activities are clearly defined, clarified and accepted
ii. Investigation work – during which the *Contractor* conducts his plant investigation work.
iii. Detailed scope definition and clarification according to the agreed LOSS's.
iv. Finalising of quantities of the LOSS's presented in the BOQ.
v. BMS building rationalisation and minimisation based on a risk assessment

The Basic Engineering phase shall be concluded by a design freeze milestone.

All basic Engineering activities are executed by the *Contractor* in active co-operation with the *Employer*.

The *Contractor* shall identify any discrepancies that would lead to shortcomings in the design and makes the *Employer* aware of such discrepancies and shall provide recommendations.

Any discrepancies found in the design after design freeze is the responsibility of the *Contractor*.

3.4.7. Detailed engineering

Detailed engineering is defined as being all activities necessary to translate the *Contractor's* Works, as defined at design freeze, into fully functional BMS.

Detail engineering of the interfaces within the *works* and the third-party interfaces shall form part of the *works*.

As a minimum, detailed engineering consists of the development, clarification and acceptance of the following:

i. HMI graphics on Workstation
ii. Detailed electrical configuration
iii. Detail documentation
iv. Erection documentation
v. Equipment list
vi. Detailed network configuration diagram showing the equipment used and the demarcation of their location including all cable connections and labelling
vii. Alarm list(s) and alarm response procedures
viii. Factory Acceptance Test procedures
ix. Engineering and maintenance procedures
x. Detailed engineering of the interfaces within the *works* and the interfaces to other systems.

During the detailed engineering phase, the *Contractor* is responsible for the execution of an alarm rationalisation process that shall meet the performance requirements of Appendix A Project Standard, Annexure 2 of the guideline 240-56355466 Alarm Management System Guideline.

The *Contractor* shall perform a pre-FAT and submit the results 8 weeks prior to the conducting of the FAT.

The pre-factory acceptance test shall be conducted at the *Contractor's* factory in preparation for the FAT and this shall be shown in the Accepted Programme.

The *Contractor's* Pre-FAT tests shall be documented as part of the *Contractor's* QC procedure.

3.5. Use of *Contractor*'s design

The design and information submitted as part of the works shall be *Employer's* property for use.

3.5.1. Licenses and confidentiality

3.5.1.1. Licenses

All licenses required by the *Employer* covering the equipment, standard software and application software, forming part of the *works*, shall be included as part of the *works*.

Licenses for the equipment and software provided shall include the *Contractor's* Sub-*Contractor*s or third-party licenses and shall be unlimited and valid for the entire life of the BMS.

All licenses are site licenses that shall be used at the Power Station Site.

3.5.1.2. Confidentiality

All participants will be required to sign NDA's and that the company and its directors must be vetted by the SSA.

3.5.1.3. Upgrades

The *Contractor* shall provide all upgrades of software and firmware and the associated licenses throughout the duration of the *works*.

The *Contractor* shall, prior to completion of the project, ensure that all software and firmware is consistent across the *works*.

3.5.1.4. *Contractor's* organisation

The *Contractor* shall submit a project organisational chart to the *Employer* for acceptance.

The *Contractor's* organisational chart shall indicate all project and engineering resources that shall be utilised for the complete project.

The organisational chart shall indicate resources that shall be utilised for each of the Project Methodology Phases.

3.6. As-Built Drawings, Operating Manuals and Maintenance Schedules

3.6.1. C&I Documentation Requirements from Vendors

This document provides the list of documents and project phases during which the *Contractor* shall submit these documents to the *Employer* provided in Part 2 C3.2.

This document also indicates the format of the documents to be submitted.

The *Contractor* shall submit a detailed Master Document List (MDL) after contract award. This MDL shall have all the documents listed in the C&I Documentation Requirements from Vendors document as a minimum.

The MDL shall provide dates when the documents shall be delivered to the *Employer*, within the project phase timelines specified in the C&I Documentation Requirements from Vendors document.

The MDL shall further subdivide the C&I Documentation Requirements from Vendors requirements according to the Sectional Completion requirements of the *works* and the requirements in this requirement.

3.6.2. Limits of Supply and Services (LOSS)

The Limits of Supply and Services (LOSS) of the Tender are given in graphical format in the LOSS diagrams in Part 2 C3.2. The LOSS diagrams indicate the limits for the scope of supply and services for individual items and the supply and interfaces to third party systems.

The *Contractor* shall redline and add to the LOSS diagrams supplied with the enquiry to identify missing work. The *Contractor* shall tender according to the provided and agreed LOSS diagrams. Any missing work is for the *Contractor's* account.

3.6.3. Project drawings

The *Employer* shall provide the *Contractor* with all the relevant architecture drawings of the powerhouse and related buildings. The *Contractor* shall request the *Employer* for any clarification regarding the drawings if required. The relevant drawings for Ingula Pumped Storage Scheme could be found in Part 2 C3.2 CCTV and IAC.

Site Layout: Drawings 0.83/20 002 revision 0 and 0.83/20 003 revision 1 refers to the general site layout drawing for Ingula Pumped Storage Scheme. The site layout drawing contains overview information detailing the layout of the powerhouse and surface buildings that form part of *Contractor's* scope of work.

Buildings: Part 2 C3.2 has all the relevant drawings for CCTV and Access Control requirements.

4. Procurement

4.1. People

4.1.1. Minimum requirements of people employed on the Site

The *Contractor* shall provide expertise in the form of identified experts and specialists for the duration of the *works*.

Experts shall have proven experience, in similar projects, as leading design and commissioning Engineers for access control, CCTV, setting up the BMS and its interfaces in the *works*.

As a minimum, the experts shall be involved during the detailed engineering activities and on-site for the testing and commissioning.

Detailed CVs of each expert shall be submitted to the *Employer* for acceptance. Replacement of any individual with another shall be subject to the *Employer's* acceptance.

All service providers undertaking the installation of electronic security systems, in terms of the Section 1(1) of the PSIRA Act 56 of 2001 shall be required to comply with the following but not limited to:

i. Registered with PSIRA as a "service provider".
ii. All directors of the company must be registered with PSIRA;
iii. All technicians who will work on this contract must be registered with PSIRA as a "security officer".
iv. A letter of good standing issued by PSIRA shall be required as part of the returnable documents and shall be kept up to date during project execution.

4.1.2. BBBEE and preferencing scheme

The *Contractor* shall comply with the *Employer's* Black Economic Empowerment Policy / Code of Good Practices on BBBEE; refer Part C1.2 Contract Data – Part One.

4.2. Subcontracting

No *Subcontractor* shall be appointed without the written acceptance of the *Project Manager*, refer to Clauses 11 and 26 of the ECC.

The *Contractor* shall provide any necessary facilities in order to manage any *Subcontractor* to ensure that the works are carried out in accordance with:

i. The Accepted Programme;
ii. The conditions of contract;
iii. The Works Information and in particular, the requirements of the Safety Plan, Environmental Management Plan, Quality Management Plan and Operational procedures

4.3. Plant and Materials

4.3.1. Quality

Proof of compliance with materials specifications and samples of materials shall be required. This shall also apply to the sub*Contractor*s. All materials and plant which are procured for the *works* shall be subject to the provision of a proof of payment by the *Contractor* or his Sub*Contractor*s at least 30 days after delivery to site; ownership shall then transfer to the *Employer* once valuated, accepted and paid for by the *Employer*.

The *Contractor's* responsibility in terms of materials obtained on site shall include but not limited to:

i. Ensuring that all materials comply with the specifications for each classification.
ii. Provision of all necessary plant and equipment to enable assessment, extraction and transportation to the works.
iii. Shaping and stabilization of excavated faces of stockpiles and or platforms to natural ground profile and prevention of erosion as directed by the Supervisor.
iv. Rehabilitation of disturbed grassed areas, within the vicinity or areas leading to the stockpiles or platforms.
v. No additional payment shall be made over and above the items in the Bills of Quantities, the *Contractor* shall be deemed to have allowed for all the above in his tendered rates.

4.3.2. Conduits

The use of PVC and uPVC Conduits shall be accepted provided the *Supervisor's* acceptance is obtained in writing prior to contract commencement. Where PVC and uPVC conduits are cast into concrete, the *Contractor* shall be present during the pouring of concrete to ensure that the conduits are not damaged or blocked. All joints shall be taped to prevent the ingress of wet fines during wet concrete vibration.

All AC detection and evacuation alarm conduits shall be Bosal/heavy duty steel galvanised, unless cast or built in.

Under no circumstances shall structural concrete be chased without the *Supervisor*'s written permission.

4.3.3. Plant & Materials provided "free issue" by the *Employer*

All other Plant and Materials are to be provided by the *Contractor.*

4.3.4. Spares and consumables

The *Contractor* shall recommend during detailed design the required spares relating to equipment that shall be installed as per the final accepted design.

The *Contractor* shall supply a recommended spares list based on his accepted design

After *Employer's* acceptance these spares should be supplied prior to completion.

4.4. Tests and inspections before delivery

The *Contractor* is required to provide a Certificate of Conformance for each item to be supplied and/or delivered (Serial Number should be used for traceability). Where Batch testing was done the serial number of the item to be supplied and/or delivered must be traceable to the Batch tested

The *Contractor* shall provide delivery lead times for each offered products, equipment, module, software and associated licences.

The *Contractor* shall provide a testing/ commissioning program and procedure to be accepted by the Project *Manager*.

The *Contractor* is required to perform the following tests before delivery of the *works*:

Factory acceptance testing of the control system. The *Contractor* is to submit the respective testing procedures to the *Employer* for his review and acceptance prior to conducting testing at the *Contractor's* facilities.

Site acceptance testing and commissioning of the integrated system with the control system and all associated equipment. The *Contracto*r is to submit the respective testing procedures to the *Employer* for his review and acceptance prior to conducting testing

4.4.1. Factory Acceptance Testing (FAT)

During FAT, the *Contractor* shall demonstrate that the BMS meets the requirements of the *Employer's* requirement and prove the functionality of the system prior to shipment.

The *Contractor*, the *Employer* and any third parties shall witness the FAT. The FAT shall test hardware functionality and performance as well as application software functionality and performance.

The *Contractor* shall guarantee that the BMS hardware and software are available and operational in time for the individual tests.

As a minimum the *Contractor* shall conduct the FAT using five fully configured BMS connected together on a network with similar functionality to the fibre ring network. The *Contractor* shall provide all the BMS subsystems for the five BMS to be tested as part of the FAT.

The interfaced subsystems shall be simulated to confirm the functionality. The following elements shall be tested, as a fully connected and integrated system, during the FAT:

i. Selected BMS equipment accepted by the *Employer*
ii. Selected BMS equipment control panel accepted by the *Employer*
iii. Selected subsystems accepted by the Engineer - access control, CCTV systems and Perimeter detection system interface supplied by the *Contractor*.

Selected cabling and associated field / infrastructure equipment accepted by the *Employer* (such as fibre / copper network, CCTV cameras, access control readers).

For FAT conducted abroad or in South Africa, arrangements for travel and accommodation shall be made by the *Employer*. A minimum of 12 weeks' notice shall be given by the *Contractor* prior to FAT commencement.

The *Contractor* shall prepare a detailed test procedure in preparation for FAT as mentioned in the minimum assessment and testing requirements as per Part 2 C3.2 standards 8 weeks before the FAT.

The proposed detailed test procedure shall be prepared by the *Contractor* and submitted to the *Employer* for acceptance during the Detailed Engineering stage.

As a minimum, the proposed FAT procedure identifies the following:

i. Major test activities.
ii. Comprehensive list and description of the individual tests to be performed.
iii. How the tests are to be prepared and conducted.
iv. Test dates and durations.
v. Checklists - how the test results shall be documented.
vi. Acceptance criteria.
vii. How the identified Deviations shall be processed.
viii. Safety, health and environmental risks/impacts and existing risk control measures efficiency levels and proposed risks mitigation.
ix. Re-testing requirements.
x. Proposed hold and witness points.
xi. A Final FAT report shall be prepared by the *Contractor* that includes the following as a minimum:
xii. Test procedures used during FAT.
xiii. Detailed test results.
xiv. Deviations identified during the tests.
xv. Resolution of the Deviations.
xvi. Re-tests have been conducted and its results thereof.
xvii. FAT certificate.

The *Contractor* shall submit the final FAT report to the *Employer* for acceptance. FAT Completion shall be achieved upon acceptance and sign-off of the final FAT report by the *Employer*.

4.5. Marking Plant and Materials outside the Working Areas

Not Applicable

5. Construction

5.1. Temporary works, Site services & construction constraints

5.1.1. *Employer*'s Site entry and security control, permits, and Site regulations

For all intents and purpose, temporary works for this contract shall be any work or infrastructure and or establishment which the *Contractor* requires in order to provide the *Works*; which includes inter alia his facilities, laboratories for control and acceptance testing, connection to existing water, sewer, electricity, etc. All such temporary works shall be adequately decommissioned, restoration to natural environment and the area made good on completion of the *works*; all to the acceptance of the *Project Manager.*

Method statements shall be prepared prior to commencement of any work for the acceptance of the *Supervisor*. All costs relative to this aspect shall be on account of the *Contractor*.

5.1.2. Restrictions to access on Site, roads, walkways and barricades

For all intents and purpose, temporary works for this contract shall be any work or infrastructure and or establishment which the *Contractor* requires in order to provide the *Works*; which includes inter alia his facilities, laboratories for control and acceptance testing, connection to existing water, sewer, electricity, etc. All such temporary works shall be adequately decommissioned, restoration to natural environment and the area made good on completion of the *works*; all to the acceptance of the *Project Manager.*

Method statements shall be prepared prior to commencement of any work for the acceptance of the *Supervisor*. All costs relative to this aspect shall be on account of the *Contractor*.

5.1.3. People restrictions on Site; hours of work, conduct and records

Restrictions and hours of work may apply. The *Contractor* is required to keeps records of his people on Site, including those of his Sub*Contractor*s which the *Project Manager* or *Supervisor* has access to, at any time.

The *Contractor* is required to manage the interface between his Sub*Contractor*s and ensure access is granted prior to establishing and commencing work. Working hours are Monday to Friday, between sunrise and sunset, unless permission is granted by the *Project Manager* to work any other day or after sunset.

5.1.4. Health and safety facilities on Site

There are no health and safety facilities on-site. The *Contractor* shall make his own arrangements for site medical facilities and fire-fighting facilities.

5.1.5. Publicity and progress photographs

In terms of the Contract, the *Contractor* is not required to provide the *Project Manager* or the *Supervisor* with photographs of work progress. Other than the *Supervisor*, the *Contractor*, and the *Employer's* Environmental Control Officer, no one shall be allowed to take photographs of the works or parts thereof without prior written authorisation by the *Project Manager.*

5.1.5.1. Advertisements and Publications

All advertisements and/or publications related to this Project shall first be accepted by the *Project Manager* prior to its release.

5.1.5.2. Notice Boards

Project notice board shall be provided and erected as instructed.

5.1.6. Site Usage

5.1.6.1. Working Areas

The extent and outline of the works area that may be used by the *Contractor* in carrying out the works shall be agreed with the *Supervisor* and the *Employer's* Environmental Control Officer. Reference may be made to the Drawings for a general overview of the layout and extent of the works.

5.1.6.2. Fencing

Existing fencing is to be maintained.

5.1.6.3. Permits and Wayleaves

The *Contractor* shall make all arrangements to obtain wayleaves and permits for services which cross the road alignment as applicable.

The *Contractor* allocates staff to be trained and authorised as Responsible Persons according to *Employer*'s Plant Safety Regulations (36-681).

In this contract *the Contractor* shall appoint employees to attend and be authorised as follows:

i. All Construction and Assistant Supervisors to attend Plant Safety Regulation and be authorised as Responsible Persons and authorised supervisors.
ii. Two (2) Supervisors to be authorised in terms of the PSR as Responsible Persons, and
iii. Two (2) Assistant supervisors to be authorised as Authorised supervisors.

5.1.7. Facilities, Samples and Inspections

The *Contractor* shall arrange facilities where appropriate, to allow for the provision of samples, to the acceptance of the *Supervisor*.

The *Supervisor* will carry out routine site inspections of finished work as well as of work in progress. The *Contractor* shall allow access to the works for such routine inspections.

5.1.8. Liaison with Statutory Authorities and/or Landowners

The *Contractor* shall be responsible for liaising with and ensuring compliance with the requirements of the appropriate statutory authorities in carrying out the works.

5.1.9. Equipment provided by the *Employer*

None

5.1.10. Existing premises, inspection of adjoining properties and checking work of *Others*

The *Contractor* is required to inspect the work of *Others* to which he is required to connect / interface / integrate to avoid delays to his work.

5.1.11. Site Establishment

5.1.11.1. *Contractor*'s Camp/ Laydown

The *Contractor* must make his own arrangements for laydown and or site camp areas.

5.1.11.2. Power Supply to the Site

The *Contractor* shall make his own arrangements for power supply to his site offices.

5.1.11.3. Water

Potable water for domestic consumption shall be brought onto Site by the *Contractor.*

5.1.11.4. Other Facilities and Services

The *Contractor* shall provide all facilities and services required for completion of the *works* as detailed in the *Scope of Works*, including site medical and fire-fighting facilities.

5.1.12. Existing Services

Existing services (Telkom and Power Supply) may be affected by this contract. Within the locality of the *works*, there are existing services (water pipes and electrical cables) which the *Contractor* shall take extreme care to prevent any damages during the execution of the *works.*

The *Contractor* shall liaise with the *Supervisor* before work commences.

The *Contractor* shall be responsible to expose and protect all existing services where directed.

5.1.13. Hook ups to existing works

The following interfaces with other systems were identified and to take into consideration for the *Contractor's* scope of work. These systems are not necessarily installed as yet but may be in the process of being installed by *Others*. The *Contractor* liaison with the stakeholders and OEMs of these systems/contracts to ensure interfacing with the equipment of this contract is achieved seamlessly and interface points are agreed between the *Contractor* and the 3rd party system stakeholders.

5.1.13.1. Lighting System

The *Contractor* liaisons with the Fencing & Lighting *Contractor* to, together, design the ultimate solution by matching the proposed camera technology with the supplied light technology. The *Employer's* Standard, Security Lighting for Eskom Applications 240-139282493 shall be applicable for the lighting and the CCTV shall fit into and be compatible with this lighting.

5.1.13.2. Fire Detection System

The intent of this interface is for the Integrated Access Control System to automatically release/open electro-magnetic controlled doors in identified escape routes. The *Contractor* shall make provision in their design for future interface.

5.1.13.3. Time Synchronization (GPS) System

To ensure proper root cause analysis of incidents on site, all time related electronic equipment supplied with this contract are time synchronised with each other as well as time synchronised to the station GPS.

5.1.13.4. Perimeter Detection & Alarming

The intent of this detection is to relay all alarm signals from the Perimeter Fence System to one single location by integrating the Perimeter Fence Detection System into the BMS.

5.1.13.5. The OT/IT interface requirements

i. 240-91190304 Rev 2 Specification for CCTV Surveillance with Intruder Detection
ii. 240-102220945 Specification for Integrated Access Control System (IACS) for Eskom Sites
iii. 240-55683502 Definition of operational technology (OT) and OT / IT collaboration accountabilities
iv. 240-79669677 Demilitarised Zone (DMZ) designs for Operational Technology standard

5.2. Completion, testing, commissioning and correction of Defects

5.2.1. Work to be done by the Completion Date

On or before the Completion Date the *Contractor* shall have done everything required to Provide the Works. The *Project Manager* cannot certify Completion until all the work has been done and is also free of Defects

which would have, in his opinion, prevented the *Employer* from using the *works* and *Others* from doing their work.

5.2.2. Start-up procedures required to put the *works* into operation

All Site Acceptance Tests (SAT), Site Integration Tests (SIT) and Quality, Inspection and Test Plans (QITP) are accepted by *Employer*.

5.2.3. Take over procedures

The following conditions is subject to initiate the take-over procedure: All Site Acceptance Tests (SAT), Site Integration Tests (SIT) and Quality, Inspection and Test Plans (QITP) are accepted by *Employer*. Any defects will be corrected by the *Contractor*.

5.2.4. Performance tests after Completion

The *Contractor* to provide support on installed systems (i.e., new patches release on software that require configuration) for a period of 12 months after completion.

5.2.5. Training and technology transfer

5.2.5.1. General

The *Contractor* shall provide training on the equipment and systems included as part of the *works* to the various categories of the *Employer's* technical staff for the duration of the *works*.

All training is to be conducted at *Employer's* site, Ingula Power Station.

All training must realise certification on completion

The objective of the training is to provide the power station staff with the necessary skills and knowledge to achieve all the plant performance targets with respect to safety, maintainability, availability, reliability and economic plant operation.

The *Contractor* shall provide all formal training courses for the operator, maintenance and engineering staff at the Power Station.

The *Contractor* shall provide up-front engineering training to the *Employer's* engineering team such that the *Employer's* engineering team is fully conversant with all aspects of the *Contractor's* technology and systems.

A detailed training program and the full training material shall be submitted by the *Contractor* to the *Employer* 8 weeks before the commencement of the training.

The training only begins once the *Employer* has:

i. Accepted the training program provided.
ii. Accepted the training material provided.

The Up-front engineering training is provided specifically for the *Employer's* engineers

Completion of the Up-front engineering training shall be granted once the *Employer* is satisfied that the *Employer's* engineering team has been adequately trained.

Formal submittal of design documents shall not be submitted before the completion of the Up-front engineering training.

5.2.5.2. Training of engineering staff

The *Contractor* shall provide training to the engineering staff that shall be using the system in the form of on-the-job training and formal courses.

All training is to be conducted at *Employer's* site, Ingula Power Station.

Training for the engineering personnel shall be provided in two separate stages:

i. Up-front BMS engineering training within 3 months of Contract Award. The *Contractor* shall provide for 6 participants from the *Employer.*
ii. Project specific engineering training for the engineering personnel in two different formats:
   a. Formal building management system engineering courses as specified in the Key date Schedule. The *Contractor* shall provide 2 courses with 3 participants from the *Employer* per course for a total number of 6 participants.
   b. The *Contractor* shall assess the *Employer's* participants for competency after each of the formal courses.

5.2.5.3. Engineering staff training content

The Engineering Training includes as a minimum:

i. A system design philosophy which includes lessons and improvements.
ii. The system architecture.
iii. Developing, debugging and testing of all software including programming.
iv. Graphic display design and programming.
v. Database management.
vi. Network design, communication, configuration, security and expansion.
vii. All information necessary for an individual to modify the system.

5.2.5.4. Training of maintenance staff

The *Contractor* shall provide training to the maintenance staff that shall be using the system in the form of on-the-job training and formal course.

The *Contractor* shall test and declare the participants competent as being able to maintain the BMS.

The *Contractor* shall conduct formal BMS maintenance courses

The *Contractor* shall provide 2 formal BMS maintenance courses with 8 participants per course for a total of 16 participants.

In addition to the above, the *Employer* shall have the option to second additional *Employer's* maintenance trainees to the *Contractor* who shall integrate these staff into his organisation for training purposes.

5.2.5.5. Maintenance Staff Training Content

Basic maintenance training shall include as a minimum:

i. Familiarisation with the documentation forming part of the works, including drawing configuration logic.
ii. Hardware familiarisation.
iii. Hardware installation and configuration which includes the computers, processing modules, communication modules, I/O modules, power supply monitoring modules, network modules and all other peripheral equipment supplied as part of the works.
iv. Graphic display configuration.
v. Report generation.
vi. Operator interface familiarisation including keyboard and display functions, controls, alarms and messages.
vii. System hardware.
viii. Software maintenance.
ix. System Administration.

5.2.5.6. Training of Operators

The *Contractor* shall provide 6 formal operator training courses with 8 participants from the *Employer* per course for a total of 48 participants.

All training is to be conducted at *Employer's* site, Ingula Pumped Storage Scheme Station.

5.2.5.7. Operator Training Content

Operator training shall include as a minimum:

i. Familiarisation with the documentation provided as part of the works, including drawing configuration logic.
ii. Graphic display, design and configuration.
iii. Operator interface familiarisation including keyboard and display functions.

5.2.5.8. Training documentation

The *Contractor* shall provide all course material including manuals in accordance with the requirements of Project Standards.

The course material shall be in English and shall include all third-party documentation.

The *Contractor* shall submit draft documentation of all training course one month prior to commencement of each training course.

The *Employer* shall review the documentation and request modification or additions to the training course, which shall be incorporated by the *Contractor*.

Final accepted documentation incorporating all comments and modifications proposed by the *Employer* shall be supplied to the *Employer* one week prior to commencement of training.

Training documentation shall address specific training objectives and shall not be simply reference manuals or extracts of other documentation.

A copy of the training documentation is supplied for each trainee with an additional 3 hardcopy master sets and one electronic copy for the *Employer's* library and training department.

All training documentation provided by the *Contractor* shall be customised for the Power Station.

The training documentation shall contain the specific BMS architecture, configuration, layout, software, equipment, HMI and design provided by the *Contractor* as part of the *works*.

Training manuals shall be continuously updated by the *Contractor* up to the Completion of the whole of the *works*.

5.2.5.9. Participation of *Employer* staff

The *Employer* shall have the option to second three engineers to work with the *Contractor* during the design, installation and commissioning stages of the contract.

The *Employer's* engineering staff seconded to the *Contractor* shall not be viewed as part of the *Contractor's* resources necessary to provide the *works*.

The *Employer* may withdraw such staff at any time.

5.2.5.10. Certification of *Employer* staff competence

The *Contractor* shall after an agreed "on-job" training period and successful completion of the training certify the *Employer's* developed staff as being competent to maintain the relevant systems.

6. Plant and Materials standards and workmanship

6.1. Building works

During the construction of the works there are numerous standards and specifications to which the *Contractor* must adhere to. The documents listed, including normative references within, are not bound in this document but are obtained by the *Contractor* at his own expense and must be adhered to during the implementation of the works.

Where a SANS standard referenced has been replaced by a newer standard, the *Contractor* is required to adhere to the latest revision of the newer standard. Where a SANS standard referenced is composed of several parts, all applicable parts are to be adhered to.

6.1.1. Materials, Workmanship and Products

6.1.1.1. Materials and Workmanship

Only new and undamaged materials are to be used in the works. Materials to be permanently installed in to the works are not to be used for any temporary purposes on site. Work is required to be for the acceptance of the *Supervisor* and is executed in accordance with the relevant manufacturer's written recommendations and instructions.

6.1.1.2. Proprietary Products

For the purpose of submission of tenders, rates for items described in the bills of quantities by trade names, catalogue references, etc., are for the particular type and manufacture specified.

Once the Contract has been signed the acceptance of the *Project Manager* is required to be obtained prior to any substitution and where products or materials, etc., other than those specified are used.

6.2. Process control and IT works

This section indicates the list of project standards that the *Contractor* shall adhere to. The *Contractor* shall also recommend other relevant standards that are beneficial for this project.

The *Contractor* shall obtain copies of International and National standards documents. The Project Standards are provided in Part 2 C3.2 CCTV IAS Applicable Standards.

The *Contractor* shall report any conflict or ambiguity within this *Employer's* requirement with any referenced standards, specifications or technical guideline for decisions to be made by the *Employer*.

Substitutions of any standards in Part 2 C3.2 shall be accepted by the *Employer*.

Additional standards proposed by the *Contractor* shall be submitted for acceptance by the *Employer*.

7. List of drawings

7.1. Drawings issued by the *Employer*

Layout drawings have been provided for Information only so the Contractor gets an overall appreciation of the building and layout. The scope of work is detailed on “marked-up” drawings folder.

Note: Some drawings may contain both Works Information and Site Information.

Drawing number	Revision	Title
Applicable Drawings Referenced in Works		
0.83/00013 – Sheet C, D, E, G, H, J		All electrical and C&I cabinets shall conform to the Ingula guidelines
0.83/79 400 - Sheet 6		Electrical fence
0.83/79 700 - Sheets 1 to 22	0	Surface buildings, dams and underground
0.83/50 042 Rev 10	10	Ingula Pumped Storage Scheme 0 0CYH10, 0 0CYW10 Communication Carrier
0.83/20 002	0	Site Layout
0.83/20 003	1	General site layout drawing for Ingula Pumped Storage Scheme
IGLD-MFP14-0101-01087623-DD_ZP3	0	Panel Fibre-Network
0.83/70 010 Sht 1	1	IPSS Admin Building GA Ground Floor
0.83/70 011 Sht 1	1	IPSS Admin Building GA 1st Floor
0.83/70 014 Sht 5	1	IPSS Admin Building GA Basement
0.83 74 010 Sht 1	2	IPSS Emergency Power Building GA Ground & Foundation
0.83/73 010 Sht 1	3	IPSS Visitor Centre GA Floor Plan
0.83/23 402 Sht 1	10	IPSS Excavation Operating Floor Sectional Plan B-B
0.83/27 726 Sht 1	2	IPSS Bramhoek Dam (Lower Site) Security Acess Control & CCTV Camera Layout
0.83/23 081 Sht 1	1	IPSS Intake Structure Bridge GA

0.83/23 431 Sht 1	5	IPSS Machine Hall-Excavation MDC, MDS &OHR Rock Support –Key Plan
0.83/23 535 Sht 3	11	IPSS Machine Hall Turbine Floor- Concrete Plan Unit 1 and 2
0.83/23 535 Sht 2	10	IPSS Machine Hall Turbine Floor- Concrete Plan Unit 3 and 4
0.83/23 540 Sht 1	10	IPSS Machine Hall Generator Floor- Unit 3 and 4 Plan
0.83/23 540 Sht 2	10	IPSS Machine Hall Generator Floor- Unit 1 and 2 Plan
0.83/23 550 Sht 1	10	IPSS Machine Hall Operating Floor- Unit 3 and 4 Plan
0.83/23 550 Sht 2	7	IPSS Machine Hall Operating Floor- Unit 1 and 2 Plan
0.83/24 052 Sht 1	7	IPSS Transformer Hall- GA Operating Floor Plan
0.83/24 054 Sht 1	4	IPSS Transformer Hall- GA Battery room Plan
0.83/24 376 Sht 1	0	IPSS Exploratory Tunnel Portal Extension Fence Layout
0.83/24 561 Sht 1	0	IPSS Main Access Tunnel Portal Extension Fence Layout
0.83/24 835 Sht 1	1	IPSS Outlet Structure Bridge Security Gate Layout
0.83/26 300 Sht 1	2	IPSS Bedford Dam (Upper Site) Intake Tower & Conduit GA
0.83/27 726 Sht 1	2	IPSS Bramhoek Dam (Lower Site) Security Fencing & Handrail Layout
0.83/23 219 Sht 1	0	IPSS Surge Shafts & Surge Risers Crab Docking Station Fence Layout
0.83/70 001 Sht 1	1	IPSS Admin Building Guard House
0.83/50042 Sht 1	10	IPSS 0 0CYH10, 0 0CYW10 COMMUNICATION CARRIER BLOCK DIAGRAM

8. List of Eskom Standards

8.1. Standards issued by the *Employer*

List of standards issued by the *Employer* at or before the Contract Date and which apply to this contract.

Document Number	Title
202-7180 Rev 4	Ingula Pumped Storage Scheme KKS Manual
240-102220945 Rev 2	Specification for Integrated Access Control System (IACS) for Eskom Sites
240-102220945 Rev 2	Specification for Integrated Access Control System (IACS) for Eskom Sites
240-106030205 Rev 1	Fibre Optic Gantry to Substation Control Room Scope of Work Guideline (Reg)
240-46264031 Rev 3	Fibre-Optic Design & installation Standard - Substations
240-48623131 Rev 1	Alarm Response Procedure Template
240-55410927 Rev 0	Cyber Security Standard for Operational Technology
240-55683502 Rev 0	Definition of operational technology (OT) and OT / IT collaboration accountabilities
240-56227443 Rev 1	Requirements for Control and Power Cables for Power Stations Standard
240-56355466 Rev 2	Alarm Management System Guideline
240-56355728 Rev 2	Human Machine Interface Design Requirements Standard.
240-56355731 Rev 2	Environmental Conditions for Process Control Equipment Used at Power Stations Standard
240-56355808 Rev 2	Ergonomic Design of Power Station Control Suites
240-56356396 Rev 1	Earthing and Lighting Protection Standard
240-57859210 Rev 1	Alarm System Performance of Digital Control Systems Applied in Fossil Plant
240-70733995 Rev 2	Optical Distribution Frame / Patch Panel / Patch Box
240-78980848 Rev 4	Specification for Nonlethal Energized Perimeter Detection System (NLEPDS) for Protection of Eskom Installations and its Subsidiaries
240-79669677 Rev 2	Demilitarised Zone (DMZ) designs for Operational Technology standard

240-86973501 Rev 3	Engineering Drawing Standard Common Requirements
240-91190304 Rev 2	Specification for CCTV Surveillance with Intruder Detection
32-894 Rev 0	Eskom Server Room and Data Centre Standard
36-944 Rev 0	General Drawing Standard Work Instruction
36-945 Rev 0	Work Instruction for Process (P&ID, PFD, PPFD and SPFD), Hydraulic and Pneumatic Drawings.
36-946 Rev 0	Work Instruction for Electrical Drawings and Documentation
36-947 Rev 0	Work Instruction for Control and Instrumentation Drawings and Documentation
NRS 081 2014	Single-Mode Non-Dispersion Shifted Optical Fibres
NRS 088-1 2019	Duct and Direct-Buried Underground Fibre-Optic Cable Part 1 Product Specification
NRS 088-2_2019	Duct and Direct-Buried Underground Fibre-Optic Cable Part 2 Installation Guidelines

9. Annexure A

Document Number/Folder	Revision	Title
	N/A	Baseline Risk Assessment Ingula Security & Infrastructure Project
0.83/93 003 - Sht 1	Rev 1	Project Locality Plan
14/12/16/3/3/1/5/81	N/A	Environmental Authorisation
201-49	Rev 3	Group Capital Project Risk Management Procedure
202 - 7836	Rev 0	Ingula Pumped Storage Scheme Health and Safety Specification for the Ingula Access Roads Project
202-7179	Rev 6	Ingula Pumped Storage Scheme Project Quality Plan (PQP)
202-7253	N/A	Ingula Security Access and Egress Control Standard
202-7281	Rev 4	Alcohol Testing
202-7387	Rev 1	*Contractor* Data Book Specifications
202-7402	Rev 1	Traffic Monitoring Procedure
202-7457	Rev 0	Traffic Management Plan
240-105658000	Rev 1	Supplier Quality Management Specification
240-44175132	Rev 0	Eskom Personal Protective Equipment (PPE) Specification
240-62196227	Rev 5	Life Saving Rules
240-82672729	Rev 1	Group Capital Risk and Resilience Management Plan
27/2/2/V12B/1/3/9	N/A	Water Use Authorisation
32-1123	Rev 0	HIV/AIDS in the workplace
32-1123	Rev 0	HIV-AIDS in the Workplace Policy
32-1126	Rev 1	Smoking Policy
32-136	Rev 3	*Contractor* Health and Safety Requirements
32-407	Rev 1	Behaviour Safety Observations Procedure
32-418	Rev 3	Working at Height Standard
32-727	Rev 1	SHEQ Policy
32-93	Rev 5	Vehicles and Driver Safety Management
32-95	Rev 6	Environmental Occupational Health Incident Management Procedure
474-1325	1	Design Review Procedure
ISO31000	N/A	Risk management — Principles and guidelines
N/A	Rev 6	Ingula Site Map Sep 2011
N/A	Rev 6	Construction Environmental Management

		Plan (CEMP)
QM-58	0	Supplier Contract Quality Requirements Specification
SANS 1921-6:2004	N/A	South African National Standard (SANS): Construction and management requirements for works contracts. Part 6: HIV/AIDS awareness

10. Annexture B - Product Design and Engineering

10.1. Design Artefacts

The solution shall be accompanied by a basic design. A basic design comprises of document(s) detailing the overall architecture, solutions/systems configuration/layout, and equipment and/or software selected. System design choices: this should include information on design options, costing, constructability, procure-ability, operability, sustainability, reliability, availability, inspect-ability, testability, expandability, decommission-ability, and all other risks considered prior to arriving at the recommended option.

A detailed design comprises of document(s) detailing the selected equipment, interfaces, modules, ports, software, firmware, operating systems, and applications for the solution. System network addressing plan, licensing, and configuration templates.

The *Contractor* shall develop the detailed design and it will be reviewed by the *Employer* post contract award, as part of the solution development process.

A System Implementation Plan (SIP) comprises of document(s) detailing the installation and commissioning activities, site survey forms, staging plans, Installation Test Plans (ITPs) and knowledge transfer plans (operator, administrator, and technician) and training plans (planner, operator, administrator, and technician), and cutover plans. The *Contractor* shall submit the SIP documentation for review and acceptance.

The *Contractor* shall develop the SIP after developing the detailed design, as part of the solution development process.

A System Ready for Use (SRFU) comprises of document(s) detailing the Acceptance Test Plans (ATPs), commissioning, and change management plans, operator readiness plans, maintenance, administration, disaster recovery plans and procedures. The *Contractor* shall submit the SRFU documentation for review and acceptance.

The supplier shall develop the SRFU after developing the SIP, as part of the solution development process.

Three sets of printed copies of the systems engineering and design stage documentation is submitted to the *Project Manager* for acceptance five (5) working days prior to the start of the detailed technical clarification discussions.

The systems engineering and design stage documentation is in a logical format and adequate state of completeness, prepared in conformity with the agreed documentation synopsis.

Records are kept of all designs, design decisions and calculation in a format that can be readily followed. Such designs and calculations are submitted to the *Projects Manager* for review and acceptance. Acceptance by the *Project Manager* in no way diminishes the *Contractor*s design responsibility.

The *Contractor* obtains the acceptance of the systems engineering and design stage documentation from the *Project Manager* prior to the commencement of the technical clarifications.

It is the *Contractor's* responsibility to solve any process information, protection, measuring, monitoring and interface problems encountered during execution of the Contract.

The *Contractor* prepares and presents all designs and documentation to discuss and finalise the functional definition and scope of the work to be done for the works during the technical clarification.

The *Contractor* is responsible for the verification, formulation and engineering of the measuring, monitoring, protection, display, data handling, interfacing, and information management philosophy for all the components of the works.

The *Contractor* is responsible for leading technical clarification discussions with the *Employer*.

The *Contractor* is responsible for collecting all information and data required for design to enable the design to be complete.

The *Contractor* will supply a layout of the Access Control and CCTV system after basic/detailed design as well as after implementation to ensure that any areas that were lacking in the design has been covered when the project has been finalised.

The *Contractor* performs the function of a coordinator, technical leader and takes responsibility for all technical interfaces between the works and other systems as indicated in the Works Information.

10.2. Design assurance

All designs produced shall be submitted for review by the relevant *Employer* design review committees, the *Contractor* shall present these, if required, and to take on full design accountability.

OEM validation of designs shall be obtained where applicable.

Penetration tests shall accompany all physical security and cybersecurity designs.

The *Contractor* shall be OEM accredited to offer the solution (letter from OEM shall be provided as proof of accreditation).

The *Contractor* shall be OEM accredited to offer the design and planning services on the offered solution (letter from OEM shall be provided as proof of accreditation).

Contractor shall provide case studies demonstrating use of offered solution. The case studies should be clear on the level of skills and expertise the supplier has with delivery of similar solutions (i.e., design, planning, installation, commissioning, SHEQ, and project management).

The *Contractor* shall document an Engineering Architecture Design that describes how the current installed Eskom Physical Security systems can interface and integrate with their proposed solution. The design shall take into consideration current and future migration plans as stipulated by *Employer*.

The Engineering Architecture will be presented to the relevant *Employer* Technical Governance for acceptance.

The proposed solution should cover all aspects of the product(s) which include software and hardware designs.

The *Contractor* shall ensure that all the stipulated requirements are understood and considered: functional, performance design, etc. It is the responsibility of the *Contractor* to seek further description from *Employer* if necessary.

The proposed solution should be reliable and scalable in line with Eskom's technology roadmaps.

The *Contractor's* designs shall be approved and signed off by their own ECSA registered Engineer.

All designs shall comply with the issued specifications and the Eskom OT Cyber Security standards.

The designer shall ensure that the applicable safety standards required by the regulations are complied with in the design, taking into consideration the OH&S (Occupational Health & Safety) specification submitted by Eskom.

The *Contractor*'s Design may be used by Eskom in other projects.

10.3. Design Engineering

The *Contractor* shall always be ready to demonstrate and/or test any functionality called for in the specification. The demonstration and/or testing will primarily be at the supplier's premises and/or its customer(s). In specific instances, where integration to existing systems is required, the demonstrations will be at Eskom premises.

For functional demonstrations, the *Contractor* shall submit a detailed ATP which describes how the *Contractor* intends to demonstrate the required functionality. Eskom reserves the right to add or remove tests on the ATP. The ATP is applicable for equipment (hardware), software, and management systems.

The final ATP shall be signed off by a technical representative of Eskom.

The *Contractor* shall produce a Factory Acceptance Test (FAT) Procedure for all the supplied equipment.

The development of the Maintenance Standard must consider the threats and limitations the proposed system has. It shall aim to maintain the performance of the equipment throughout the duration of the contract, including any foreseen modifications.

Inform Eskom of any known hazards emanating from the design and how they should be mitigated

10.4. Application

The *Contractor* shall analyse and interpret the Eskom requirements into the System design.

The *Contractor* shall review existing site-based data and include the data into their design.

The *Contractor* shall conduct site surveys to ensure accuracy of the information used in the design. At minimum, the site survey information shall include the following:

i. Cabinet space
ii. DC and AC power requirements
iii. Cable routing
iv. Earth points
v. Air conditioning
vi. Site layout (floor drawings and cabinet layout)
vii. Condition of existing equipment
viii. Required interfaces
ix. SOW per site
x. A list of additional works required per site

The *Contractor* shall request *Employer* for access to the sites under consideration.

The *Contractor* must inform *Employer* of any additional infrastructure required on site.

Design documentation is required across all sites.

The proposed application design shall be presented to the relevant DRT committee (*Employer* to advise) for review and acceptance.

i. Data shall only be stored in ***Employer's*** accepted project files, formats, and folders. Any data shall be available to the authorized staff when required.
ii. Where there are deviations from the accepted standards, the deviations shall be submitted to the *Employer* DRT for acceptance.
iii. The *Contractor* shall comply with the Eskom SHE requirements when conducting site surveys.

10.5. Equipment and Product Profile

The *Contractor* shall give the first date of manufacture for all proposed equipment.

The *Contractor* is required to provide sets of product brochures.

The *Contractor* shall provide the MTBF figures for all the proposed equipment.

An overview of the product(s) proposed in relation to the enquiry shall be given.

The product development and history shall be documented. Emphasis shall be placed on the continuity and integration of the product range.

A product life cycle road map shall be provided for all proposed products and/or equipment. Any foreseen future developments and periods must be outlined.

All product(s) submitted in the enquiry must be available for purchase throughout the contract duration. Where the product(s) are phased out by the OEM during the contract period, the *Contractor* shall ensure continuity of supply of these product(s) to Eskom, for at least the duration of the contract.

The *Contractor* must be able to provide support for the product(s) in the enquiry for a minimum period of 10 years from the date of the contract being awarded. Where the product(s) are phased out by the OEM during the contract period, the *Contractor* shall ensure continuity of support of these product(s) to Eskom, for the minimum period of 10 years from the date of the contract being awarded.

The *Contractor* may suggest industry standard, economic and environmentally friendly solutions if the proposed solution replaces obsolete or older equipment, more so when the older equipment was offered by the same Supplier. Eskom is not obligated to implement the *Contractor* suggestions.

The *Contractor* shall provide *Employer with* a description of any additional functionality above the technical requirements stipulated in Eskom specifications. These may be accessible through minor modifications or software updates/upgrades/etc. *Employer* shall reserve the right to implement these additional features.