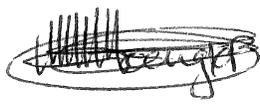
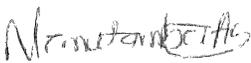
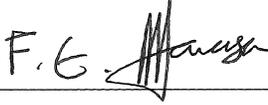
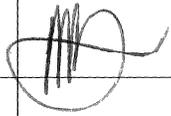


	Works Information	Generation
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Compiled by: Khumo Skosana C & I Engineering Senior Advisor		20/10/2025
Functional Responsibility: Katlego Mangope C&I Engineering Manager		20/10/2025
Reviewed By: Bethuel Moeng Senior Advisor Environmental Management		20/10/2025
Reviewed By: Jabu Mtsweni Senior Advisor Quality Department		20-10-2025
Approved By: Lutendo Murovhi Environmental Manager (Acting)		20/10/2025
Approved By: Thabo Gininda Operating Manager		
Approved By: Fulufhedzani Managa Maintenance Manager (Acting)		21/10/2025
Authorised By: Lindokuhle Ngobese Engineering Manager		22/10/2025
Accepted By: Esias Cholo Project Manager		

C3.1: EMPLOYER'S WORKS INFORMATION

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1 DESCRIPTION OF THE WORKS

1.1 EXECUTIVE OVERVIEW

This document contains the works information for Matla Power Station upgrade of the S5 PLC and SCADA to the latest technology on the market, at Slurry Plant, which is currently obsolete.

The primary concern is the risk to production and degradation of safety of the plant and personnel due to obsolescence. The risk exposure has been highlighted by the subsequent increasing failure rate of the control system failures. The objective of this project is to perform the necessary replacements to eradicate obsolescence that will increase the plant safety, reliability and availability. It is required that the upgrade project be done with minimal disruptions to current operations, and a thorough changeover strategy and procedures be put in place to facilitate the migration from the old to the new control system in the shortest possible time, the changeover is to be executed within three days per-cubicle.

This technical specification report developed by the engineering team for the purpose of providing the technical information required for the works information.

1.2 EMPLOYER'S OBJECTIVES AND PURPOSE OF THE WORKS

The purpose of the works is to upgrade the PLC, SCADA and networks, the technology upgrade and modifications must retain the Operating and Control philosophy.

At Matla Power Station the function of the Slurry Plant is to receive, mix and dispose of both Pulverised Fly Ash (PFA) and Bottom Boiler Ash (BBA) to a remote ash dam.

The PFA is conveyed pneumatically from the six (6) generating units to bulk storage silos at the Slurry Plant. Airslides then convey the PFA to the PFA mixers where it is slurried. The BBA is slurry pumped from the generating units to Hydrobins where the water is decanted. Conveyors are utilised to transfer the BBA from the Hydrobins to mixers, which also introduces the BBA to the slurry pumps' suctions.

The ash slurry is then pumped to the ash dam with three (3) pump trains, each consisting of five (5) pumps in series (Running with only 4).

The Slurry plant is controlled remotely from the Slurry plant control room. The plant is controlled through multiple (9) Siemens S5 115U and 150U PLCs and the plant status is viewed and monitored on the Citect SCADA system version 5.5. The S5 PLC's were installed at Matla Power Station in the 1980's. The OEM no longer supports the S5 technology and the spares are impossible to obtain due to the system being obsolete for number of years. Recently some of the I/O modules have become problematic causing erroneous readings from instrumentation in the field as well as failure to control certain sections of the plant. The system reliability is in dire state and need replacements as soon as possible.

The basis for the supply of engineering deliverables is in form of documentation relevant to the different activities as stated in the Appendices below:

#	APPENDIX	DESCRIPTION
1	Appendix A	Matla Power Station Slurry Plant_VDSS
2	Appendix B	Matla Power Station Slurry _Cable Schedule
3	Appendix C	Matla Power Station Slurry Plant_ IO Block Diagrams
4	Appendix D	Matla Power Station Slurry Plant_ LOSS Diagrams
5	Appendix E	Matla Power Station Slurry Plant Project Standards
6	Appendix F	Matla Power Station Slurry _Plant Control and Operating Philosophy
7	Appendix G	Matla Power Station Safety, Health, Environment and Quality

1.3 INTERPRETATION AND TERMINOLOGY

Available	It is the when a system, component or equipment is in the up state, i.e. in service, operational and able to perform as required.
Balance of Plant (BOP)	It consists of a power plant's auxiliary plant systems that are required to support the power island(s), e.g. fuel processing systems, cooling systems, water treatment, material handling, etc. The specific set of plant systems that form the balance of plant is dependent on the applicable power plant's configuration and design.
Control System	The control system consists of the Operating system, Engineering system, Process automation system, Protection Automation System, Operating & Engineering Network, network management system, User Management system and interfaces to 3rd Party systems that are specific to a particular plant
C&I Equipment Rooms	The room that are used to house the control systems
HMI	The Human-Machine interface used for operation and monitoring of the plant.
HVAC	Heating, ventilation, and air conditioning are the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality
SCADA	SCADA is an acronym for supervisory control and data acquisition, a computer system for gathering and analysing real time data. SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation.
Power Supply Cabling	All the cabling required to power the field equipment
Trunking	A rigid structure supporting a number of cables

Factory Acceptance Test (FAT)	It is an activity that demonstrates that the control system complies with its specification(s).
Functional Logic Diagrams	Logic diagrams are diagrams in the field of logic, used for representation and to carry out certain types of reasoning.
Field Equipment	Instrumentation, cold junction boxes and junction boxes
OEM	The OEM refers to the original equipment manufacturer
OPC	Open Platform Communications is a series of standards and specifications for industrial telecommunication. The OPC server is a software program that converts the hardware communication protocol used by a PLC into the OPC protocol. The OPC client software is any program that needs to connect to the hardware, such as an HMI. The OPC client uses the OPC server to get data from or send commands to the hardware.
Operator Workstation	The primary interface of the operating plant via which the HMI is accessed with the number of operating display units.
PLC	A programmable logic controller (PLC) or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process. It is a type of control system; one that is used in the automation industry for simple and/or sequential control applications. The main elements of a PLC are the microprocessor-based controllers and input/output (I/O) cards. It is a standalone automation system usually dedicated to the control and protection of small auxiliary plant systems. It does not contain an operator or communication network within itself and is usually interfaced to other systems (e.g. a SCADA system or DCS) when remote operating capability is required.
Supplier	It is the company, agent or entity that supplies the applicable technology or product

The following abbreviations are used in this Works Information:

Abbreviation & Acronyms	Description
AC	Alternating Current
ATPV	Arc Thermal Performance Value
BBA	Boiler Bottom Ash

C&I	Control and Instrumentation
CM	Change Management
CoE	Centre of Excellence
CRA	Concept Release Approval
DCS	Digital Control System
DRA	Definition Release Approval
DRP	Design Review Procedure
ECM	Engineering Change Management
EDWL	Engineering Design Work Lead
ERA	Execution Release Approval
EMC	Electromagnetic Compatibility
FAT	Factory Acceptance Test
FRA	Finalisation Release Approval
HVAC	Heating, ventilation and air conditioning
JB	Junction Box
kPa	Kilo Pascals'
LPS	Low Pressure Services
MTTR	Mean-Time-To-Repair
OEM	Original Equipment Manufacturer
OPCR	Outside Plant Control Room
OPC	Open Platform Communications
PS	Power Station
PARICS	Participate, Accountable, Responsible, Inform, Consult, Sign-Off
PCM	Process Design Manual
PECM	Project Engineering Change Management
PFA	Pulverised Fly Ash
PLC	Programmable Logic Controller
PLCM	Project Life Cycle Model
PIS	Plant Information System
QCP	Quality Control Plan
RACI	Responsibility, Accountability, Consult and Inform
RAID	Redundant array of independent disks
ROC	Required Operating Capability
SANS	South African National Standards

SAT	Site Acceptance Test
SIT	Site Integration Test
SHE	Safety, Health & Environmental
SRD	Stakeholders Requirements Definition
SAS	Substation Automation System
IED	Intelligent Electronic Device
AFC	Approved for construction
OBL	Outside battery limits

2 MANAGEMENT AND START UP.

2.1 MANAGEMENT MEETINGS

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

Table 1: Project Meetings

Title and purpose	Approximate time & interval	Location	Attendance by:
Risk register and compensation events	Weekly on Tuesday's and Thursday's at 08:00	Employer's Project Manager Office	Employer, Contractor, Supervisor, and Quality inspectors.
Overall contract progress and feedback	Bi-weekly via Ms Teams during the planning stage and daily when on site and work is being conducted. Site meetings are held at 08:00	Employer's Project Manager Office	Employer, Contractor and Supervisor

- (2) 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.
- (3) 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 DOCUMENTATION CONTROL

2.2.1 DOCUMENT VERIFICATION AND VALIDATION

The *Contractor* to verify the loop and wiring diagrams supplied by the *Employer* by doing proper plant walks and they will mark-up and produce the updated versions. The drawings will be supplied to the *Contractor* after contract award

2.2.2 DOCUMENT MANAGEMENT

- (1) All documents supplied by the *Contractor* shall be subject to Eskom's approval.
- (2) The language of all documentation shall be in English.
- (3) The *Contractor* shall include the Eskom's drawing numbers in the drawing title block. This requirement only applies to design drawings developed by the *Contractor* and his Subcontractors.
- (4) Drawing numbers will be assigned by the *Employer* as drawings are developed.

2.2.3 DOCUMENT IDENTIFICATION

- (1) Eskom will submit the Vendor Document Submission Schedule (VDSS) as per Appendix A of the works info to the *Contractor*.
- (2) The VDSS is revisable and changes must be discussed and agreed upon by all parties.
- (3) Changes in the VDSS can be additional documentation to be submitted, changes in submission dates or corrections in documentation descriptions, document numbers, etc.

2.2.4 DOCUMENT SUBMISSION

- (1) All project documents must be submitted to the delegated Eskom Representative with transmittal note according to Project / Plant Specific Technical Documents and Records Management Work Instruction 240-76992014.
- (2) 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 Info
- (3) The *Contractor* is required to submit documents as electronic and hard copies and both copies must be delivered to the Eskom Representative with a transmittal note.
- (4) In addition, the *Contractor* shall be provided with the following standards which must be adhered to:
 - i. Project Handover Documentation Management Procedure (240-66920003).
 - ii. Project Documentation Deliverable Requirement Specification (240-65459834).
 - iii. Technical Documentation Classification and Designation Standard (240-54179170).

2.2.4.1 SHAREPOINT TRANSMITTAL

- (1) The *Contractor* shall submit all documentation to the Eskom Representative as well as the Project's Documentation Centre in the following media:

- i. Electronic copies shall be submitted to Eskom Documentation Centre through SharePoint transmittal site that will be provided during contract award.
- ii. Hard copies shall be submitted to the Eskom Representative accompanied by the Transmittal Note.

2.2.5 DRAWINGS FORMAT AND LAYOUT

- (1) The creation, issuing and control of all Engineering Drawings will be in accordance to the latest revision of 240-86973501 Engineering drawing Standard.
- (2) Drawings issued to Eskom will be a minimum of four hardcopies and electronic copies. The *Contractor* is required to submit electronic drawings in Micro Station (DGN) format, and scanned drawings in pdf format. No drawings in TIFF, AUTOCAD or any other electronic format will be accepted.
- (3) Drawings issued to Eskom may not be "Right Protected" or encrypted.

2.2.6 ENGINEERING CHANGE MANAGEMENT

- (1) All design changes shall be performed in accordance to the latest revision of the Eskom Project Engineering Change Management Procedure (240-53114026) and the *Employer* shall ensure that *Contractor* is provided with latest revisions of this procedure.
- (2) Any uncertainty regarding this procedure should be clarified with the *Employer*. All design reviews will be conducted according to the Design Review Procedure (240-53113685).

2.2.7 PLANT CODING

- 1) Eskom KKS Key Part Standard (240-109607736) shall be used to allocate codes to plant or system included in the *works*. Plant Coding shall be undertaken by the *Employer* and as such the *Contractor* shall make available the following documentation to code:
 - i. C&I
 - a. C&I architecture drawings
 - b. C&I cubicles
 - c. Cable block diagrams
 - d. Cable schedules
- 2) The *Employer* will assign a coding technician who will interact with the *Contractor* in coding the plant.
- 3) It is also the responsibility of the *Contractor* to consistently apply the KKS codes throughout the rest of the technical documentation which shall include, but not limited to:
 - i. Load schedules
 - ii. Board parts lists
 - iii. Cable block diagram
 - iv. Termination diagram
 - v. Alarm lists, loop diagrams

- vi. Signal lists
 - vii. Schematic diagrams
 - viii. Termination diagrams
 - ix. Logic diagrams, etc.
- (4) The *Contractor* shall ensure that all documentation is coded (as per the codes assigned by the technician) prior submission to *Employer* for review.
 - (5) Coding and labelling of components inside electrical and C&I panels shall be done by the *Contractor*.

2.2.8 PLANT LABELLING

- (1) It is the responsibility of the *Contractor* to manufacture and install coded equipment's labels.
- (2) Labels are manufactured and installed according to Eskom Plant Labelling Abbreviation Standard (240-109607332).
- (3) The *Contractor* will label all coded equipment and labelling.
- (4) The Coding technician will do a quality check on the adherence to the Coding and labelling standards before installation on plant.

2.3 HEALTH AND SAFETY RISK MANAGEMENT

- (1) Health and safety file should be approved by Safety risk management department prior to any work commences on site
- (2) All work is to be done in accordance with OHS Act 85 of 1993, Matla plant procedures and Plant Safety Regulations. (240-150642762).
- (3) Matla power station SHEQ induction must be done before access to site can be granted
- (4) The contractor should ensure that all employees have acquired the required competency for the task they are performing.
- (5) The contractor to ensure compliance to updated legal requirements and other requirements.
- (6) BUY QUIET: All stakeholders are encouraged to purchase or rent quieter machinery, equipment, and tools to reduce worker noise exposure, contribute towards compliance to OHSA noise exposure limits and ultimately reduce the risk of noise induced hearing loss.

2.4 ENVIRONMENTAL CONSTRAINTS AND MANAGEMENT

- (1) All activities listed in the National Environmental Act 107 of 1998, EIA Regulations as amended, must have environmental AUTHORISATION before commencement of work.
- (2) The contractor shall comply with all applicable legal and other requirements.
- (3) The polluter pays principle will be applied.
- (4) The contractor manager shall ensure compliance with Eskom Matla Environmental procedures to ensure the prevention of pollution (refer: OMOP 4090 and 4402).
- (5) The last payment will be processed based on the status of the last housekeeping check sheet (Annexure C: OMOP 4402) of designated area.

- (6) EMS file based on ISO14001 will be required.

2.5 QUALITY ASSURANCE REQUIREMENTS

- (1) The contractor/executioner of work will be responsible for drawing up all QCP documentation and this must be approved by engineering and authorised by the Quality Department before commencing with the work.
- (2) Contractors/executioner to adhere to QM 58 and OMOP4497 requirements
- (3) Number of NCR issued can affect your next tendering process.
- (4) The QCP shall be signed progressively by the Engineer/Supervisor, Eskom QC Inspector, Contractor QC Inspector and/or AIA.
- (5) No procuring of outage items without the approval of scopes by quality
- (6) All outage scopes creep and scopes addition should be approved by quality
- (7) No contractor should be in the possession of scopes for execution without the scopes approved by quality
- (8) The contractor is subjected to quality auditing at any point in time during execution of scope

2.6 PROGRAMMING CONSTRAINTS

- (1) The *Contractor* submits a programme within 1 week of the contract date.
- (2) The program shall be in Microsoft Excel or Projects format (preferably 2010 version or lower)
- (3) The programme indicates:
 - i. The hour duration of each activity
 - ii. The working calendar (number of hours per day, days per week)
 - iii. The exact quantity of people per day.

2.7 INVOICING AND PAYMENT

- (1) 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.
- (2) 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 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 procedures for invoice submission and payment (e.g. electronic payment instructions)

2.8 INSURANCE PROVIDED BY THE EMPLOYER

Refer to the Contract Data Section 8 – Risks and Insurance.

2.9 CONTRACT CHANGE MANAGEMENT

- (1) The *Contractor* or the *Project Manager* notifies each other of any event which may lead to a change in agreed terms as per NEC 3.

2.10 PROVISION OF BONDS AND GUARANTEES

- (1) 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 C1.3, Sureties.
- (2) 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.
- (3) Such withholding of payment due to the *Contractor* does not affect the *Employer's* right to termination stated in this contract.

2.11 RECORDS OF DEFINED COST, PAYMENTS & ASSESSMENTS OF COMPENSATION EVENTS TO BE KEPT BY THE CONTRACTOR

- (1) The *Contractor* may keep records of payment and assessments of compensation events if he deems it necessary.

2.12 TRAINING WORKSHOPS AND TECHNOLOGY TRANSFER

2.12.1 GENERAL REQUIREMENTS

- (1) The *Contractor* provides 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*.
- (2) All training provided by the *Contractor* is customised for Matla Power Station and is directly applicable to the actual equipment hardware and software supplied for the *works*.
- (3) Training is focused on the specific Matla Power Station Slurry Plant Control Systems' architecture, configuration, layout, equipment, software, hardware, and design that the *Contractor* provides for the *works*.
- (4) Generalised training based on the *Contractor's* generic control system architecture, HMI and design philosophies is not acceptable.
- (5) Training material and tools are not shared by trainees during the training.
- (6) The training is provided as per the detailed training programme and prospectus accepted by the *Project Manager*.

- (7) Maintenance staff are trained and authorised to perform certain maintenance activities such as replacement of defective components and general servicing during outages.

2.12.2 TRAINING CATEGORIES

- (1) Practical hands-on training for each individual trainee forms an integral part of each of the courses in these categories:
- i. Training of Maintenance staff.
 - ii. Training of Operators.
 - iii. Training of engineering staff.
- (2) The elements of the training are described in the subsections below.

2.12.3 TRAINING OF ENGINEERING AND MAINTENANCE STAFF

- (1) Engineering and Maintenance training includes, as a minimum:
- i. Familiarisation with the documentation forming part of the *works*, including drawing configuration logic.
 - ii. Hardware familiarisation.
 - iii. Hardware configuration which includes the 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. Hardware installation
 - v. Development, debugging and testing of all software.
 - vi. Software configuration and low-level programming.
 - vii. Graphic display design, development and configuration.
 - viii. System Configuration and Documentation Control, including all necessary activities for system expansion/modification, and software storage.
 - ix. Control System software reloading.
 - x. Graphic display configuration.
 - xi. Drawing and hardcopy report generation.
 - xii. Operator interface familiarisation including keyboard and display functions, controls, alarms and messages.
 - xiii. System hardware maintenance through use and interpretation of diagnostic routines and error codes of on-line and off-line diagnostic software for the detection of faulty modules.
 - xiv. Module problem report retrieval.
 - xv. Control System hardware maintenance training including the programmable logic controllers, I/O modules, network modules and all other peripheral equipment supplied as part of the *works*.

2.12.4 TRAINING OF OPERATORS

- (1) Operator training includes, 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, plant control, plant monitoring, navigation, alarms, messages, creation and use of operator configurable displays and operator assignable trends as well as retrieval and printing of plant logs.
- iv. Process control and operating philosophies.

2.12.4.1 TRAINEE PARTICIPANTS

- (1) The total number of participants to be trained is as follows:
 - i. Engineering : 12
 - ii. Operator : 12
 - iii. Maintenance : 10 (or More)
- (2) The *Employer* bears the cost of salaries, accommodation, travelling expenses and other allowances of his personnel during the training, but all other training costs are borne by the *Contractor*.
- (3) There shall be a minimum a minimum of two training sessions for each of the disciplines identified (e.g. engineering, operating and maintenance)

2.12.4.2 TRAINING DOCUMENTATION

- (1) The *Contractor* provides all course material including manuals.
- (2) The course material is in English and includes all third party documentation.
- (3) Printed and soft copies of the training documentation are supplied for each trainee plus an additional 1 hardcopy master set and 1 soft copy.
- (4) All training documentation provided by the *Contractor* is customised for Matla Power Station.
- (5) The training documentation contains the specific Slurry Plant control System (PLC and SCADA) configuration, layout, software, equipment, and design provided by the *Contractor* as part of the *works*.
- (6) Training manuals are continuously updated by the *Contractor* up to the date of issue of the Defects Certificate for the whole of the *works*.

3 ENGINEERING AND THE *CONTRACTOR'S* DESIGN

3.1 *EMPLOYER'S* DESIGN

This system monitors and controls the various ash and water flows to ensure that optimum use is made of the available water and effluent for transporting ash to the dam.

The Slurry plant is controlled remotely from the Slurry plant control room. The plant is controlled through multiple Siemens S5 115U and 150U PLCs all located in one equipment room, and the plant status is viewed

and monitored on the Citect SCADA system version 5.5. In addition to control operations the control system protects the various parts of the system, by initiating alarms or operational signals, to advise the operator of malfunctions. In some instances, where equipment damage is likely, the controllers can shut the plant down automatically in the event of a failure.

The plant is designed to operate continuously and has duplicate and/or standby equipment that may be brought on-stream as the demand requires it.

The incoming BBA and PFA from the station are stored in Hydrobins and Silos respectively. The Hydrobin system is utilised to separate the BBA from the water that was used to quench and transport the BBA from the bottom of the boilers. Once the water has been decanted the BBA may be handled, using conveyor belts. The PFA is in the form of a fine powder and is transported pneumatically or by using air slides. In order to transport the two ash streams to the ash dam they are slurried with Ash Water Return (AWR) in a mixer system and pumped, via a set of pumps along a pipeline to the dam.

The slurry pump set comprises one variable speed and four-fixed speed slurry pump. High-pressure gland sealing water pumps are used to provide sealing water to the pump set; protecting the pump seals against the abrasive effect of the ash. Each system comprises three identical "trains". Each train consists of a silo, air slide, hydro bin, conveyor belts, mixer and slurry pump set (five pumps). These different components are inter-selectable between the three different systems to provide flexibility in terms of PFA and BBA routes e.g. Silo three (3) can be selected together with air slide two and Hydro bin 14 and mixer 1.

The Slurry Plant control system consists of the following: Nine (9) S5 PLC's (EYD 01, 10, 11, 20, 21, 22, 23 24 and 25) and Citect SCADA System (version 5.5). The SCADA system comprises of 2 redundant servers (with historian functions) 2 monitors and 2 redundant workstation PC's with 2 monitors for each workstation.

3.2 SYSTEM IDENTIFICATION (AS BUILT)

Slurry Plant automated by Siemens Simatic S5-115U PLC consists of the following:

Table 2: PLC CUBICLE I/O COUNT

EYD01 Cubicle	EYD 10 CUBICLE: (BULK SILOS)	EYD 11 CUBICLE: (COMPRESSOR PLANT)
115U CPU 944	2 x 115U CPU 943	1 x115U CPU 943
3 x (32bit x 24VDC Digital Input)	4 x (32bit x 24VDC 0.5A) Digital Output	1 x Comms module
6 x (16bit x 24VDC) Relay Output	6 x (32bit x 24VDC 0.5 A) Digital Input	1 x interface module
4 x (8 Channels) Analog Input	2 x Communication processor	8 x (32 bit x 24VDC) Digital input
3 x (8 Analog Output)	2 x Interface module	1 x (8 channels) Analog input
	2 x 24V Power Supply	7 x (32 bit x 24VDC) Digital output
		1 x 24V Power Supply

<p>EYD 20 CUBICLE: (SUPERVISORY PLC)</p> <p>CPU (2 x 924, 2 x 925, 2 x 926 and 2 x 927) 2 x Jumpering Module 4 x Memory Module 5 x Interface module 2 x Digital Output 2 x Communication processor</p>	<p>EYD 21 CUBICLE: (SLURRY PLANT PLC)</p> <p>12 x Digital Input 6 x Digital Output 3 x Power Supply 3 x Interface module 4 x CPU (924, 925, 926 and 927) 1 x memory module 1 x Comms module</p>	<p>EYD 22 CUBICLE: (SLURRY PLANT PLC)</p> <p>3 x Analog input 8 x Digital Input 6 x Digital Output 3 x Power Supply 3 x Interface module 4 x CPU (924, 925, 926 and 927) 1 x Memory module 1 x Comms module 1 x Jumpering module</p>
<p>EYD 23 CUBICLE: (SLURRY PLANT PLC)</p> <p>3 x Analog Input 8 x Digital Input 6 x Digital Output 3 x Power Supply 3 x Interface module 4 x CPU (924, 925, 926 and 927) 1 x memory module 1 x Comms module</p>	<p>EYD 24 CUBICLE : (SLURRY PLANT PLC)</p> <p>18 x Digital Input 15 x Digital Output 3 x Power Supply 4 x Interface module 4 x CPU (924, 925, 926 and 927) 2 x Memory module 1 x Comms module</p>	<p>EYD 25 CUBICLE : (SLURRY PLANT PLC)</p> <p>15 x Digital Input 14 x Digital Output 3 x Power Supply 4 x Interface module 4 x CPU (924, 925, 926 and 927) 2 x Memory module 1 x Comms module</p>

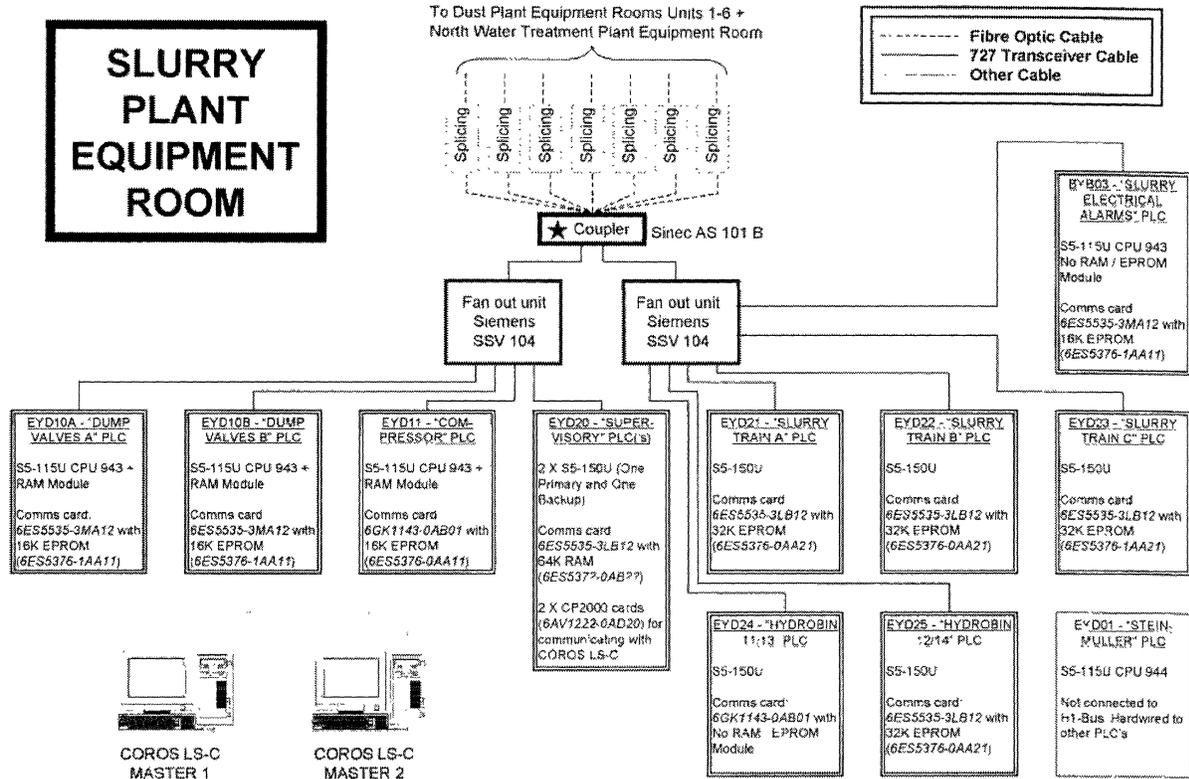


Figure 1: Existing Slurry Plant Network Layout

3.3 PARTS OF THE WORKS WHICH THE CONTRACTOR IS TO DESIGN

- 1) The *Contractor* engineers and designs a complete Control System based on the existing control philosophy and any changes, which may be required for Matla Slurry Plant as per the scope and requirements, identified in the sections below, according to OEM and industry best practices.
- 2) The field equipment remains the same i.e. (Instruments / actuators, Primary device / tapping point / impulse piping, Field cable, Junction box, Trunk cable & main cable racks etc.cabling to the switchgear LV and MV.
- 3) The *Contractor* is responsible for verifying and identifying all scope requirements for the plant systems, as part of the *Contractor's* engineering and design effort in order to meet the functional and performance requirements of the works.
- 4) The *Contractor* undertakes all activities of engineering and design from system engineering through technical clarification, design freeze, production engineering, factory acceptance tests (FAT) and site integration testing (SIT) to installation and change over from the existing control and monitoring system to the new control and monitoring system (decommissioning and recommissioning). A maximum allowable down time of three days per-cubicle is allowed for the decommissioning and recommissioning activities.

- 5) As a minimum, the design addresses the following common scope in the equipment room.
 - i. Use the currently installed Cabinets that are on the adjacent existing PLC room at Slurry Plant
 - The *Contractor* to supply and install module racks and slots
 - The *Contractor* is responsible for marshalling and terminations
 - The *Contractor* is responsible for all Earthing connections
 - ii. Signals communicating via the network switches must be retained and must not be affected by the upgrade (i.e. Ash pumps, K-pumps, compressors)
 - iii. Replace all network switches
- 6) The *Contractor* works with the Employer's Representative and /or Electrical *Contractor* to re-instate all interlocks and interfaces on functional units of the LV switchgear and controlgear assemblies. The Electrical *Contractor* will be responsible for terminating in the switchgear in the presence of the and under the guidance of the C&I *Contractor*
 - a. The *Contractor* shall provide an estimation of the amount of heat dissipated by the offered components installed in the equipment room. The *Contractor* interfaces to the HVAC for alarms and events to the operator including the equipment room and control room temps and humidity measurements. These readings to be displayed on the HMI.

3.4 PROCEDURE FOR SUBMISSION AND ACCEPTANCE OF CONTRACTOR'S DESIGN

3.4.1 DESIGN REVIEW PROCEDURE

The *Contractor* is the Design Authority as defined in the Design Review Procedure 240-75005287. The *Contractor* is responsible for executing the design and all associated works in the design procedure and conduct all the design reviews as specified in this procedure. The *Contractor* and the *Employer* are both responsible for conducting the following design reviews:

- a. Design Freeze Review
- b. Integrated Design Review
- c. Construction Completion Review
- d. Acceptance Testing Review

3.4.2 ENGINEERING CHANGE PROCEDURE

The *Contractor* takes note of the *Employer's* Engineering Change Procedure 240-53114002. An engineering change includes any proposed change originating from engineering, *Contractors*, project management or construction management.

The Engineering Change Procedure applies to the *Employer's* personnel or *Contractor's* performing engineering or engineering related work where the quality of the engineering work performed is the direct responsibility of Eskom.

3.4.3 PROCESS FOR SUBMISSION OF DOCUMENTS

The *Contractor* submits all documents according to the accepted VDSS. The process for the submission of documents is described below:

- a. The *Contractor* submits the documents/drawings to the Project Manager.
- b. The *Employer's* Document Controller registers the documents.
- c. The *Employer's* Document Controller will supply the documents/drawings to all relevant parties within the *Employer's* project team.
- d. The *Employer's* project team reviews the documents/drawings and will submit all comments or inputs to the Project Manager and the Project Manager submits to the *Contractor* for consideration.
- e. If the *Employer* finds major deficiencies in the submitted documents/drawings, the *Contractor* revises the documents/drawings and resubmits to the Project Manager.
- f. The *Employer* reviews the documents/drawings and if no major deficiencies are found, the *Contractor* organises a Design Review session to which employer shall be invited for review
- g. The *Employer* and the *Contractor* conduct a Design Review.
- h. If any fundamental errors were found in the designs or further actions are required, the *Contractor* record all concerns raised and revises the designs for resubmission to the *Employer* via the project manager.
- i. The *Contractor* organises a Design Review session once all designs were revised according to the concerns raised by the *Employer*.
- j. If no fundamental errors were found in the designs during the Design Review session, the *Contractor* compiles the Design Review minutes or report and submits it to the Project Manager.
- k. The *Employer's* Document Controller registers the report.
- l. The *Employer's* project team reviews the *Contractor's* report/minutes. If the report/minutes are not acceptable, the *Contractor* revises the report/minutes and resubmits to the Project Manager.
- m. The Project Manager will accept the *Contractor's* design once the report/minutes are accepted by the *Employer's* project team.

3.4.4 TIME REQUIRED FOR ACCEPTANCE OF DESIGNS

Not later than one month after receipt, the Project Manager will return one copy of the drawing marked "Accepted"; "Accepted as Noted" or "Not Accepted", as may be appropriate. The notations "Accepted" and "Accepted as Noted" authorize the *Contractor* to proceed with the manufacture of the Plant covered by such drawings subject to the corrections, if any, indicated thereon. Where prints or drawings have been "Not Accepted" or "Accepted as Noted" the *Contractor* makes the necessary revisions on the drawings and submit further copies for acceptance in the same procedure as for the original submission of drawings. Every revision shows by number, date and subject in the revision block on the drawing.

3.5 OTHER REQUIREMENTS OF THE CONTRACTOR'S DESIGN

3.5.1 SYSTEM INTERFACE

The *Contractor* is responsible for all system interfaces which forms part of the Works. The *Employer* will provide the relevant information defining the system interfaces. The *Contractor* caters for all the identified interfaces and shall provide for any additional 15% capacity terminal interface

3.6 WORKS AND THINGS FOR THE WORKS SUPPLIED BY THE EMPLOYER/OTHERS

SUPERVISOR AND RESPONSIBLE PERSON COURSE

The *Contractor* appoints two people to attend necessary training intervention or course provided by the *Employer* for authorisation to take out a work permit. No work will commence without an authorised supervisor and responsible person on site. The authorisation process will take at least three to four weeks.

3.6.1 CABLING

The instrumentation and power cabling where deemed necessary is provided by the *Contractor* and shall be fully compliant with 240-56227443 Requirements for Control and Power Cables for Power Stations Standard. The core drilling for cables, sealing the cable slots, disconnecting the existing equipment and cables, reconnecting the cables and repositioning the lights is the responsibility of the *Contractor*.

- The *Contractor* to re-use the existing instrument/trunk cabling that is currently installed on the existing PLC cubicles. A cable schedule is provided as per Appendix B and the *Contractor* is to investigate any other cabling that does not form part of the cable schedule and cater for it accordingly by tracing its whereabouts and allocating cabling numbering for it and if during implementation any cable is found to be causing shorts the *Contractor* will investigate and replace such a cable.
- The *Contractor* is responsible Earthing connections

3.6.2 VERMIN AND FIRE PROOFING

Where fire seals or vermin seals may be damaged by the *Contractor* these shall be replaced by the *Contractor* as part of the works completed.

3.6.3 REMOVAL OF EXISTING EQUIPMENT

The removal of existing PLC equipment including cubicles, all the old HMI, servers, network cabinet, operator desks and all other equipment and cabling that is not required shall be the responsibility of the *Contractor* after the installation and commissioning of the plant.

The *Employer* will determine the area and location where the removed equipment shall be stored. The *Contractor* to be advised by the *Project Manager* with regards to storage of all removed equipment.

3.6.4 PADLOCKS

The *Employer* will supply all padlocks. All pad lockable devices, doors etc., are capable of accepting the *Employer's* standard padlock as specified in 240-56227516. Sample of padlock used is provided by the Supervisor on request. Drawing 0.00/10344 shows the padlock in the closed position, adequate space is provided to insert the padlock into locking devices when in the open position.

3.7 AS-BUILT DRAWINGS, OPERATING MANUALS AND MAINTENANCE SCHEDULES

a. Language

All documentation, including reports, manuals, etc. is in the English language.

b. Type Test Reports

Type test documentation represents the design of the functional unit with respect to the configuration, type and rating. The information to be included in type test reports is in accordance with the applicable SANS standard. The report of the type tested functional unit and associated components reflects the equipment under consideration. The type test report is provided in full, containing all records of the tests conducted as well as the drawings.

c. Manuals

The technical, training, maintenance and operating manuals are provided for each type equipment supplied. Where generic manuals are provided, an addendum is provided indicating the applicable project specific components.

Manuals are of a good quality and cover the following as a minimum:

- I. Technical descriptions of the equipment and component parts
- II. General arrangement drawings
- III. Installation instructions with drawings or pictures
- IV. Operating and maintenance instructions for all components
- V. Detailed parts lists (accompanied by exploded view type drawings clearly detailing the part and uniquely identifying it)
- VI. Spare part ordering instructions

Any special instructions pertaining to storage of spare parts or their shelf life is included in the maintenance manual. All drawings requested for component location, dismantling and re-assembly for maintenance are included in the maintenance manual. All special tools required for operating and maintenance of the equipment are presented in a form of a schedule in the operating and maintenance manual, respectively. The content of the training manual is based on the content of the technical, operating and maintenance manuals.

3.7.1 DRAWING REQUIREMENTS

The *Contractor* provides drawings for the required equipment as per 240-86973501 .

The *Contractor* supply reproducible drawings according to the Vendor Document Submittal Schedule (VDSS) that is supplied by the Employer. The *Contractor* develops the following minimum requirements for the drawings:

3.7.2 DRAWING NUMBERING SYSTEM

The *Contractor* may assign his own drawing number as required to meet his document control system requirements: However final handover shall require all drawings to have the relevant Eskom drawing numbers

3.7.3 GENERAL ARRANGEMENT DRAWINGS

The *Contractor* provides general arrangement drawings completely dimensioned, showing:

- a. Arrangement of equipment offered.
- b. Plant, front view, and other elevation views.
- c. Required clearances for opening doors and for removing circuit breakers.
- d. Conduit or cable entrance locations for bottom entrance.

3.7.4 WIRING DIAGRAMS

The *Contractor* provides detailed wiring diagrams to show the following:

- a. Approximate physical locations of all items in each control panel.
- b. All interconnecting wiring between control panels.
- c. Identification of all terminals, terminal blocks, and wires by numbers.
- d. Clear identification, by some distinguishing method, of all wiring which will be installed by the *Contractor*.

4 LIVE CHANGE OVER METHODOLOGY

The *Contractor* is responsible for the live changeover methodology.

4.1 Pre-Changeover Work

- 1) Pre-changeover work relates to any work to be undertaken on a system before changeover can be undertaken (for which the system must then be placed on “outage”). No plant-wide outage is planned for the Common Plant.
- 2) Prior to undertaking any pre-changeover work:
 - i. The *Contractor* provides an overall changeover strategy based on a phased replacement, such that the systems (including the network and SCADA) are changed-over in sequence, in such a manner that the control system is available after each changeover.
 - I. The *Contractor* submits the strategy for approval by the *Project Manager*
 - II. The *Contractor* provides a changeover plan and commissioning plan, which is informed by the approved strategy, for each system
 - III. The *Contractor* develops a risk assessment, mitigation and options to recover the process plant are clearly identified

The following list below is the highlighted activities to be completed in pre-changeover:

- UVG Cable tracing and marking must be completed

- Network must be installed and operational
 - Fibre network installed and tested
 - New cabinets (where required) installed (After SIT)
 - All network cabinets installed (power, ground, GPS, new structure)
 - Installation of fully functional control system hardware in the room of its final location
 - Software loaded to Automation Processors
 - Power supplies must be installed and operational
 - Grounds installed in new cabinets
- 3) It is the responsibility of the *Contractor* to engage with the Employer's operating (4) and maintenance team to ensure that:
- i. The strategy and plans are compiled to sufficient detail prior to commencing with any pre-changeover work.
 - ii. All relevant stakeholders have been consulted to inform the strategy and plans prior to commencing with any pre-changeover work.
 - iii. The plant system is available and mitigations are in place to initiate a changeover, once the pre-changeover work is completed.
 - iv. The *Contractor* is responsible for arranging all required resources for the change over and the management thereof.

5 PROCUREMENT

5.1 PEOPLE

5.1.1 MINIMUM REQUIREMENTS OF PEOPLE EMPLOYED ON THE SITE

- (1) Only qualified and experienced people to be employed.
- (2) The *Contractor* shall comply with Basic Condition of Employment Act and Labour Relation Act for the use of labour in executing the *works* to give effect to the right to fair labour practices referred to in section 23 (1) of the Constitution by establishing and making provision for the regulation of basic conditions of employment; and thereby to comply with the obligations of the Republic as a member state of the International Labour Organisation; and to provide for matters connected therewith.
- (3) The *Contractor* must have at least 2 of Supervisory and Artisan staff authorized in Plant Safety Regulations and/or High Voltage Regulations. In order for any person to do work at the Power Station, this person should be authorized to take out a permit to work.

5.1.2 BBBEE AND PREFERENCING SCHEME

- (1) The *Employer* formal Black Economic Empowerment (BEE) programme was first initiated in 1995 with the publication of its policy regarding procurement from Black Suppliers

- (ESKADAAT6). ESKADAAT6 has set the standard for BEE programmes within Eskom and across South Africa as a whole.
- (2) Eskom's policy is to maximise purchases from Black or Black Empowering Enterprises (BEE's) whether Black Woman-owned, small or Large Black or Black empowering suppliers. The purpose is to promote entrepreneurship in black communities and give black business access to the mainstream of business opportunity.
 - (3) Eskom will concentrate its development efforts on black supplier's ninth manufacturing, construction and mining /extraction sector of the economy and provide support.

5.1.3 SUPPLIER DEVELOPMENT AND LOCALISATION

- (1) Eskom Holdings SOC Limited ("Eskom"), as a State Owned Company, is required to drive and implement government's socio-economic initiatives.
- (2) Eskom's Supplier Development and Localisation (SD&L) Programme, which is an essential component of its overall Transformation Programme, has as its primary objective the achievement of maximum and sustainable local development impact through leveraging Eskom's procurement spend in a manner that allows flexibility within the business in order to accommodate Government local development initiatives and policies.
- (3) The SD&L programme seeks to maximise the following transformation objectives:
 - i. B-BBEE: The focal point of Eskom's B-BBEE Strategy is the sustainable development and empowerment of local black businesses, while continuing to uphold Eskom's core values. During the exemption phase, Eskom's stated policy was to give preference to level 1-4 B-BBEE contributors.
 - ii. Local Content: Means the target committed by *Contractors* as a percentage of the contract value that will be spent in South Africa. The total local content amount is calculated by adding rand value amounts as reported by suppliers in their quarterly report submissions.
 - iii. Industrialisation: Means any investment made by the supplier that results in building new and/or enhancing local capacity as well as increasing the export, thus enhancing industrialisation. The objective is to maximise Eskom and supplier spend to foster the establishment of new plants, expanding of existing plant and purchasing of machinery/equipment for local development.
 - iv. Skills Development: Eskom seeks to influence the development of skills through procurement spend, in order to contribute to the reduction of scarce skills and to build the country's capacity to compete globally.
 - v. Supplier Development: Means providing a platform to develop emerging suppliers, through first-tier and second-tier contracting, and opportunities for national and international suppliers using the joint venture mechanisms
 - vi. Job Creation: Means the number of jobs created by suppliers as a result of Eskom's contract. This contributes towards the achievement of localisation objectives of alleviating poverty through job creation.

- vii. Corporate Social Investment: In terms of the integrated Socio-Economic Development (SED) policy approved in 2014, Eskom together with its Subsidiaries, *Contractors*, Suppliers and Service Providers are required to participate in Corporate Social Investments (CSI) initiatives / programmes that are aimed at maximising the direct beneficiation of the Local communities around areas where Eskom operates its plant.

5.2 SUBCONTRACTING

5.2.1 PREFERRED SUBCONTRACTORS

- (1) The *Contractor* shall make use of any supplier for sourcing of equipment, tools and material whatever that the *Contractor* will use to execute *works* shall comply with the SABS.

5.2.2 SUBCONTRACT DOCUMENTATION, AND ASSESSMENT OF SUBCONTRACT TENDERS

- (1) The *Contractor* shall submit the proposed contract data for each subcontracting for acceptance to the *Project Manager*.
- (2) The *Contractor* shall prepare subcontracting document as according to NEC contract.
- (3) The *Contractor* must inform the *Employer's* representative when intending to subcontract some of the *works* from the contract scope.
- (4) The *Contractor* shall not subcontract a contractor that has lower or higher level accreditation than his/her according to CIDB.

5.2.3 LIMITATIONS ON SUBCONTRACTING

- (1) The *Contractor* shall not subcontract more than 25% of the contract scope

5.2.4 ATTENDANCE ON SUBCONTRACTORS

- (1) The *Contractor* shall in writing inform the *Employer's* representative about the subcontractor intentions for site visit.

5.3 PLANT AND MATERIALS

5.3.1 QUALITY

- (1) Refer to Matla quality manual in QM58 for compliance.

5.3.2 PLANT & MATERIALS PROVIDED "FREE ISSUE" BY THE EMPLOYER

- (1) The *Employer* will provide power supply, water and land for the storage of equipment and material.
- (2) The *Contractor* shall supply all the necessary equipment and material required to execute the *works*.

- (3) Should the *Contractor* need to use any of the *Employer's* Equipment, including compressed air, electricity, water supply and crane, it must be specified by the *Contractor*. The *Employer* does not guarantee continuity of supply of any of these items.

5.3.3 CONTRACTOR'S PROCUREMENT OF PLANT AND MATERIALS

- (1) The *Contractor* shall make use of SABS approved plant and material.
- (2) Test certificates shall be given to the *Project Manager* of the project.
- (3) All warranties for the equipment, standard software and application software provided are included as part of the *works*.
- (4) All warranties are in the name of Matla Power Station.

5.3.4 SPARES AND CONSUMABLES

5.3.4.1 MAINTENANCE SPARES

- (1) The *Contractor* makes recommendations and supplies a spares list with a price per component at tender stage. The validity of this spares list is 12 months. The *Employer* reserves the right to purchase these spares within 12 months of the signing of the contract.
- (2) The *Contractor* supplies a complete listing of the components supplied and installed with technical description, model number and other technical detail as required by the SAP system and provided by the *Project Manager*. This will be used to update or create technical specifications for spares by the *Employer* (in the SAP system) and facilitate ease of ordering spares when required.

5.3.4.2 COMMISSIONING SPARES

- (1) The *Contractor* keeps sufficient spares to maintain the whole of the *works* up to the Defect date. If the *Contractor* is not planning to keep spares, a contingency plan should be put in place, and accepted by the *Project Manager*, to ensure that failures can be corrected with a minimal impact on the plant and process.

5.4 TESTS AND INSPECTIONS BEFORE DELIVERY

5.4.1 GENERAL

- (1) The *Contractor* does not bring to the working area those plant and material which the Works Information states are to be tested or inspected before delivery, until the supervisor/engineer has notified the *Contractor* that they have passed the test.
- (2) The Control System will undergo Factory Acceptance testing (FAT).
- (3) The *Employer* has the right to appoint a representative or representatives to inspect all parts during manufacture and to be present at any of the tests specified.
- (4) Arrangements for witnessing inspections are made through the *Project Manager*.

- (5) A minimum of ten working days' notice is given by the *Contractor* for inspections and is shown in the Accepted Programme.

5.4.2 FAT

- (1) During FAT, the *Contractor* demonstrates that the Control System meets the requirements of this Works Information and the detailed engineering design freeze documentation.
- (2) The FAT is done at a *Contractor's assembly factory*.
- (3) The *Contractor*, the *Project Manager* and the *Employer's* representative (s) witness the FAT.
- (4) All Control System hardware is included in the FAT, including HMI, network switches, and servers.
- (5) The *Contractor* provides all facilities and simulation systems at the FAT venue such that full testing of the control system logic can be done.
- (6) As a minimum, the following tests and inspection are performed during the FAT:
 - i. Full testing of the PLC programme.
 - ii. System integrity and application tests
- (7) The *Project Manager* determines if any further testing is required in addition to that specified, such as that of any new technologies being used.
- (8) The *Contractor* prepares a detailed FAT procedure which is approved by the *Project Manager*.

5.4.3 FAT PROCEDURE

- (1) The *Contractor* prepares a detailed test procedure in preparation for FAT.
- (2) 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 will be documented.
 - vi. Acceptance Criteria.
 - vii. How the identified discrepancies will be processed.
 - viii. Retesting requirements.

5.4.4 FAT REPORT & FAT COMPLETION

- (1) A Final FAT Report is prepared by the *Contractor* that includes the following as a minimum:
 - i. Test procedures used during FAT
 - ii. Detailed Test results
 - iii. Discrepancies identified during the tests
 - iv. Resolution of the discrepancies
 - v. Retests conducted and results thereof
 - vi. FAT certificate
- (2) The *Contractor* submits the Final FAT Report to the *Project Manager* for acceptance.

- (3) FAT Completion is achieved upon acceptance of the Final FAT Report by the *Project Manager*.

6 CONSTRUCTION

6.1 TEMPORARY WORKS, SITE SERVICES & CONSTRUCTION CONSTRAINTS

EMPLOYER'S SITE ENTRY AND SECURITY CONTROL, PERMITS, AND SITE REGULATIONS

- (1) Refer to Access Control Procedure 4421.

6.1.1 RESTRICTIONS TO ACCESS ON SITE, ROADS, WALKWAYS AND BARRICADES

- (1) Pedestrian crossings are made on the road they should be used when crossing the road.
- (2) Inside the plant walkways are clear; they should be used when walking inside the plant to keep safe on any object that might fall.
- (3) Barricades are provided where there are open trenches and around the sumps and manholes.
- (4) The *Contractor* shall occupy only such ground as is necessary to carry out the *works*.
- (5) All fences and other structure that have been damaged or interfered with by the *Contractor* shall be restored to be a condition at least equivalent to their original condition.

6.1.2 PEOPLE RESTRICTIONS ON SITE; HOURS OF WORK, CONDUCT AND RECORDS

- (1) The LAR is for the person in charge of the plant to maintain control over activities taking place on his plant that are not covered by the Plant Safety Regulation and Operating Regulations for High Voltage Systems.
- (2) Activities that are allowed to be carried out under the LAR must not require a permit and must satisfy the following criteria:
 - i. They must not involve danger to the person carrying out the activity;
 - ii. No plant isolations must be required;
 - iii. The activity must be performed by a skilled person and there must be no risk of a production loss;
 - iv. The duration of the activity must be less than 24 hours.
 - v. The Supervisor accompanies the *Contractor* during the first instances of working under a LAR on a specific plant area.
- (3) It is very important that the person who plans to do an activity on a plant under the LAR informs the person in charge of the plant (ASS on the panel or Operating Supervisor) of what will be done.
- (4) This means verbally telling the person in charge of the plant what will be done and not just signing the LAR book. The LAR book is also signed.
- (5) It is also important that as soon as the activity is completed the person, who was doing the activity, notify (verbally) the person in charge of the plant that conditions are back to normal and that the LAR has been signed off. Just signing the LAR book is not sufficient.
- (6) For more information please refer to Plant Safety Regulation.

6.1.3 HEALTH AND SAFETY FACILITIES ON SITE

Refer to Health and Safety Specification document 32-727 and 32-520

6.1.4 ENVIRONMENTAL CONTROLS, FAUNA & FLORA, DEALING WITH OBJECTS OF HISTORICAL INTEREST

- (1) Refer to Environmental Policy in 32-727 and 32-520

6.1.5 TITLE TO MATERIALS FROM DEMOLITION AND EXCAVATION

- (1) The *Contractor* has no title to an object of value or historical or other interest within the site.
- (2) The *Contractor* shall notify the *Project Manager* when such an object is found and the *Project Manager* will instruct the *Contractor* how to deal with it.
- (3) The *Contractor* does not move the object without instruction.
- (4) The *Contractor* has title to material from excavation and demolishing only as stated in the Works Information.

6.1.6 COOPERATING WITH AND OBTAINING ACCEPTANCE OF OTHERS

- (1) The *Contractor* shall co-operate with others in obtaining and providing information which they need in connection with the *works*.
- (2) The *Contractor* shall share the working area with others in executing the *works*.

6.1.7 PUBLICITY AND PROGRESS PHOTOGRAPHS

- (1) Should publicity and/or progress photographs be required, an application shall be made via the *Project Manager*.

6.1.8 CONTRACTOR'S EQUIPMENT

- (1) The *Contractor's* attention is drawn to the applicable regulation framed under the Machinery and Occupational Safety Act, 1983 (Act No. 6 OF 1983).
- (2) When working in built-in areas, the *Contractor* shall provide and use suitable and effective silencing devices for pneumatic tools and other plant that would otherwise cause a noise level exceeding 85 Db(A) during excavation and other *works*.
- (3) Alternatively the *Contractor* shall by means of barriers, effectively isolate the source of any such noise in order to comply with the said regulation.

6.1.9 EQUIPMENT PROVIDED BY THE EMPLOYER

- (1) Should the *Contractor* require using any of the *Employer's* Equipment, including compressed air, electricity, water supply and crane, it must be specified by the *Contractor* during the kick off meeting. The *Employer* does not guarantee continuity of supply of any of these items.
- (2) The *Employer* shall be entitled to withdraw use of the said Equipment, should proper maintenance and cleanliness not be ensured. In that event, the *Contractor* shall be obliged to provide the necessary Equipment at his own cost.

- (3) The *Contractor* is responsible for the repair, replacement or correction as necessary of all pieces of tools and equipment supplied by the *Employer* which are damaged and / or lost whilst in the *Contractor's* custody and control.
- (4) The *Contractor* site manager must ensure that any one of his employees or Sub-Contractor, operating hoist equipment belonging to the *Employer*, is authorised by an Accredited Company and retraining is done annually. Arrangements for training courses can be made via Matla Power Station Maintenance Training but the *Contractor* will absorb costs.
- (5) A copy of this accredited and valid training certificate must be given to the *Employer's* Supervisor, who will then arrange access for usage.

6.1.10 SITE SERVICES AND FACILITIES

- (1) Potable Water Supply is available at the existing points.
- (2) Electrical Power Supply requirements are as follows:
 - i. Power is available at the existing points.
 - ii. The *Contractor* provides his own portable 380V electrical distribution boards, and supply cables to and from the boards, for all his power supply requirements to execute the *works*.
 - iii. *Contractors'* Electrical Distribution Boards complies with OHSA as referred to in the Electrical Installation Regulations and the Electrical Machinery Regulations.
 - iv. Each board brought onto site must have a Certificate of Compliance issued by an accredited person.
 - v. The *Contractors'* Electrical Distribution Boards are installed at the *works* on a time negotiated with the *Project Manager*, prior to the possession date.
 - vi. The *Employer* connects distribution boards to a 380V three-phase AC power supply, only after the *Contractor* has submitted the valid Certificate of Compliance.
 - vii. All *Contractors'* Electrical Distribution Boards are earthed to the steel structure of the plant.
- (3) The *Employer* provides the *Contractor* access to existing toilet facilities. The *Contractor* is to provide this facility should the existing facilities not be within reasonable distance from the working area.
- (4) The *Contractor* are not allowed to use the *Employer's* dining facilities, unless a specific agreement has been made between the *Contractor* and Eskom Catering and Accommodation Services (ECAS).
- (5) The *Contractor* may buy take away meals from the fast foods outlet on Site.
- (6) The *Contractor* provides a First Aid service to his employees and subcontractors. In the case where these prove to be inadequate, like in the event of a serious injury, the *Employer's* Medical Centre and facilities will be available.
- (7) Outside the *Employer's* office hours, the *Employer's* First Aid Services are only available for serious injuries and life threatening situations.

- (8) The *Employer* recovers the costs incurred, in the use of the above *Employer's* facilities, from the *Contractor*.

6.1.11 RESTRICTIONS TO ACCESS ON SITE, ROADS, WALKWAYS AND BARRICADES

- (1) The *Contractor* should provide facilities they deem necessary in executing the work. This must be discussed with the *Project Manager* prior to commencement of work.

6.1.12 PEOPLE RESTRICTIONS ON SITE; HOURS OF WORK, CONDUCT AND RECORDS

- (1) The *Contractor* shall properly deal with and disposal of water to ensure that the *works* are kept sufficiently dry for their proper execution.
- (2) The *Contractor* shall provide, operate and maintain in sufficient quantity such pumping equipment, well points, pipes and other equipment as may be necessary.
- (3) The *Contractor* shall also provide temporally *works* as may be necessary to minimise damage, inconvenience or interference.

6.1.13 HEALTH AND SAFETY FACILITIES ON SITE

- (1) The *Contractor* will be held responsible for any damage to known services (services that are within the site of the *works* and are known/shown on drawings or highlighted by *Employer*) and he shall take all the necessary measure to protect them.
- (2) All *works* or protective measure shall be subjected to approval.
- (3) In the event of service being damaged the *Contractor* shall immediately notify the authority concerned as well the *Project Manager* and the engineer.
- (4) The *Contractor* shall not repair any such service unless instructed to do so by the *Project Manager*.
- (5) The *Contractor* shall complete such an investigation well in advance, prior to the start of construction work in the said section and shall submit a report in good time to enable the engineer to make whatever arrangements that are necessary for the protection, removal or diversion of the service before any construction *works* commences.
- (6) As soon as any underground service not shown in the in the drawing is discovered, it shall be deemed to be known service and the *Contractor* will be held responsible that the *Contractor* for any subsequent damage to it.
- (7) If such service is damaged during the course of its discovery, the cost of rectifying the damage will be met by the *Employer* unless it is established that the *Contractor* did not exercise reasonable diligence and that the damage was avoidable.
- (8) Where the authority concerned elects to carry out on site own account any alteration or protective measure, the *Contractor* shall co-operate with and allow such authority reasonable access and sufficient space and time to carry out the required work.
- (9) Permanent alteration or permanent diversion of service necessitated by the execution of the *works* and authorized will be paid for in terms of the conditions of contract, but no such work

will be paid for if it has not been previously inspected and if no proper written instruction was given.

6.1.14 ENVIRONMENTAL CONTROLS, FAUNA & FLORA, DEALING WITH OBJECTS OF HISTORICAL INTEREST

- (1) Where underground cables and pipes are present in the area, care must be exercised to ensure that they are not damaged. In the case of damage to existing components, the *Contractor* will be held liable for replacement/repair thereof.

6.1.15 TITLE TO MATERIALS FROM DEMOLITION AND EXCAVATION

- (1) The *Contractor* shall take all responsible measure to minimise any dust nuisance, pollution of stream and inconvenience to or interference with public as a result of the execution of the *works*.
- (2) Remove all rubble and dispose to appropriate facility as according Matla waste management Procedure OMOP 4090

6.1.16 COOPERATING WITH AND OBTAINING ACCEPTANCE OF OTHERS

- (1) The sequence of installation is as per the Execution Methodology provided by the *Contractor* and accepted by the *Project manager*.
- (2) Installation of the relevant equipment does not begin until the detailed engineering documentation for the section of the plant concerned has been accepted by the *Project Manager*.
- (3) Quality inspections and tests are carried out by the *Contractor* after installation to prove the compliance of the installation with the Works Information and the detailed engineering design freeze documentation.
- (4) Installation is only considered complete once the quality inspections and tests for the installation concerned have been accepted by the *Project Manager*.
- (5) The *Project Manager* is to specify hold and witness points during the installation and testing stages of the project.
- (6) The *Contractor* gives fifteen working days advance notice to the *Project Manager* of holds and witness points.
- (7) The *Contractor* confirms hold and witness points at least seven working days prior to the test activity.
- (8) The *Contractor* provides all test equipment for any inspections and tests.

6.1.17 SITE INTEGRATION TEST (SIT)

- (1) The Site Integration Testing (SIT) of the Control System is part of the *works*.
- (2) The SIT only begins once the control hardware has been installed in the final location and connected to permanent power supplies.
- (3) The SIT is carried out before plant commissioning commences to ensure:

- i. Correct performance of the control hardware
 - ii. Safety of plant and personnel
 - iii. Compliance with the Works Information and the detailed engineering design freeze documentation
- (4) The *Contractor* prepares a detailed SIT procedure
- (5) As a minimum, the proposed SIT 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 will be documented
 - vi. Acceptance Criteria
 - vii. How the identified discrepancies will be processed
 - viii. Retesting requirements
- (6) In the event of an error in any test (hardware or software) the fault is logged, analysed and resolved.
- (7) The *Contractor* is allowed to rectify the fault and retest for the full duration on condition that the *Project Manager* finds the fault to be minor.
- (8) Major faults such as IO module failure or CPU failure or major faults as determined by the *Project Manager* may lead to the termination of the SIT.
- (9) The *Contractor* rectifies the fault and re-starts the SIT after proving the compliance and performance of the rectified piece of equipment by carrying out the appropriate diagnostic tests.
- (10) A Final SIT Report is prepared by the *Contractor* that includes 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
- (11) The *Contractor* submits the Final SIT Report to the *Project Manager* for acceptance.
- (12) When all tests are successful and the Final SIT Report is accepted by the *Project Manager*, the system is classified as 'ready for use'. The system is then deemed ready for commissioning.

6.1.18 HOOK UPS TO EXISTING WORKS

The *Contractor's* design and execution methodology and plan takes into consideration the running units constrain and mitigated accordingly.

6.2 COMPLETION, TESTING, COMMISSIONING AND CORRECTION OF DEFECTS

6.2.1 USE OF THE *WORKS* BEFORE COMPLETION HAS BEEN CERTIFIED

- (1) The *Employer* may use any part of the *works* before completion has been certified. If he does so, he takes over the part of the *works* when he begins to use it except if the use is:
 - i. For a reason stated in the Works Information
 - ii. To suite The *Contractors* method of working
- (2) The *Project Manager* certifies the date upon which the *Employer* takes over any part of the *works* and its extension within one week of the date.

6.2.2 MATERIALS FACILITIES AND SAMPLES FOR TESTS AND INSPECTIONS

- (1) The *Contractor* and the *Employer* provide material, facilities and samples for test and inspection as stated in the Works Information.

6.2.3 COMMISSIONING

- (1) The commissioning of the Matla Power Station Slurry Plant PLC and SCADA system is part of the *works*.
- (2) Commissioning is defined as bringing into service all items of the *works*, and meeting the functional requirements and performance criteria of the Works Information.
- (3) The *Contractor* provides sufficient personnel for the satisfactory and timely commissioning of equipment.
- (4) The *Contractor* co-operates fully with the *Project Manager* or Representative(s) in the commissioning of plant.
- (5) The *Contractor* provides all the test equipment for the commissioning of the control hardware and will supply a commissioning procedure.
- (6) The *Contractor* certifies that equipment is in a suitable and safe condition for use before it is placed in service.
- (7) The commissioning activities are carried out in conjunction with the *Project Manager*.
- (8) If a defect is identified in the equipment interfacing to, or external to the *Contractor's* scope the *Contractor* informs the *Project Manager* or Representative(s) immediately.

6.2.4 START-UP PROCEDURES REQUIRED TO PUT THE *WORKS* INTO OPERATION

- (1) The *Contractor* shall carry out sufficient checks to satisfy himself that the materials used and the workmanship comply consistently with the specified requirements and the results of those checks shall, if so ordered, be made available to the Engineer.
- (2) The Engineer may carry out such check as s/he deems necessary at any point or any depth or any layer, as the result of the Engineer's check shall be made available to the *Contractor*.

6.2.5 TAKE OVER PROCEDURES

- (1) Takeover will be on or before the Completion Date the *Contractor* shall have done everything required providing the *works* and the Engineer has done all the necessary inspection and the approval of the *works* done.

6.2.6 ACCESS GIVEN BY THE *EMPLOYER* FOR CORRECTION OF DEFECTS

- (1) The Supervisor issues the Defect certificate at the later defect date and the end of the last defect correction period. The *Employer's* right in respect of the defect which the supervisor has not found and notified are not affected by the issue of the defect certificate.
- (2) The *Contractor* contacts the *Project Manager* to gain access to the site to correct defects.

6.2.7 PERFORMANCE TESTS AFTER COMPLETION

- (1) The *Contractor* shall conduct operational acceptance test after commissioning in the presence of the *Project Manager* and the Engineer according to the QCP, the end user and functional requirements.
- (2) The *Contractor* requests commencement of operational acceptance test from the *Project Manager*.
- (3) The final OAT Report is prepared by the *Contractor*.
- (4) The *Contractor* submits the final OAT Report to the *Project Manager* for acceptance.

6.2.8 TRAINING AND TECHNOLOGY TRANSFER

- (1) The *Contractor* shall provide any associated transfer of technology and knowledge to the Employer as per requirements specified in section 2.12

6.2.9 OPERATIONAL MAINTENANCE AFTER COMPLETION

- (1) Operational maintenance after Completion not part of the *works*.

7 PLANT AND MATERIALS STANDARDS AND WORKMANSHIP

7.1 INVESTIGATION, SURVEY AND SITE CLEARANCE

- 1) This activity is a pre-cursor to the Detailed Engineering, during which the *Contractor* conducts the necessary plant investigation work. The *Contractor* is to investigate all the existing loop drawings, and do plant walks to familiarise themselves with the plant.
- 2) The *Contractor's* plant investigation work is conducted on a Functional Group basis and then on a KKS basis, where applicable.
- 3) The scope of the plant investigation work includes, but is not limited to:
 - i. Verification of the location and suitability of all process control and network equipment

- ii. Verification of control system loops and terminations
- iii. Verification of power requirements and terminations
- iv. Verification of the scope of work as defined by the *Works Information*
- v. Verification and amending of all philosophies relevant to the scope of work.
- vi. Cable tracing, verification and cable schedule updating

The *Contractor* is responsible for:

- i. Clarifying the input documentation and scope of work to be performed.
 - ii. Identifying any discrepancies in the input documentation and making the *Employer* aware of such discrepancies. The *Contractor* provides recommendations, where applicable, and takes action to resolve such discrepancies.
 - iii. Collecting any process/plant data and information required for the *Contractor's* design to be completed.
- 4) The *Contractor* provides a pre-cursor method statement as part of the tender returnable for the live change over (live change over refers to switching from the existing PLC to the supplied installed new PLC). The method statement must consider that the maximum time to do the changeover is three (3) days per-cubicle. The final live change over method statement which will be utilised for the actual live changeover is provided and submitted to the project manager after the *Contractor* has investigated the plant for review and acceptance by the *Employer*.
- 5) The *Employer* provides drive schedules and instrument schedules once the contract is awarded.

7.2 STANDARDS

The *Employer* Standard Specification applicable to the *Works* are provided by the *Employer*. The *Employer* will submit revised/updated standards. The *Contractor* is to obtain his own copies of International and National Standard Specification documents.

It is the responsibility of the *Contractor* to report any conflict within this *Works Information* with any referenced standard, specification or technical guideline.

7.3 CONTROL AND INSTRUMENTATION WORKS

7.3.1 C&I SCOPE

- 1) Design, supply, install and commission a new control system
- 2) Usage of new installed control system cubicles, and if required the *Contractor* to supply more cubicles and / or cabling. Cleaning of the cabinets to be used- will it be for the station or the *Contractor*?
- 3) Operator workstation replacement- 6 operator screens and 3 workstations (2 screens per workstation).
- 4) The operator workstations to be located at the existing control room
- 5) Sealing of the openings that allow the dust into the room or new sealing door to be installed.
- 6) Supply of operator workstation desks and chairs. The power cabling in that room needs to be included for the contractors scope to ensure it's up to standard and accessible for maintenance

- 7) Supply and deliver Engineering Station equipment and furniture which will be allocated where the current PLC' are installed.
- 8) Use the currently installed Cabinets that are on the adjacent existing PLC room at Slurry Plant
- 9) Replace all network switches
- 10) Supply and install network cables
- 11) Supply and install the SCADA system and the system to have a historian
- 12) Supply servers with server cabinets
 - Ensure that the servers are redundant
- 13) Supply and install network cabinets
- 14) Trunk cables from the junction boxes to the existing PLC to be used for the new control system
- 15) The scope excludes field equipment and JB's
- 16) Interface to radio link, units ash pumps and K-pumps
- 17) Removal of the old cabinets once the plant is up and running

7.3.2 GENERAL REQUIREMENTS

- (1) The PLC is provided by the *Contractor* as part of the *works*.
- (2) The *Contractor* designs, engineers, installs and commission the Control System.
- (3) The PLC consists of the following function groups as per the table (Table 3: Slurry Plant PLC Function Group Definitions) below:

Table 3: Slurry Plant PLC Function Group Definitions

Current PLC Cubicles	Function Grouping
EYD01	Steinmuller PLC – Marshaling
EYD 10A CUBICLE	Dump Valves
EYD 10B CUBICLE	Dump Valves
EYD 11 CUBICLE	COMPRESSOR PLANT
EYD 20 CUBICLE	SUPERVISORY PLC
EYD 21 CUBICLE	Train A
EYD 22 CUBICLE	Train B
EYD 23 CUBICLE	Train C
EYD 24 CUBICLE	Hydrobin 11 & 13
EYD 25 CUBICLE	Hydrobin 12 & 14
BYB03	Electrical Alarms

7.3.3 SLURRY PLANT PLC REQUIREMENTS

- (1) The PLCs are to be located in the Slurry Plant C&I Equipment Room. All PLC's are located in the same room.
- (2) The PLCs are fully programmable, micro-processor-based systems designed for use in process plant applications.
- (3) The PLCs interface to the SCADA and Historian

- (4) The PLCs complies with the requirements (for both software and hardware) specified in the PLC OEM programming, installation and operating manuals and equipment data sheets.
- (5) Each PLC has the following functions and/or components:
 - i. Redundant power supplies.
 - ii. Input/output modules for data acquisition & signal processing for the processing of signals from field equipment and interfaces.
 - iii. Data validation functions.
 - iv. Interfacing with Electrical switchgear/s.
 - v. Redundant Communication with the SCADA and Historian.
 - vi. Interrogation of field contacts using 24 V DC.
 - vii. Interfacing with analogue input measurements from the field based on two-wire 24 V DC, 4 - 20 mA signals.
 - viii. Redundant Internal power supply & distribution components.
 - ix. Redundant Processors
- (6) All software logic diagrams are engineered and depicted according to the Control System Flowchart (CSF) format and not Ladder Logic or Statement Lists STL format.
- (7) The software logic source code is clear, concise, has detailed comments and consistent variable names.
- (8) Spare capacity on the I/O modules of 10% is provided.
- (9) The CPU's capacity should not be utilised more than 50% which should leave it with another 50% of processing capacity for future use, and has redundancy should one fail, the other should take over
- (10) The IP addressing used by each PLC is consistent across the PLC network.
- (11) All interfaces between the PLCs and operator workstation are provided by the *Contractor*.
- (12) The *Contractor* provides the necessary fibre cables to tie in the new control system into the SCADA network.

7.3.4 OPERATOR WORKSTATION (HMI/SCADA)

The operator workstation shall provide plant operators with all information, protection, and control facilities required to operate the plant safely, reliably and consistently.

- (1) The new thin clients are placed on the existing control room desk at the slurry plant control room.
- (2) The HMI is the human interface for operating and monitoring of the plant systems on the Slurry Plant.
- (3) A multilevel password system is used to restrict the operating functionality of the workstations to authorised personnel only.
- (4) The log in and log out functionality is seamless without requiring the shutdown or restarting of the HMI.

- (5) No passwords or access control of any form is required by an operator to monitor any individual section of the plant.
- (6) Each operating workstation functions independently from all other operating workstations forming part of the applicable workstation.
- (7) Failure of any operating screen does not inhibit plant operation.
- (8) The workstation is configured such that it supports on-line maintenance.
- (9) Faulty screens and pointing devices can be replaced without re-initiating or re-booting the workstation.
- (10) A fully functional HMI is provided. The functionality provided by the HMI includes – but is not limited to the following:
 - i. Operating functionality
 - ii. Indication
 - iii. Alarming and alarm responses
 - iv. Event viewing
 - v. Trending and reporting
 - vi. Access to historical data

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

- (11) Uniformed signal descriptions, standard abbreviations and consistency of wording are used throughout the HMI.
- (12) Any incorrect operation is indicated to the operator by audible signal or suitable text message.
- (13) All operator actions are logged and linked to the user's profile.
- (14) Individual users have the ability to configure, save and restore their settings
- (15) HMI graphic pages on the operating and overview screens.
- (16) The performance related to the display of the graphical user interface is in accordance with 240-56355728 "Human Machine Interface Design Requirements Standard",
- (17) All information available to the operator from the HMI is printable when required.
- (18) All normal operations which include stopping, starting and restarting after a trip take place from the operator workstation.
- (19) The HMI graphics on the Operator Workstation represents the actual plant layout.
- (20) The operator workstation has an alarm log page showing chronologic alarms and trips.
- (21) The operator workstation has events log page showing all the events
- (22) The operating system utilized on all equipment to realize the HMI functions, including the Operator and Engineering System is "Windows 10" or later.
- (23) Graphics for the different types of components that will be presented on the HMI due to upgrades or modifications for the purpose of interfacing the HMI to the Process Automation System are designed and clarified during Detailed Design with the Employer's Operating and Engineering team.

7.3.5 SERVERS PHYSICAL SPECIFICATIONS

The *Contractor* shall provide all the required control system servers with the following physical specifications

The minimum specifications for each control system server will be as follows:

- 1) Redundant connections to each applicable network.
- 2) Use dedicated server hardware.
- 3) Hot swappable redundant power supplies.
- 4) Hot swappable redundant hard drives via a suitable RAID configuration.
- 5) Server cubicles

7.3.6 INTERFACE TO EXISTING/NEW SYSTEMS

- (1) The Control System provided by the *Contractor* interfaces to the existing Field Equipment and Switchgear as per LOSS diagrams in Appendix D
- (2) The *Contractor* to interface to the currently installed radio link for starting and stopping of the pumps at the SWR switchgear
- (3) The *Contractor* to interface to the ash pumps at the units used for ashing by configuring the interlocks for the releases. The philosophy and the interlocks of the ash pumps will be provided to the *Contractor* by the Employer.
- (4) The *Contractor* to interface to the K-pumps by studying the control and operating philosophy of the K-pumps and reinstating them to the normal working operation. The interlocks and control and operating philosophy will be handed over to the *Contractor* after contract awarding.
- (5) The *Contractor* retains the existing network interfaces to main water treatment plant (WTP), North WTP and any other interfaces, which will be affected by the *works*.

7.3.7 PLANT INFORMATION SYSTEM (Historian)

The *Contractor* provides, as part of the works, a Plant Information System (PIS) that is a central database repository for the long term storage of all plant information produced at Matla Power Station Slurry Plant. This includes plant information generated by the *Contractor's* control systems, as well as other sources identified by the Project Manager.

The system is used for the remote access and retrieval of near real-time and historical plant information by the PIS Clients. The slurry plant PIS provides easily accessible information for power plant technical services such as operating, maintenance and engineering.

7.3.8 PLANT INFORMATION STORAGE

The PIS stores the plant information for the Outside plant centrally on a fully redundant server. The redundant PIS data server is physically separated from the Control system servers, EDC (Engineering/Diagnostics/Commissioning) workstations and operator workstations, and is provided by the *Contractor* as part of the works.

The PIS is able to store all analogue tags with a resolution of 1ms or better, and all events at a resolution of 1 ms. The PIS is also able to store each analogue tag according to the amount of change in the tag value, where the amount of change is specified by the user. The PIS data servers store a minimum of 5 years of all historical plant information on-line at maximum resolution of off-line data, as part of the works.

The PIS is able to back up the historical plant information stored on the PIS data servers to external hot-swappable HDDS (Hard Disk Drives), while on-line and without any loss of availability and functionality of the PIS.

7.3.9 PIS INTERFACE

The *Contractor* supplies as part of the works web server software that allows the PIS clients, with the appropriate user rights and a standard Internet browser, to view all the near real-time and historical plant information from the PIS in the form of

- Trends
- Chronological lists
- Reports
- Process graphics

The design and engineering of web pages that supply the near real-time and historical plant information from the PIS to the PIS clients is provided as part of the works. A maximum of 50 PIS clients are able to access all near real-time and historical plant information from the PIS, and a maximum of 50 PIS clients are able to access near real-time and historic plant information from the PIS simultaneously.

7.3.10 STATION LAN INTERFACE

The plant information system connects to the station LAN through a redundant firewall creating a DMZ in accordance with the Eskom Standard. The firewalls are provided as part of the works.

The *Contractor* installs and supplies all cabling required to connect to the station LAN and all necessary associated equipment such as connection boxes, and switches. Bus cable jointing, and termination forms part of the works.

The *Contractor* assesses the cable routes at site and provides full details for the Project Manager's acceptance.

7.3.11 REDUNDANCY

The PIS data server is fully redundant. In the event of a failure of one of the PIS data servers, the other PIS data server automatically takes over its functions, without any loss in availability or functionality of the PIS.

All interfaces to the PIS are fully redundant. There is no single point of failure. The failure of any single component (for an example, a switch, a NIC, a cable, or a firewall) does not result in any loss of functionality or availability of the PIS.

7.3.12 TIME SYNCHRONISATION

The PIS data servers are synchronized with the GPS system supplied as part of works by the *Contractor*.

7.3.13 SECURITY

A user is requested to enter username and password before being able to access the configuration and diagnostic software of any PIS component.

7.3.14 PIS DATABASE STRUCTURE

The databases on the PIS data servers hold all plant data and are open to the queries from the control system data servers and the PIS client. The database structure is modifiable to fit the needs of Matla Power Station. Any changes made to the database are made real-time and on-line, and all changes are effective without restarting any part of the system.

7.3.15 REPORTS

As a minimum, the following reports are generated by the Plant Information system on a regular basis:

- Alarm log
- Hourly log
- Daily log
- Incident review logs
- Running time and status change log
- Summary logs

All reports generated by the Plant Information System are viewable on all PIS Clients. The final list of reports generated by the PIS is clarified during the system engineering phase.

7.3.16 LICENSING

The software licenses (both runtime and engineering) shall be portable allowing the user to transfer licenses from one PC to another without requiring intervention from the OEM/supplier.

7.3.17 AVAILABILITY

The *Contractor* configures the control system to minimise the effects of equipment failure on the overall plant and mimics the mechanical plant configuration.

7.3.18 CONTROL SYSTEM AVAILABILITY

- The availability of the control system and of the individual sub-systems is 99.99% or greater.

7.3.19 RELIABILITY

- No single point failure in the system causes unavailability or trip of any of the control system or associated plants
- If a failure occurs on the level of the operator/engineering systems, server or network, the automation units continue to operate uninterrupted.

7.3.20 SAFETY

- No individual C&I fault or no two concurrent faults may endanger the safety of the plant or people or jeopardise the integrity of major plant.

7.3.21 OPERATOR INTERFACE

- No individual fault causes the loss of an operator workstation. No individual loss causes loss of the control or operator information.

7.3.22 REDUNDANCY

The redundancy of functions within the Automation Units and hardware modules is such that the reliability, availability and maintainability levels as defined in section 6.4.

The transfer from master Automation unit processor to the slave Automation unit processor is seamless.

7.3.23 LIFE EXPECTANCY

The *Contractor* provides product supply life cycle in which the stages are depicted, stated and predictable.

All components are supported and maintainable as indicated below:

- iv. PLC Life span is ≥ 18 years
- v. SCADA Life span is ≥ 6 years
- vi. Operator station Life Span is ≥ 6 years
- vii. Information System/Historians Life span is ≥ 6 years
- viii. Network Infrastructure Life span is ≥ 12 years

At the start of commercial operation, NO C&I equipment and its associated equipment shall be at the end of life or obsolescence phase of its product life cycle.

7.4 CONTROL ROOM REQUIREMENTS

The *Contractor* to supply equipment necessary support such as documentation, references, procedures and computerised support system necessary for the execution of the operators, engineers and maintenance staff duties. A printer is provided for Slurry plant control room to be used for logs, reports and drawings and other documents on request by operators, engineers and maintenance personnel

The *Contractor* to provide the following as a minimum:

- Lighting and Luminaries requirements (normal and emergency)
- Small power requirements
- Electrical plug points
- Channelling for cabling
- Position of equipment and hardware
- Any special isolation from electromagnetic interference

All desks are custom designed, suitable for mounting the operating display devices required by the respective operator workstation. The desks surfaces provide space for writing as well as space for a telephone. Each desk contains a facility for the storage of the keyboard such it does not interfere the operator's working area when it is not in use. A set of matching desk drawers are provided for each operator. Desks are durable, robust suitably matched to the furniture and control room décor.

All furniture is of the modular type, and is of robust design clad in industrial type fabric suitable for the environment in which it used (i.e. continuous use 24 hours per day) and is in accordance *Employer's* corporate identity standards and per the specification, Matla_002. The final design and layout of the desks, furniture and panels are discussed and clarified during the system engineering phase (technical clarification meetings) and provided to the Project Manager for acceptance.

7.5 SLURRY PLANT OPERATOR WORKSTATION AND DESK CONFIGURATION

The Slurry Plant Operator workstation requires a six operating display units configured to allow two independent operations to be undertaken concurrently by the Slurry Plant operator and assisting operators with associated pointing devices.

The *Contractor* provides two operator display units for the Slurry Plant Engineering Station and as a minimum the *Contractor* also provide three workstations.

The Engineering Station to be housed at the PLC room were the currently S5 PLC cubicles are, after the cubicles have been removed.

The *Contractor* to provide a desk and two chairs for the Engineering station, a LAN connections, all the cabling and the cabling racks for Engineering Station.

7.6 LIST OF REFERENCE PROCEDURES, STANDARDS AND SPECIFICATIONS

The *Contractor* complies with all standards, specifications and regulations as listed within this works Information, on the table below:

Table 4: Eskom Governance and Project Controls Specifications

No.	Document No.	Description / Title
1.	36-681	Generation Plant Safety Regulations
2.	32-520	Occupational Health and Safety Risk Assessment Procedure
3.	32-727	SHEQ Policy/Procedure
4.	ISO 9001	Quality Management Systems
5.	240-53113685	Design Review Procedure (DRP)
6.	240-52844017	System Reliability, Availability and Maintainability Analysis Guideline
7.	240-56355728	Human Machine Interface Design Requirements Standard
8.	240-56355815	Control & Instrumentation Field Enclosures and Cable Termination Standard
9.	240-109607736	Eskom KKS Key Part Standard
10.	240-109607332	Eskom Plant Labelling Abbreviation Standard
11.	240-55410927	Cyber Security Standard
12.	40-72926760	Operational Technology (OT) Operating Model
13.	240-56355731	Environmental Conditions for Process Control Equipment Used at Power Station
14.	240-143485806	Generation auxiliary plant medium voltage protection standard.
15.	240-56227589	List of Approved Electronic Devices to be Used on Eskom Power Stations Standard
16.	240-56176852	Essential Power Supplies for Power Stations Standard
17.	32-245	Eskom Waste Management Standard
18.	4444	Matla Power Station Risk Management Procedure
19.	474-305	Plant Equipment Risk Management Procedure
20.	13340-04	Matla Power Station Environmental Policy

7.7 DRAWINGS ISSUED BY THE EMPLOYER

This is the list of drawings issued by the *Employer* at or before the Contract Date and which apply to this contract.

Note: Some drawings may contain both *Works* Information and *Site* Information.

Drawing number	Revision	Title
0.47/41120	1	New Ash Handling Plant Basic Flow of AWR and Slurry Pipelines
0.47/52549	0	Ash Handling Plant (Under PFA Silo1)
0.47/52550	0	Ash Handling Plant (Under PFA Silo2)
0.47/52551	0	Ash Handling Plant (Under PFA Silo3)
0.47/52552	0	Ash Handling Plant (Air Slide 1)
0.47/5255	0	Ash Handling Plant (Air Slide 2)
0.47/5255	0	Ash Handling Plant (Air Slide 3)
0.47/5257	0	Ash Handling Plant (Hydrobins)
0.47/5258	0	Ash Handling Plant (BBA Conveyors)
0.47/5259	1	Ash Handling Plant BBA Box (Mixers)
0.47/52560	0	Ash Handling Plant BBA Box (AWR and AWRSE Tanks)
0.47/52562	1	Slurry Pumping System