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1. PROGRAMMABLE LOGIC CONTROLLERS (PLCS)

1.1 PLC HARDWARE & ENGINEERING

New Modicon M580 PLC's shall be supplied, installed, programmed, tested and commissioned for the complete control and operation of the respective existing and new plant installed. The PLC's and the required components shall be supplied as specified in the EWS standardised preferred equipment list.

The Contractor's engineering design shall include for all cubicles and hardware required for PLC control, and shall include comprehensive equipment lists, cubicle GA drawings and Control Centre drawings, I/O schedules and functional descriptions.

Provision shall be made for PLC control of all items require, plus allowance for expansion.

The Contractor shall furthermore ensure that the complete design, installation, commissioning shall include all necessary cabling, interfacing, connections, mountings etc. to ensure that the final product is complete, functional and to a good engineering standard.

The Contractor shall provide the following documentation to the integrator to enable the integrator to complete his scope. Documentation shall be at "For Construction" revision.

- Plant P&ID's
- IO Lists including:

- o instrument ranges;

- o alarm setpoints;

- o IO allocations per PLC system/rack/card;

- Plant network layout

- SCADA Hardware specifications

On completion of electrical and control panel manufacture, the contractor shall complete a Factory Acceptance Test (FAT) of all panels at his premises before delivery to site. The contractor shall inform the engineer that panels are ready for FAT and a team including the employer, the engineer, and the integrator shall attend and witness the FAT.

Acceptance of the FAT shall require acceptance by the employer, the engineer and the integrator.

The integrator has then accepted the panels for site tests and commissioning.

1.2 SOFTWARE ENGINEERING:

1.2.1 PLC Software

Integrator Scope

The integrator shall utilise the latest revision Unity Pro Software Program for the programming of the PLCs. The integrator shall provide their own computer for the programming and software engineering and on completion of the project the engineered software shall be transferred to the Employer. The software shall remain the property of

the Employer with all copies kept by the Integrator during the course of the contract transferred to the Employer on completion of the Contract. No password protected codes will be accepted.

The integrator shall use information provided by the contractor and the EWS representative to develop the Function Design Specification (FDS) for approval by the EWS representative, prior to detailed software development.

Additional information shall be provided to the integrator in the form of the Process and Control Description which will assist with the FDS development.

The software engineering shall be developed in accordance with the final design P&ID and the FDS, which will include information from the Process and Control Description and sample FDS.

All control loops in the software engineering shall be based on an island control basis for the various process sections.

Software engineering shall be done using a structure format of function blocks to facilitate program simplicity and fault finding.

Certain standard programming function blocks might be provided by EWS to the successful tenderer to facilitate standardisation and shall be incorporated when programming the PLC and HMI for each section.

The integrator shall however be required to develop new function blocks in consultation with the Employer and the Engineer for approval prior to implementing the program.

The integrator shall allow for a minimum of three reiterations of the PLC program for changes as may be requested by the Employer and EWS representative without their pricing for this work.

2.   I/O LIST:

The Process and Control Description is to be read in conjunction with the P&ID drawings and single line schematic diagrams.

The Contractor, on completion of design, shall submit to the EWS representative comprehensive I/O lists for the new PLC in the form of a I/O list. This list shall be the expansion of the instrumentation index supplied at tender stage and shall include information listed in section 1.2 above.

The resultant I/O's shall be forwarded to, and used by the integrator for configuration of the respective process PLC's and to provide the necessary input to the overall HMI system to be installed under this Contract.

3.   HUMAN MACHINE INTERFACES (HMI'S)

3.1   HARDWARE

For the local interaction and control of the respective plant areas the contractor shall supply and install Schneider Magelis 15" Graphic Terminal (HMI) (model number) units.

Each MCC shall be fitted with an HMI.

3.2   SOFTWARE

Integrator Scope

The integrator shall use the latest revision Vijeo Designer Software Program for programming the HMIs. The integrator shall provide his own computer for the programming and on completion of the project transfer the software and licence to the Employer.

The software engineering shall be developed in accordance with the final design P&ID, the Process and Control Description and sample Process Control Philosophy. All control loops in the software engineering shall be based on an island control basis for the various process sections.

Software engineering shall be done using a structure format of function blocks to facilitate program simplicity and fault finding.

Certain standard programming function blocks and graphics might be provided by EWS to the successful tenderer to facilitate standardisation and shall be incorporated when programming the PLC and HMI for each section.

The integrator shall however be required to develop new function blocks in consultation with the Employer and the Engineer for approval prior to implementing the program. The new developed software shall however be required to follow the standard EWS display format.

The integrator shall allow for a minimum of three reiterations of the HMI program and display graphics and trending for changes as may be requested by the Employer and Engineer without their pricing for this work.

4.   CONTROL NETWORK

The network design provides for a Modbus on Ethernet communication backbone which has been designed to support two systems namely:

- eThekweni Electrical MV Gear and Standby generator on site.
- eThekweni Water and Santiation, PLC and SCADA data and control communications.

4.1   NETWORK HARDWARE

The Contractor shall supply and install ethernet switches, which shall be high quality industrial grade.

Network switches utilised in the design shall be the standard preferred model managed switches as specified in the Schedule of Quantities.

The switches shall have the option to accept both fibre and copper cable in order to reduce the number of media convertors required. Configurable ports are preferred for flexibility.

The manufacturing details in respect of the panels to house the network switches is covered under the Motor Control Centres.

4.2 NETWORK CONFIGURATION

Integrator Scope

The intergrator shall configure each switch for maximum efficiency of the data transfer between his configured PLC's and SCADA systems.

4.2.1 Documentation

The integrator shall include design drawings & documentation to the SCADA system and allow for retrieval of documentation or drawings from the operator accessible system help screens.

Available documentation shall include:

- Process & Control Description

- Functional Design Specification

Available drawings shall include:

- Control Network Overview Layout

- Power Distribution Schematics & Drawings

- PLC Card Wiring Diagrams

- Loop Sheets

- MCC Schematics

- Instrument Data Sheets