| Eskom | Specification | Technology |
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Title: **Technical Specification for Upgrade of Duvha Electric Compressors and Dryers**

| | |
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## TABLES

# FIGURES

# 1. INTRODUCTION

This document provides the technical specifications for the upgrade of the Electric Compressors two, three four and Air Dryers one, two three and four and associated cooling water pumps and piping at Duvha Power Station.

# 2. SUPPORTING CLAUSES

## 2.1 SCOPE

This document covers the control and service air compressor system and associated components.

### 2.1.1 Purpose

The purpose of this document is to specify the technical requirements for the replacement of the electric compressors, air dryers and associated equipment.

### 2.1.2 Applicability

This document is applicable to Plant Engineering and Duvha Power Station.

## 2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

### 2.2.1 Normative

[1] 240-53113685, Design Review Procedure

[2] 382-ECM-AABB-D00139-29 Concept Design Report for Duvha Power Station Upgrade of Compressors and Dryers Project

### 2.2.2 Informative

[3] 382-ECM-AABZ26-RP000-11- Upgrade of the LPS compressors and dryers ROC

[4] 384-CAO-BSSS-D00185-2- Upgrade of Duvha Electric Compressors and Dryers SRD

[5] 382-ECM-AABZ18-PN0012-2 Engineering Management Plan for the upgrade of Duvha Electric compressor and dryers

[6] 240-4332798, Engineering Policy

[7] 474-34, Project Engineering Change Procedure

[8] 240-53114002, Engineering Change Management Procedure

[9] ISO 9001 Quality Management Systems.

[10] Occupational Health and Safety Act(OHS Act)

## 2.3 DEFINITIONS

### 2.3.1 Disclosure Classification

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

## 2.4 ABBREVIATIONS

| | |
|---|---|
| HMI | Human Machine Interface |
| kPa | Kilo Pascal |
| kPag | Kilo Pascal Gauge |
| LDE | Lead Discipline Engineer |
| LPS | Low Pressure Services |
| $m^3$/hr | Cubic metres per hour |
| mamsl | Metres above mean sea level |
| $Nm^3$ | Normal cubic metres |
| $Nm^3$/min | Normal cubic metres per minute |
| OPCR | Outside Plant Control Room |
| ppm | Parts per Million |
| PBS | Plant Breakdown Structure |
| PDP | Pressure Dewpoint |
| SANS | South African National Standards |
| SIT | Site Integration Test |
| LV | Low Voltage |
| MV | Medium Voltage |
| CFS | Combine Fuse Switch |
| MCB | Miniature Circuit Breaker |

## 2.5 ROLES AND RESPONSIBILITIES

**Compiler** : The document compiler is responsible for ensuring that this document is up-to-date and that this document is not a duplication of an existing documentation, regarding the document's objectives and content.

**Functional Responsibility** : The Functional Responsible Person shall determine if the document is fit for purpose, before the document is submitted for authorisation.

**Authoriser** : The document authoriser is a duly delegated person with the responsibility to review the document for alignment to business strategy, policy, objectives and requirements. He/she shall authorise the release and application of the document.

## 2.6 PROCESS FOR MONITORING

This document will be approved following a Multidisciplinary Design Review that will be performed as per the Design Review Procedure 240-53113685.

## 2.7 RELATED/SUPPORTING DOCUMENTS

N/A

# 3. TECHNICAL REQUIREMENTS

## 3.1 SUMMARY OF SCOPE

**Table 1 Summary of Scope**

| Discipline | Scope |
|---|---|
| Mechanical | Replacement of complete electrical compressor trains for compressors two, three and four. Replacement of air dryers one to four. Replacement of cooling water pumps for compressors two, three and four and associated piping where required |
| Electrical | Power supply to compressor trains, air dryers and associated components |
| C&I | The Contractor shall design, engineer, supply, install and commission the following:<br>• Three new Siemens S7 PLC (Slave Controllers) for the three electric compressors for control and protection of the electric compressor, dryer and auxiliaries.<br>• Program to fetch all information from the black box controller<br>• New S7 PLC (Master Controller)<br>• Master HMI to be upgraded to KP700 Comfort<br>• Programming of Marshalling PLC to accommodate new electric compressors<br>• Electric compressor controller (Compressor onboard controller provided by the Contractor) interface to the Slave Controller<br>• Dryer controller (onboard controller provided by the Contractor) interface for each compressor to the Slave Controller<br>• Field instrumentation for the auxiliaries as per the Instrument Schedule<br>• Field instrumentation interface to the Slave Controller.<br>• Drives interface to the Slave Controller as per the Drive Schedule.<br>• New junction boxes<br>• New tapping points for additional instrumentation<br>• New impulse piping for additional instrumentation<br>• Cabling, racking and power distribution<br>• Bus communication link (PROFINET) between the Master Controller and the Outside plant SCADA for compressor status and monitoring<br>HMI and VA changes |
| Civil | Ensuring adequacy of existing equipment supports |

### 3.2 SYSTEM DESCRIPTION- EXISTING SYSTEM

Duvha Power Station Compressed air system comprises of four electric compressors for the production of control and service air. Each compressor has its own desiccant heatless twin dryer for moisture removal.

**Table 2: Existing Electric Compressors**

| Machine | Make & Model | Compressor capacity ($Nm^3/min$) | Discharge Pressure (kPag) | Compressor type | Dryer |
|---|---|---|---|---|---|
| Electric Compressor 1 | Ingersoll Rand Centac C400 | 52 | 700 | Electrical Centrifugal | Heatless Desiccant |
| Electric Compressor 2 | Ingersoll Rand Centac C18-MX3 | 52 | 700 | Electrical Centrifugal | Heatless Desiccant |
| Electric Compressor 3 | Ingersoll Rand Centac C18-MX3 | 52 | 700 | Electrical Centrifugal | Heatless Desiccant |
| Electric Compressor 4 | Ingersoll Rand Centac C18-MX3 | 52 | 700 | Electrical Centrifugal | Heatless Desiccant |

### 3.3 SITE CONDITIONS

The Altitude of the low pressure services building at Duvha PowerStation is 1600 metres above sea level. Atmospheric pressure at the elevation is 85 kPa. Other site characteristics at Duvha PowerStation which shall be used for sizing equipment are listed on the table below:

**Table 3: Ambient site conditions**

| Ambient condition | Minimum | Average | Maximum |
|---|---|---|---|
| Pressure | 80kPa | 85kPa | 90kPa |
| Temperature | -10°C | 35°C | 40°C |
| Relative Humidity | 20% | 60% | 80% |

### 3.4 PLANT REQUIREMENTS

The new upgraded plant should provide clean, dry, oil free air to air users at Duvha Power Station to meet the following quality requirements.

- Discharge Pressure : 620-820 kPa(g)
- Dew Point : - 40 °C PDP
- Max Oil Content : < 0.1mg/m3
- Max Particle Size : < 1micron

The following equipment must be replaced with completely new equipment. The AKZ codes of the equipment referred to is listed in Table 4 table below:

- Compressors  two, three and four
- Cooling water pumps for compressor 2,3 and 4
- Air Dryers for compressor 1,2,3 and 4

Reusable pipes and fittings may be reused, provided they can perform the required function.

**Table 4: AKZ codes of equipment to be modified.**

| Equipment | AKZ code |
|---|---|
| Compressor 2 | 00US12D001 |
| Cooling water pump A for compressor 2 | 00US12D004 |
| Cooling water pump B for compressor 2 | 00US12D003 |
| Compressor 3 | 00US13D001 |
| Cooling water pump A for compressor 3 | 00US13D004 |
| Cooling water pump B for compressor 3 | 00US13D003 |
| Compressor 4 | 00US15D001 |
| Cooling water pump A for compressor 4 | 00US14D004 |
| Cooling water pump B for compressor 4 | 00US14D003 |
| Air Dryer 1 | 00US11G001 |
| Air Dryer 2 | 00US12G001 |
| Air Dryer 3 | 00US13G001 |
| Air Dryer 4 | 00US15G001 |

## 3.5 EQUIPMENT SPECIFICATIONS

### 3.5.1 Compressors

- New Ingersoll Rand Centac C400 compressors shall be installed to replace the obsolete C18MX3 compressors (compressor 2, 3 and 4).
- The compressor shall be supplied as a complete packaged unit with a drive motor, on board controller and air end.
- The new compressors shall meet the following requirements:
  - The compressor shall deliver a flow of 52 $m^3$/min (FAD) at a discharge pressure of 760 kPa(g).
  - The compressor operating range shall be between 620kPa(g) and 820 kPa(g) on the discharge.
- The compressors shall operate sufficiently under all possible environmental conditions as specified in Table 2
- All compressors shall have a permanently fixed stainless steel/trifoliate data plate in a conspicuous place with the following minimum particulars:
  - Name of manufacturer;
  - Compressor model;
  - Year of manufacture;
  - Output pressure in units of Pascal;
  - Input voltage and frequency in units of volts and hertz;
  - Rated power and current in units of watts and ampere respectively;
  - Compressor AKZ identification number.

### 3.5.2 Intake air filters

- The compressor shall be supplied with an intake air filer.
- The new intake filter shall be located at the same position as the existing intake air filters.
- The new air filter elements shall meet the technical requirements listed in the table below:

**Table 5: Inlet air filter technical data**

| **First stage filter** | |
|---|---|
| Filtering surface | 0.9$m^2$ |
| Nominal flowrate | 50$m^3$/min |
| Filters per assembly | 2 |
| Filter class | G4 |
| Initial pressure drop | 60 Pa |
| Recommended final pressure drop | 250 Pa |

| | |
|---|---|
| Collapse pressure | 500Pa |
| Thermal stability | 80°C |
| Moisture resistance | Up to 100% relative humidity |
| **Second stage filter** | |
| Filtering surface | 36m$^2$ |
| Rated Flow at 100kPa, 15°C and 0% Relative humidity | 100m$^3$/min |
| Filters per assembly | 1 |
| Filter class | F9 |
| Initial pressure drop | 200 Pa |
| Recommended final pressure drop | 650 Pa |
| Cracking | 1000Pa |
| Thermal stability | 60 |
| Moisture resistance | Up to 100% relative humidity |

- The filter assembly shall meet the following requirements:
    - The filter shall be supplied with differential pressure transmitters to measure the pressure drop across each of the two stages.
    - Each filter stage shall have its individual pressure transmitter.
    - The differential pressure signal shall be displayed locally and remotely.
    - The measuring range of differential pressure transmitter shall include the minimum and maximum expected pressure drop across that filtration stage.

- All filters shall have a permanently fixed stainless steel data plate in a conspicuous place with the following minimum particulars:
    - Name of manufacturer;
    - Filter model and size;
    - Year of manufacture;
    - Filter AKZ identification number.

### 3.5.3 Air dryers

Each compressor shall be fitted with a dedicated desiccant heatless dryer. The dryers shall have the following features:

- The dryers shall deliver air with a pressure dew point of at least -40°C at all times.
- The dryer performance characteristics shall be based on a sizing with an inlet air pressure of 700 kPa(g), inlet temperature of 35°C and an inlet air relative humidity of up to 100%.
- The compressed air pressure drop across the dryer shall not exceed 30 kPa based on an inlet pressure of 700 kPa(g).
- Each dryer shall be a packaged unit including an on-board controller. The controllers shall control the individual dryer discharge pressure dew-point at the set-point.
- The dryer shall have a variable purge discharge control function to economise the dryer air consumption.
- If the noise from a dryer in operation shall exceed 85 dB, this shall be clearly stated.
- The pressure vessels of the dryer shall meet all the requirements of OHSAct, Pressure Equipment Regulations.
- Each dryer shall be fitted with at least three filters, namely the water separator, the oil filter and the after filter. These shall meet the following requirements:
    - The after filter shall have a filter element that that removes particles down to 0.1 micron.
    - The oil filter shall have a filter element that that removes oil aerosols down to 0.01 micron
    - The water separator shall have a filter element that that removes particles down to 3 microns
    - The pressure drop across each filter shall not exceed 30 kPa(g) at which point a filter replacement signal shall be generated.
    - Each filter shall be fitted with a digital pressure transmitter which will have a local display and transmit a signal to the C&I system.
    - Each filter shall have a zero loss water trap. The water separator condensate drain shall have the capacity to remove all the water that condenses within the compressor, under all operating conditions.
- All the individual dryer units shall have the following general features as a minimum:
    - Inlet and outlet air connections;
    - Regeneration air outlet
    - Dryer outlet pressure dew-point control;

- Pressure dew-point monitor with an alarm;
- Safety valve/s on dryer units shall be sized for the capacity of the compressor upstream of the dryer.

- All dryers shall have a permanently fixed stainless steel/trifoliate data plate in a conspicuous place with the following minimum particulars:
  - Name of manufacturer;
  - Dryer model and size;
  - Year of manufacture;
  - Input voltage and frequency in units of volts and hertz;
  - Power and current in units of watts and ampere;
  - Pressure dew-point;
  - Dryer AKZ identification number.

#### 3.5.3.1 Pressure vessels requirements

Dryers and filters will comprise of pressure vessels which shall meet all the requirements of Occupational Health and Safety Act Pressure Equipment Regulations.

- These pressure vessels shall meet the requirements of the OHS Act Pressure Equipment Regulations and 474-10327
- If the dryers are newly manufactured the pressure vessel design code shall be the latest version of Specification for unfired fusion welded pressure vessels (PD5500).
- The welding of the pressure vessels shall meet the requirements of Control of plant construction repair and maintenance welding standard. (240-56241933)
- The personnel doing the welding work must meet the requirements of Qualification certification and accreditation requirements for personnel and entities performing welding related work on Eskom plant (240-56246601)
- Dryer NDT testing shall meet the Requirements for NDT on Eskom plant standard. (240-83540088)
- The personnel doing the NDT tests must meet the requirements of Eskom NDT personnel approval for quality related special processes om Eskom plant (240-83539994)
- The specification of the flanges shall meet that of the interfacing piping (existing or new).
- Each dryer and filter vessel (if applicable) shall have a separate permanently fixed data plate in a conspicuous place on the vessel with the following minimum particulars in accordance OHSAct PER.
- Transport and storage shall conform to the following requirements:
  - On delivery the equipment shall be dry externally and internally and ready for installation

- The equipment shall be protected from any damage during transportation
- Each flange nozzle shall be protected by wooden blank to protect against damage
- The equipment shall be stored inside the building or in the ventilated covers. The storage area shall be clean, dry and dust free.

#### 3.5.3.2 Cooling water system

- The existing heat exchanger shall be retained.
- New 80 NB pipes shall be installed for supply and return line of the demineralised water in the cooling water closed loop system.
- The demineralised line top up shall be interfaced with the new closed loop reticulation pipes on the supply side to the compressor.
- The existing open loop (potable water) piping shall be reused.
- The pipes shall meet the requirements listed in Power Plant Water Systems Design Guideline (240-108079430).
- Pressure and temperature transmitters shall be installed in the piping system to indicate pressure drop across the heat exchanger and temperature difference across the compressor.
- These instruments shall have local and remote display capabilities.
- Both the closed loop and open loop pumps shall be replaced with new reliable pumps.
- The pumps shall meet the requirements stipulated in Centrifugal Pumps Specification (240-56030558).

### 3.5.4 Piping design

- The existing intake (between the intake filter and the compressor) pipe shall be reused
- The piping on the compressor discharge side shall be new to accommodate the new dryer design.
- The closed loop cooling water piping shall be 80NB in size, and shall be adjusted to interface with 100 NB heat exchanger flange.
- The following requirements must be met for air piping:
  - Pipes of diameters smaller than 150NB shall meet the requirements of SANS 62
  - Pipes larger than 150NB shall meet the requirements of SANS 719.
  - Flanges connecting to the equipment shall meet the requirements of the interfacing equipment flanges
  - Flanges connecting adjoining pipes shall meet the requirements of SANS 1123: Pipe flanges
  - All piping shall slope in the direction of air flow
  - Interface with users shall be positioned on the top of the pipe in order to prevent moisture carry-over.

  - The piping and fittings for the compressed air supply and distribution shall be designed according to the latest version of the OHS Act PER and the approved international standard EN 13480 (All parts).
  - Fittings (elbows, bends, tees and reducers) between 15NB and 50NB are suited for socket welding as far as possible and are in accordance with ASME B16.11, “Forged Fittings, Socked-welded and Threaded or BS EN equivalents.
  - Fittings of 65NB and larger are suited for butt welding and are in accordance with ASME B16.9, “Factory Made Wrought Butt-welded Fittings” or BS EN equivalents.
  - Mixing of codes (ASME or BS EN) is not permitted. One Code must be selected and used through the system until terminal points. As Duvha is an existing power station the codes used for the existing design will be considered during modifications.
  - Screwed fittings shall only be allowed for 25 NB and smaller.
- In order to satisfy the service conditions the criteria for valve selection are based on the approved international standard EN 13480 (All parts) Piping [20] or ASME B31.3: 2008, “Process Piping”.
- All valves have a minimum pressure rating of 1 000 kPa.
- Valves are in accordance with ASME B16.34, “Valves – Flanged, Threaded and Welding End” or. BS EN equivalents.
- Isolation valves on compressed air:
  - Isolation Valves larger than 32NB shall be flanged stainless steel ball valves. Where diaphragm valves are present on existing power stations these diaphragm valves can be retained.
  - Isolation valves smaller than 25NB shall be lever operated threaded end stainless steel ball valves
  - Flanged gate valves are used for all drain and vent valves
- Isolation valves on cooling water (open and closed circuit):
  - Isolation Valves larger than 32NB shall be flanged resilient seal gate valves or zero offset resilient seal butterfly valves. Butterfly valves larger than 100NB shall be provided with a gearbox.
  - Isolation valves smaller than 25NB shall be lever operated threaded end stainless steel ball valves
  - Flanged gate valves are used for all drain and vent valves
  - Valves must comply to the Cooling Plant Design Guideline.

### 3.5.5 Corrosion protection

- The compressor and dryer components shall be externally coated in accordance with the coating system listed in table below or the Supplier's equivalent coating standard. The Supplier's standard colours may be used.
- All internal components shall be suitable protected against corrosion, considering the environmental conditions.
- All piping shall be galvanised, except for small bore tubing which shall be stainless steel.
- All piping, fittings and flanges shall be hot dipped galvanized in accordance SANS 121: Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.
- Pipes shall be painted according to Duvha Power Station colour coding standard.

**Table 6: Corrosion protection specification for compressors and dryers**

| PROCESS: | ACTIVITY | DFT |
|---|---|---|
| SURFACE PREPARATION: | Abrasive blast-clean to Grade Sa 2,5 (ISO 8501-1). | |
| PRIMER COAT | Apply by brush, airless spray or dipping, one coat Single Pack Etch Primer. | 15 to 25 micrometres |
| UNDERCOAT: | After allowing sufficient time for the primer coat to dry, apply by brush or airless spray, one coat of Alkyd Universal Undercoat. | 20 to 30 micrometres. |
| FINAL COAT: | After allowing sufficient time for the undercoat coat to dry, apply one coat of High Gloss Alkyd Enamel. | 25 to 30 micrometres |
| | Total dry film thickness of coating system: | 60 to 85 micrometres |
| GENERAL: | After installation, lining up, grouting etc., all damage shall be repaired and coatings made good to the Engineer's approval. | |

### 3.5.6 Operating and control

- Equipment in the compressor plant, i.e. compressors, and filters, dryers, cooling towers, flow meters and dewpoint meters shall be interfaced and monitored on the OPCR.

### 3.5.7 Internal Interfaces

- Electrical- Power supply to compressor and associated equipment
- C&I- Control and Monitoring of the compressors

### 3.5.8 External Interfaces

N/A

### 3.5.9 Air and Water Piping

- All piping is categorised in accordance with SANS 347 “Categorisation and conformity assessment criteria for all pressure equipment”.
- Steel piping is hot dip galvanised in accordance with SANS 121 “Hot dip galvanised coatings on fabricated and steel articles – Specifications and test methods” unless otherwise specified in the Works Information.
- All air piping is sized such that the velocity of air does not exceed 9 m/s and it does not exceed the pressure drop of 2.5 to 50 kPa per 100 m of delivery pipe.
- All water delivery piping is sized such that the velocity of water does not exceed 2.5 m/s and it does not exceed the pressure drop of 5 to 50 kPa per 100 m. If a flow velocity is required to be above 2.5 m/s to prevent settling due to the deposition velocity of particles within the piping, a proposal is submitted to the *Employer* for acceptance.
- All water suction piping is sized such that the velocity of water does not exceed 1.5 to 2 m/s and it does not exceed the pressure drop of 5 to 25 kPa per 100 m.

### 3.5.10 Quality and Inspection Requirements

- The *Contractor* shall exercise strict and adequate quality control during all phases of the work.
- The *Contractor* shall prepare suitable quality control plans (QCP’s) and Inspection and Test Plans (ITP’s) for all work carried out.
- The *Employer*, the Inspection Authority, the *Employer* QC Representative and the *Contractor* shall review these QCP’s/ITP’s jointly and the actual scope of quality control and inspection required for the Contract agreed upon.
- The QCP’s/ITP’s shall be subject to the *Employer*’s approval and shall indicate all inspection and test points, the methods and procedures to be used and the acceptance criteria to be applied.

### 3.5.11 Commissioning

#### 3.5.11.1 General Requirements

Commissioning is defined as bringing into service all items of the *works* as specified, meeting the requirements of the functional Works Information, as well as the control system and Plant and Materials performance including all necessary testing and verification of the stated performance.

The *works* covered by the Works Information is installed and complete in all respects by the dates stated in the Accepted Programme. The *Contractor* provides sufficient personnel for the satisfactory and timely commissioning of the equipment.

Before Plant and Materials is placed in service, the *Contractor* certifies that it is in a suitable and safe condition.

The *Contractor* develops a commissioning procedure that is submitted to the *Employer* for acceptance.

Commissioning shall be done in accordance with 240-56356376 On-Site Commissioning for Low Pressure Systems Standard.

### 3.5.11.2 OEM Requirements for Commissioning

1. The OEM plans, co-ordinate and execute all commissioning activities for the electric compressor plant.
2. For all electric compressor, the OEM approves and signs of on:
   i. All commissioning check sheets and tests
   ii. The Operational Acceptance Test report

### 3.5.11.3 Cold Commissioning

1. As a minimum, the cold commissioning activities conducted by the Contractor consists of:
   i. Electrical and instrumentation loop check activities defined in IEC 6238
   ii. All field equipment checks
   iii. Loop checks.
   iv. Drive interface checks
   v. Testing of System functionality

### 3.5.11.4 Functional Tests

The functional tests form part of the cold commissioning of the control system and are to include the checking of all measurement loops, interlocks, sequence controls and analogue controls.

### 3.5.12 Material

- All materials and apparatus that is used for the erection of the installation shall be new and of a good quality. The *Contractor* shall present technical information and brochures for equipment and finishes
- All materials shall be new, undamaged, free of rust or other defects and shall be of the best quality.
- The contractor shall upon the request of the Employer, furnish him with documentary proof to his satisfaction that the materials are of the quality specified. Samples of materials for testing, if required, shall be supplied by the Contractor, free of charge.
- Where applicable the material and apparatus shall in terms of quality, manufacture testing and performance comply with the relevant specifications of the following:
- The South African Bureau of Standards (SANS)
- Eskom Standards and procedures
- Where material or apparatus that are used comply with the standard of any other recognised standards organisation, this should be clearly stated to avoid any ambiguity.
- The Contractor shall provide a certificate from a recognised bureau of standards for material that is used in the contract.
- All exposed equipment and finishes shall be submitted to the Employer for approval in sample form. Samples of all equipment or material shall on request be made available to the Employer before they are installed.

### 3.5.13 Tools and Spares

- The Contractor shall provide tools and spares as required for installation

- The Contractor shall handover any special tools, equipment, software and commissioning manuals to the Employer as required for maintaining or re-commissioning the compressed air system if necessary on completion of the project.

### 3.5.14 Document Requirements and Configuration Management

#### 3.5.14.1.1 Document submission

The Contractor submits a comprehensive time schedule for submission of all documentation including drawings, design calculations, schematics, wiring tables/diagrams, manuals, procedures, quality control plans and any other information for the review and acceptance by the Project Manager. This document is referred to as the Vendor Document Submission Schedule (VDSS). As a general rule, all documents are to be submitted as early as possible to allow for comprehensive review, The Contractor submits a hard copy, 1 soft copy in PDF format and 1 native updatable copy. All design documentation is submitted before the commencement of construction, and also red line drawings and documentation is submitted prior to pre-commissioning to enable the Employer to perform the pre commissioning review as per the Employer's design review procedure 240-53113685.All documents are submitted to the centralised Employer's Documentation Centre, as well as the project representative.

#### 3.5.14.1.2 Transmittal

All documentation submitted, by the *Contractor*, is accompanied by an incoming transmittal using Sharepoint. Upon receipt of the transmittal, the Employer signs to indicate acknowledgement of receipt and returns this to the Contractor.

#### 3.5.14.1.3 Email Subject

The email subject shall as a minimum, contain the following:
***(Project Name_Discipline_Subject)***

#### 3.5.14.1.4 Format and Layout Documents

For consistency it is important that all documents used within a specific domain follow the same layout, style and formatting standard.

#### 3.5.14.1.5 Handover requirements

Contractor is required to handover documentation on the VDSS in such a way that it is compatible with Eskom systems. A checklist will be developed as per Generation requirements for submission.

#### 3.5.14.1.6 Drawings and Operational Manuals Requirements

The creation, issuing and control of all Engineering Drawings will be in accordance to the latest revision of 240-86973501 Engineering drawing Standard. Drawings issued to Eskom will be a minimum of one hardcopy and an electronic copy. All Contractors are 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. Drawings issued to Eskom may not be "Right Protected" or encrypted.

#### 3.5.14.1.7 Manuals

1. The Contractor shall, unless otherwise specified, provide three (3) hard copies and three (3) soft copies in CD-ROMs of approved software format of the operating & maintenance manual of the whole installation.
2. The structure and contents of the operation and maintenance manual shall be as specified in the Contract Preliminaries and approved by the Employer.
3. All commissioning and testing results, certificates and record, photographs as necessary, description of the compressor system and equipment details.

The manual should include the following topics

- User Operating & maintenance manuals
- “as built” drawings
- Electrical wiring diagrams
- Planned maintenance schedule / procedures
- Certificates for IP Rated equipment
- Guarantee’s
- Disposal certificates
- Critical spares list

#### 3.5.14.1.8 Occupational Health and Safety Plan

The Contractor complies, procures and ensures the compliance by its Employees, Agents, Subcontractor’s and Mandatories with the provisions of the Occupational Health and Safety Act 85 of 1993 (as amended) and all regulations in force in terms of that Act.

### 3.5.15 Plant Codification and labelling

Plant identification and coding shall be done by the CM CoE according to Eskom approved procedures. The contractor will have to update the P&IDs as per coding recommendations issued by Eskom CM CoE.

The Unit will be broken down based on its functional location; Eskom Configuration Management will define the Plant Breakdown Structure up to component/tag level according to the approved Duvha Power Station coding standard. Configuration Management CoE shall be responsible for/to:

- Coding in a phased approach from concept design and progressively more detailed until completely coded in detail design.
- Develop, manage and control the Plant Breakdown Structure up to the level where plant operating and maintenance activities are performed.
- Provide plant identification codes to the contractor.
- Manage and administer all plant identification related communication.
- Ensure there are no duplicate plant codes.
- Perform plant walk-downs per system to verify plant labelling during construction and commissioning.
- Issue plant verification certificate.

### 3.6 Identification, Coding and Labelling

The Plant Breakdown Structure (PBS) will be managed within the CM CoE PBS Database and approved and authorised for use on the project.

The baseline of the PBS will be derived from the current SAP FLOC and used as the starting point for managing changes to the PBS.

The input template will be used to verify coding, descriptions and abbreviated descriptions before being imported into the PBS Database.

This template is the interface to the consultants and contractors for ensuring the integrated and correct coding is applied throughout the project.

The PBS Database will form the basis for managing the AKZ Coding and Certification Process.

#### 3.6.1 Manual Requirements

1. The operating and maintenance instruction manuals shall be prepared in accordance with the latest edition of the VGB-R 171e “Guideline for the supply of technical documentation for fossil-fired and regenerative power stations” including Appendixes 1-8. The instruction manuals are required to give a full technical description of the equipment concerned and to cover all aspects of erection, operation and maintenance.
2. Before the operation and maintenance manuals are handed over the *Contractor* must present a training course to the *Employer’s* staff. Any concerns / omissions that are listed during such a training session must be incorporated before final submission.
3. The maintenance manual should contain procedures for hydrostatic pressure test for pressure equipment including drawings and instructions.
4. The maintenance manual should include a list of suggested critical spares for stock keeping

#### 3.6.2 Tender Returnables

1. The *Contractor* shall be responsible for executing the required work in accordance with this tender specification and shall remain responsible for any discrepancies, errors or omissions of any sort on the submitted data, program, layouts or shop drawings, whether it has been approved or not approved.
2. When the standards of the equipment specified cannot be met in terms of specific design requirements; substitution or alternative equipment may be considered provided that the substituted equipment does not reduce the intended performance, operation, duty-rate, and redundancy and reliability requirements of the specification.
3. Deviations or substituted equipment not clearly shown and detailed in the Deviation Schedule, shall not be considered or accepted and shall not limit the *Contractor’s* responsibility to provide equipment in terms of the specification.
4. Should approval for the revised equipment not be obtained from the *Employer,* the *Contractor* shall be liable for all costs associated with providing equipment in terms of the specification.

#### 3.6.3 Condition monitoring

Local monitoring for the compressor must be available by a local instrument panel which shall display critical system parameters.

### 3.6.4 Design Acceptance

The *Contractor* is the Design Authority as defined in the Design Review Procedure (240-53113685). The *Contractor* is responsible for following this design procedure and conducts all the design reviews as specified in this procedure.
All designs to be submitted for acceptance to the *Employer* and the Employers Inspection Authority prior to manufacture. Manufacturing and material procurement may only start after these acceptances are obtained.

## 4. ELECTRICAL REQUIREMENTS

### 4.1 ELECTRICAL SYSTEM OVERVIEW

The control air and service air at Duvha Power Station is supplied from a common compressor plant. The plant comprises of four electric compressors under normal operation and two diesel compressors for emergency purposes. The electrical compressors are fed from the 3.3kV Station Services Boards. The associated compressor auxiliaries are fed from the 400V Water Plant South Boards as indicated in figure 1 below.

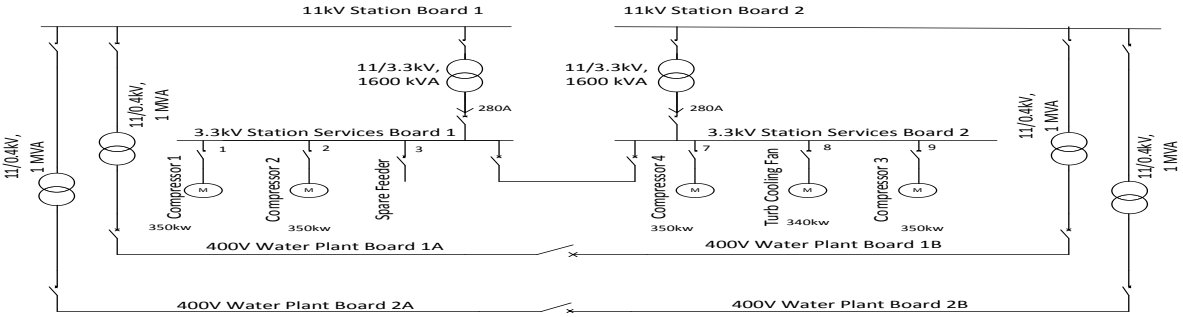


**Figure 1 Existing Electrical Reticulation**

The existing compressor 1 and 2 are fed from the 3.3kV Station Services Board 1, circuit 1 and 2, while compressor 3 and 4 are fed from the 3.3kV Station Services Board 2, circuit 7 and 9 respectively. Similarly, the existing compressor 1 and 2 auxiliaries are fed from 400V Water Plant Board 1A, CFS isolators, circuit 28 and 29 via the Compressor Cooling Pump Panels, while compressor 3 and 4 auxiliaries are fed from 400V Water Plant Board 1B, CFS isolators, circuit 106 and 103 via the Compressor Cooling Pump Panels respectively. The Compressor Cooling Pump Panels supply both the Cooling Water Pump Motors and the Main Compressor Control Panel which supplies all the other compressor auxiliaries.

### 4.2 ELECTRICAL SCOPE

The existing compressors 2, 3 and 4 and associated auxiliaries shall be replaced with new compressors and auxiliaries of the same capacity under the Low Pressure Services scope of work. It is assumed the new power requirements for the new equipment shall not exceed the power requirements for existing equipment, and hence the existing point of supply from the *Employer* shall be retained.

The *Employer* shall provide electrical point of supply, cabling including cable racks from the source (MV and LV Switchgears) to the new compressors and the Compressor Cooling Pump Panels. The new compressors and compressor auxiliaries shall have a dedicated Main Compressor Control Panels. The Main Compressor Control Panels for the compressor auxiliaries shall be fed from the existing Compressor Cooling Pump Panels.

### 4.2.1 Electrical Contractor responsibilities

The Contractor shall modify the existing Compressor Cooling Pump Panels if necessary and also provide and terminate the power cables including cable racks from the Compressor Cooling Pump Panels to the Main Compressor Control Panels, excluding the cabling and cable racks for the water cooling system. The *Contractor* shall also provide and terminate the power cables from the Main Compressor Control Panels to the field equipment and ensure that the compressor auxiliaries are properly earthed to the existing earth mat in order to maintain the earth bonding of all electrical equipment.

The Contractor shall terminate the existing cables from the MV Switchgears to the new compressors and ensure that the new compressors are properly earthed to the existing earth mat in order to maintain the earth bonding of all electrical equipment.

The Contractor shall perform earth resistivity and earth continuity tests for the new equipment to determine the status of the earthing point used. The earthing and lightning protection will comply with the Earthing and Lightning Protection Standard (240-56356396). In addition the lightning protection will comply with SANS 61024 and SANS 10313.

It shall be the responsibility of the *Contractor* to ensure that all the new equipment are interfaced to the existing electrical network and properly earthed before the plant is commissioned.

The Contractor shall provide designs calculations for cable sizing for the compressor auxiliaries and also submits updated electrical documentations (control panel schematic drawings, control panel general arrangements, termination schedules, updated switchgear schedules for Compressor Cooling Pump Panels, cable schedules, summary sheets, etc.) to the Employer for review and acceptance before procurement.

### 4.2.2 Applicable electrical standards

The electrical designs shall comply with the following electrical standards as a minimum:

- Requirements for Control and Power Cables for Power Stations Standard (240-56227443)
- Earthing and Lightning Protection Standard (240-56356396). In addition the lightning protection will comply with SANS 61024 and SANS 10313.
- Procurement of Power Station Low Voltage Motors Specification (240-57617975)
- Transport of Power Station Electric Motors Standard (240-56361435)
- Storage of Power Station Electric Motors Standard (240-56360387)
- LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltage up to and Including 1000V AC and 1500V Standard (240-56227516)
- Air-Insulated AC Metal-Enclosed Switchgear and Control Gear for Rated Voltages above 1kV (240-56227573)
- MV and LV Protection Standard (240-56357424)
- SANS 1973 (Low Voltage switchgear and Control gear Assemblies)
- SANS 10142 (The wiring of Premises)

# 5. C&I REQUIREMENTS

## 5.1 SYSTEM OVERVIEW

The C&I requirements for the electric compressors and dryers is to control, operate and monitor the system. The system is monitored and controlled from the Outside Plant Control Room (SCADA) and locally from the local control panel. The OPCR performs two main functions that of displaying data relating to the operation of the compressor plant to the operators, as well as the forwarding the data to the station historian (VA). There is a Marshalling PLC which communicates with all of the control equipment that forms part of the outside plant SCADA network, collecting data from each at regular intervals.

The new electric compressors to be installed come with an on-board controller and the instrumentation. The on-board controller does not cater for the electric compressor auxiliary therefore an additional PLC with a Local Control Panel per compressor is required for control, monitoring and protection of the auxiliaries. The PLC to be installed is the Siemens S7 for standardization purposes. For each newly installed electric compressor Siemens S7 PLC ( PLC that caters for the auxiliaries) and the on-board electric compressor controller is housed in one control panel and be located next to each electric compressor. The Master Controller location will remain as is, in the compressor plant equipment room.

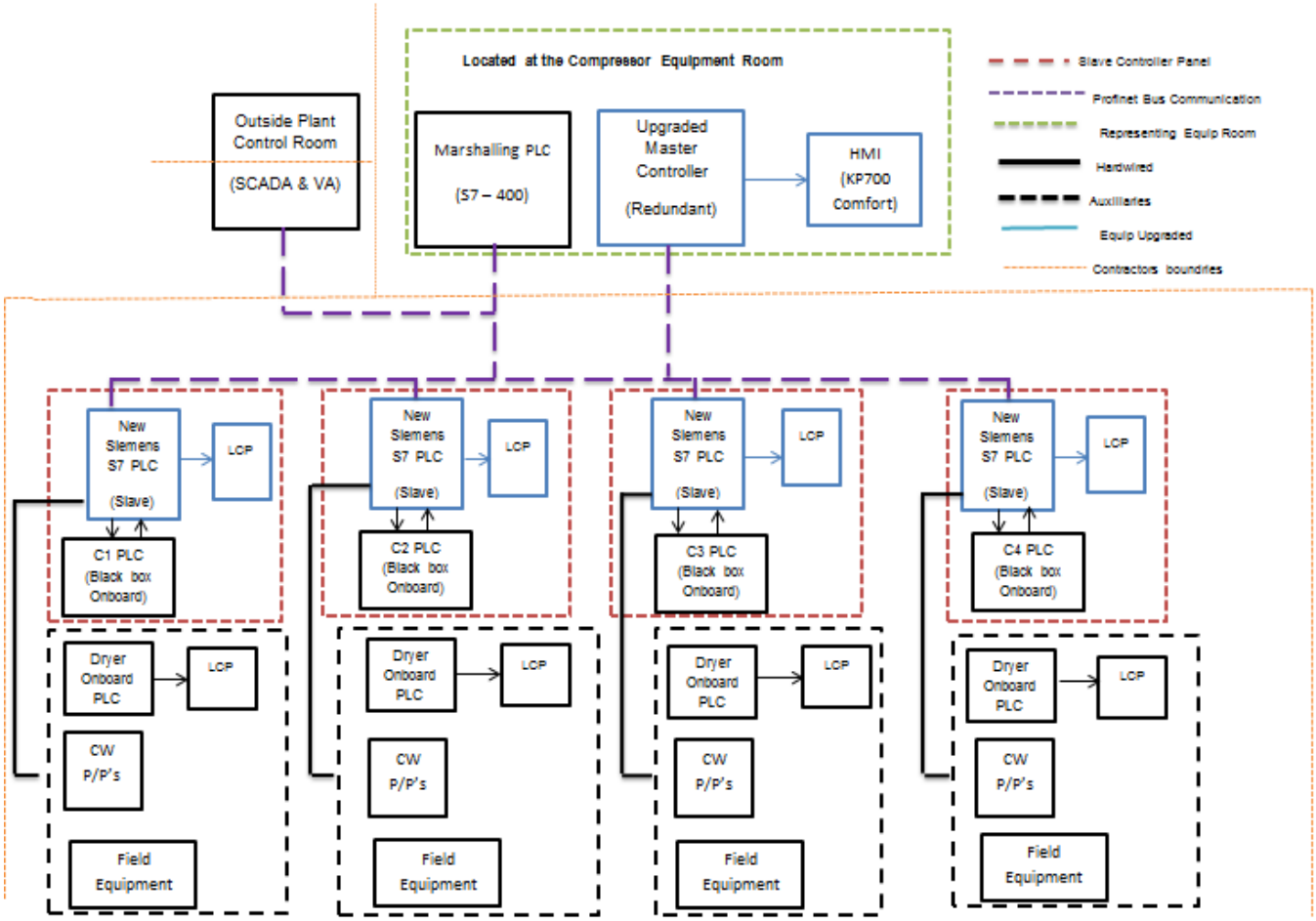


**Figure 2 As Required Electrical Compressor Configuration**

## 5.2 OPERATING PHILOSOPHY

Three compressors shall be installed in the compressor house. Each compressor shall be installed with a respective dryer, and two cooling water pumps. This set of equipment shall be referred to as a compressor train. Three compressors shall be operational with one compressor on standby. The compressor shall keep the system pressure between 450 kPa and 750 kPa. The system protections shall be sufficiently specified in the detailed design phase. In the event that a substation board is lost the diesel compressors shall kick in to supplement air supply.

Each compressor and dryer shall be supplied by the contractor as a fully packaged unit with its own standard on-board controller and on board instrumentation. Each compressor train shall have a slave controller which interfaces with the cooling water pump drives, the compressor controller and the dryer controller. This slave controller will be integrated to communicate with the master controller in the compressor house. The compressor house will have one master controller for all four compressors.

The compressor plant shall be fitted with the following measurements for control and local and remote indications as a minimum:

- Each air filter shall be fitted with differential pressure measurement device to signal when filter replacement is required.
- Each compressor shall be able to receive a signal from the discharge pressure transmitter to enable the automatic stopping/starting of the compressor.
- Each dryer unit will be fitted with dew point measurement instrumentation.
- Each dryer unit outlet pipe will be fitted with flow measurement instrumentation.
- The cooling water supply and return pipelines shall have temperature measurement.

### 5.2.1 Operating description for normal operating conditions;

#### 5.2.1.1 Auto mode

The compressors will be operated from the Master Controller in Auto mode, and from the Slave Controller in Manual mode. Sufficient compressors will be controlled (i.e. stopped or started) so that the required system air pressure is ensured. Should the duty selected compressor fail to start or not be able to supply sufficient air, the Master Controller will start the next duty selected compressor in the duty sequence. Auto-rotation duty cycling determines the sequences in which the stand-by compressor shall operate. In the auto mode compressors will stop/start without operator intervention.

#### 5.2.1.2 Manual mode

The manual mode is initiated by the operator after which the control resides with the operator. The master controller can be set to the local control mode which means that control is transferred to the slave controller. Drives can then only be started or stopped from the slave controller and not from the master controller. The operator will sequentially start the compressors in sequence to put the plant in a fully operational state. The slave controller will, however, control all respective compressors' auxiliary sequence interlocking and protection. Similarly to the remote mode, the slave controller will continuously signal to the Slave HMI the status of the plant and generate all alarms. In the event of midstream equipment failing to start or tripping due to a fault condition, the slave controller will inhibit any further starting of subsequent equipment until the fault is cleared.

#### 5.2.1.3 Start-up sequence

After the running compressor has been selected and the sequencing controller has been set to auto mode, the system will start automatically in a logical sequence with all protections and interlocks activated. The Slave Controller in the low pressure services will control all sequences. In the event of

equipment failing to start or tripping during the run up, the slave controller will automatically trip the faulty equipment and inhibit any further sequential starting of equipment. The Slave Controller will at all times, signal to the Slave HMI the status of all drives and transmits alarms for any equipment or primary device which is in a fault or abnormal state. The following start up sequence shall be followed:

- The dryer shall start-up
- The cooling water pumps shall start up
- The compressor shall start-up

#### 5.2.1.4 Shut-down sequence

Should a fault condition occur in the compressor train (any operating component) whilst the train is in a fully operational/running state, all equipment in the train will stop in the required sequence to ensure a safe shut-down. The controlled shut-down of the system will be in sequence to ensure there isn't a compressor trip. The following sequence shall be followed:

- The compressor shall stop running
- The dryer shall stop running
- The cooling water pumps shall stop running

#### 5.2.1.5 Maintenance Mode

The purpose of this selection is to run individual items of the plant out of sequence. The operator will direct the slave controller to release the plant drives (to be repaired) from any sequence interlocks with adjacent equipment, i.e. the equipment in question may be started and run up without interfacing with the upstream or downstream equipment. All plant and personnel safety protection systems will be fully operational in the maintenance mode.

#### 5.2.1.6 Operating Concept

The plant shall allow the following controls from the master controller as a minimum:

- Stopping/starting of each compressor;
- To be able to be switched to automatic/manual mode. In the manual mode the compressors shall be able to be stopped/started manually from the Slave Controller;
- System start button which will be used in the automatic mode;
- Compressor duty selector.

## 5.3 C&I SPECIFICATION

### 5.3.1 Field Equipment

#### 5.3.1.1 Field Requirements and Installations

The contractor to ensure that field installation inclusive of instrumentation, junction boxes, cabling and racking shall be properly labelled with permanent labels that will not be effortlessly removed. All labelling shall be consistent throughout the compressor plant.

Field device labels must be made of stainless steel, text on labelling be engraved as per the 240-563554: "field installation standard", whilst also adhering to SANS 10108 Hazardous area classifications.

All equipment shall be installed in accordance with the manufacturer's instructions, listed standards in Section 7and industry best practices. The equipment layout is such that when mechanical work is

performed, no C&I equipment is damaged. Where harsh environmental conditions are not avoidable, the field equipment is designed for operation in that environment must be used (i.e. all field equipment is selected according to the environment in which they will operate in). All field equipment are to be 24V DC powered and signal transferred to the local control panel ,master control panel for control and monitoring and to the Outside plant control room (SCADA) for monitoring purposes only. All field equipment excluding junction/splitter boxes and their electrical connections is rated IP 66 and operates over an ambient temperature range of: -10°C to 70°C.

#### 5.3.1.2 Transmitters

All transmitters supplied as part of the *Works* are compatible with the relevant primary measuring element. All transmitters have built in diagnostics that constantly monitor and alarm any faults on transmitter. The transmitter and its installation position are labelled such that if the transmitter is removed the label is still visible in the plant. The labels are provided as per the labelling requirements defined ETS004 Rev 4 – AKZX Plant Location Labelling

Transmitters are suited and adequate to fulfil the following function and accuracy requirements:

- All digital transmitters have built in local digital indicators that can be programmed to indicate the range and specified engineering units for the process. All transmitters provided have a high turn down ratio so that the minimum possible different types of transmitters can be used for all the applications.
- All transmitters conform to a minimum accuracy of span of 0.05%. All transmitters are supplied with a drift free guarantee period of 10 years or better
- It is ensured that the installation of the transmitters:
    i. Allow for safe and easy access for maintenance and calibration
    ii. Allow for the environmental conditions
    iii. Allow for the removal of equipment for maintenance in the vicinity of the transducer

#### 5.3.1.3 Cabling & Racking (Cable Installation and Routing)

All Cable Installation and instrumentation cables, shall be flame retardant low smoke type, and comply with 240-56227443: Requirements for Control and Power Cables for Power Stations Standard. Instrument cabling to be installed with due respect for safety, reliability, access, maintenance, environmental conditions and best practices. All cabling must be suitably protected against mechanical damage, chemicals, dust build-up and heat.

#### 5.3.1.4 The contractor to take note of the following for cabling design:

a. Instrument cabling defined as cabling between field instrumentation and junction boxes.

b. Power supply cabling is defined as being cabling required to power field equipment.

c. Cables shall only be terminated in instruments, junction boxes. No intermediate cable joints are permitted.

d. Cables connected to instruments are installed with a loop of cable to provide sufficient slack for re-making the cable connection if the instrument is removed and to allow for removing the instrument without electrical disconnection.

e. Instrument cables are routed separately from electrical power cables and crossovers that bring signal and power cables into close proximity are made at right angles.

f. The routes for power supply cabling and the racking are of a consistent and integrated design taking into account different cabling and racking routes for common modes of failure, and the redundancy concepts of the mechanical plant design.

g. The *Contractor* provides 20% spare installed capacity in all multi-core cables, rounded up.

h. The terminal blocks for the junction box terminations shall comply with SANS 60947-7-1 and 60947-7-2.

UVG cable and Field/Trunk Cable installations will be used to transfer signals from the field equipment to the Slave Controller according to 240-56355815: Cabling standards.

#### 5.3.1.5 Junction Box

New junction box is to be provided to terminate all instrumentation. Junction boxes shall be properly labelled with permanent labels that will not be effortlessly removed and to also have enclosure material of 3CR12 stainless steel grade or higher and will be powder coated using RAL7035. Junction boxes are rated IP 65. The contractor to comply with this standard 240-563555: Junction box and cable termination.

#### 5.3.1.6 Impulse Piping

Non-destructive testing is conducted on all impulse piping welds. The results of all non-destructive testing on impulse piping welds must be accepted by the Employer's representative. All pipe work provided is inclusive of supports, transition pieces to primary isolating valves and drains to provide complete impulse, equalising and blow-down lines for all instruments. The drains impulse piping provided is 1.3 meters from the manifold with tips facing away from the transmitter face.

#### 5.3.1.7 Slave and Master Controllers

The Controllers provided by the Contractor meets the following requirements:

i. Siemens S7 PLC technology.

j. Accept analogue input measurements from the field based on two-wire 24 V DC, 4 - 20 mA signals.

k. 20% spare I/O capacity at hand over

l. The Processors are configured to be dual modular redundant.

m. Redundant processors are capable of being replaced on-line with no effect on the operating plant.

n. All analogue and digital signals used for operator information, control, protection, interlocking, calculations or plant history are continuously monitored for validity.

### 5.4 SYSTEM PERFORMANCE

#### 5.4.1 Life Expectancy

All equipment and control components are supported and maintainable until the end of the year 2037.

## 5.5 GENERAL REQUIREMENTS FOR THE WORKS (C&I WORKS)

The *Contractor* is required to provide the following Engineering Documentation (C&I Design), accordingly:

- Wiring diagrams
- Cable Schedules and Cable Routing
- Termination Schedule
- Functional Logic Diagrams
- Drive & Actuator Schedule
- Instrument Schedule
- Panel Interface List
- IO Block Diagram
- Limits of Supply and Services
- Operating and control philosophy of the upgraded system to be provided
- PLC's diagrams and P&IDs to be provided of the upgraded system
- Standard equipment operating manuals
- Maintenance Manuals & Procedures
- Data sheets
- Mechanical hook-ups drawings
- Training manuals
- Network architecture and configuration drawings
- Spare capacity report
- PLCs internal equipment connection and wiring drawings
- PLCs configuration settings

### 5.5.1 Tests

#### 5.5.1.1 FAT

Testing shall adhere to at least the minimum requirements set by IEC 62381. The *Contractor* is to conduct a pre-factory acceptance test at the *Contractor*'s factory in preparation for the FAT. The *Contractor* is to completely test and verify the performance of the Duvha Electric Compressor Control System. During FAT, the *Contractor* demonstrates that the Duvha Electric Compressor System meets the requirements of this Technical Specification.

#### 5.5.1.2 Site Integration Test (SIT)

The SIT only begins once the following has occurred:

- All electric compressor control equipment has been installed in the final locations and connected to permanent power supplies
- All interfaces to 3rd party systems (OPCR and VA) have been implemented
- The SIT is carried out before plant commissioning commences to ensure:
  i. Correct performance of the Electric Compressor Control System
  ii. Safety of plant and personnel
  iii. Compliance with the Technical Specification
- As a minimum, the SIT testing and inspection activities provided by the Contractor consists of:
  i. Site integration and site acceptance activities defined in IEC 62381
- In the event of an error in any test (hardware or software) the fault is logged, analysed and resolved
- 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
- Major faults major faults may lead to the termination of the SIT
- 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

### 5.5.2 Change over from existing L2 network to new PROFINET network

- Existing PROFINET network: Currently this network consists of the bunker level PLCs, the Marshalling PLC and the Driefontein Dam PLC
- The Marshalling PLC (located at the LP Services building) has two existing ports. The existing ports are for the L2 network and the PROFINET network. The change over from L2 network to new PROFINET network will be accessed via the Marshalling PLC on the PROFINET network.
- The fibre optic cables used for the L2 are still in good condition and they can be reused for PROFINET
- Currently only two old electric compressors are running and are operated locally from their individual slave controllers, therefore the Marshalling PLC will be programmed to cater for the new electric compressors. These changes are to ensure that the process data sent to the Marshalling PLC is sent to the OPCR SCADA
- The Contractor should be able to roll back to the existing L2 if the changeover is not successful
- A detailed risk assessment must be conducted by the Contractor before a changeover to the new PROFINET is done
- The detailed risk assessment must be reviewed and accepted by the Employer

## 5.6 APPLICABLE C&I STANDARDS

Refer to Section 7

# 6. CIVIL AND STRUCTURAL DESIGN

## 6.1 CIVIL OVERVIEW

Each existing compressor is supported by a 3000mm x 1500mm concrete plinth. Each plinth supports a compressor and controller. The compressor is connected to a dryer with each its own 1100mm x 2370mm plinth. The compressor plinths are surrounded by trenches which makes modifications to the plinths difficult.

## 6.2 CIVIL SCOPE

The old C18MX3 compressor and the new C400 compressor have a similar weight, but seeing as the footprint for the new C400 compressor is smaller it has a bigger pressure on the plinth. The pressure increase on the plinth is 36% from the C18MX3 to the C400 compressors. The years of oil spillage on the concrete plinth can possibly reduce the strength of the concrete and should also be taken into account.

The new Hankison PSA dryers have similar weight as the older dryers and can be placed on the same plinths. The base dimensions for the Hankison PSA dryers are larger and modifications shall be made. The other proposed dryers have increased weights of 34% and more. These dryer's base footprint is also significantly larger than the current dryer plinths and the contractor shall be required to design a modification for the supports or replace the support with new structures.

### 6.2.1 Civil contractor responsibility

Should the supports not have sufficient capacity, the *Contractor* shall be required to design a modification for the supports or replace the supports with new structures that meet the load requirements. The supports to be assessed include the compressor plinths, supporting ground slab and the dryer plinths.

The design process shall follow the Structural Design and Engineering Standard 240-56364545, the steps below shall outline the deliverables specified:

1. The Contractor shall perform adequate calculations and design checks to show that the existing compressor plinths have the capacity for the new compressors. Vibrations have to be taken into account.
2. The Contractor shall perform adequate calculations and design checks to show that the existing dryer plinths have the capacity for the new dryers and that the dryers fit on the plinths.
3. The concrete strength of the plinths has to be checked by the contractor if deemed necessary.

# 7. CODES AND STANDARDS

| Code | Title |
|---|---|
| 240-54937450 | Fire Protection and Life Safety Standard |
| 240-54937439 | Fire Protection/Detection Assessment Standard |
| SANS 347 | Categorization and conformity assessment criteria for all pressure equipment |
| SANS 10400 | The application of the National Building Regulations |

| | |
|---|---|
| 240-56364545 | Structural design and engineering standard |
| OHSAct | Occupational Health and Safety Act 85 of 1993- Pressure Equipment Regulations |
| 240-105929225 | Compressed Air System Standard |
| SANS 1200 Series | Standardized specification for civil engineering |
| 240-56355535 | Process Calibration Equipment Standard |
| 240-56355754 | Field Instrument Installation Standard |
| 240-56355815 | Field Instrument Installation Standard for Junction Boxes and Cable Termination |
| 240-56355843 | Pressure Measurement Systems Installation Standard |
| 240-56227443 | Requirements for Control and Power Cables for Power stations Standard |
| 240-56356396 | Earthing and Lightning Protection Standard |
| SANS 62305 | Protection against lightning |
| SANS 10313 | Protection against lightning — Physical damage to structures and life hazard |
| 240-57617975 | Procurement of Power Station Low Voltage Motors Specification |
| 240-56361435 | Transport of Power Station Electric Motors Standard |
| 240-56360387 | Storage of Power Station Electric Motors Standard |
| 240-56227516 | LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltage up to and Including 1000V AC and 1500V Standard |
| 240-56227573 | Air-Insulated Withdrawable AC Metal-Enclosed Switchgear and Control Gear for Rated Voltages above 1kV up to and including 52kV |
| 240-56357424 | MV and LV Protection Standard |
| SANS 1973 | Low Voltage switchgear and Control gear Assemblies |
| SANS 10142 | The wiring of Premises |
| 240-56355728 | Human Machine Interface Design Requirements Standard |
| 240-56356376 | On-Site Commissioning for Low Pressure Systems Standard. |

## 8. AUTHORISATION

This document has been seen and accepted by:

| Name & Surname | Designation |
|---|---|
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| Piet Swanepoel | PEIC |
| Nhlanhla Ngcobo | System Engineer- Duvha Power Station |
| Nemalen Chetty | Senior Engineer – LPS CoE |

## 9. REVISIONS

| Date | Rev. | Compiler | Remarks |
|---|---|---|---|
| November 2016 | 0 | Prenolan Gangan | First Draft for Review |
| February 2017 | 1 | Prenolan Gangan | Final Revision |

## 10. DEVELOPMENT TEAM

The following people were involved in the development of this document:

David Kunene

Rudzani Monnahela

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Nomfundo Mdlokovana

Nhlanhla Ngcobo

## 11. ACKNOWLEDGEMENTS

Nhlanhla Ngcobo
Nelly Hlope

## 12. APPENDIX A- LIST OF APPLICABLE DRAWINGS

| Drawing Number | Description |
|---|---|
| 0.57/7493 | Control & Service air UM446 compressor integral pipework |
| 0.57/40835 | New Centac Compressor in LP pumphouse pipework arrangement & sections |
| 24.57/47314 Sheet 1 to 18 | Control & Service air compressor, dryers, receivers and reticulation system |
| | |