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ASSET DESIGN				
1.1. GENERAL SPECIFICATIONS AND WORKS INFORMATION				
Project Name:	MAKHATHINI 132/22-kV SUBSTATION: 2 x 3MVAr 22kV CAPACITOR BANK C-TYPE FILTER ESTABLISH			
Project No.'s:	ID	ET-STM-1712-4442-01	WBS	CDE05363
Document Identifier:	PW	ER00024-00-P05#1.1-01	Rev	1
Division & Operating Unit:	Distribution – Kwa-Zulu Natal Operating Unit			
Section:	Asset Creation – Network Engineering and Design			
Department:	Asset Design			
Project Category:	Strengthening			
Project Lifecycle Phase:	Detail Design			

Compiled and Checked by:		Authorised by:	
Name:	Jayant Raghubir	Name:	Preshnee Chetty
Designation:	Senior Design Engineer	Designation:	Design Manager
Date:	28 October 2024	Date:	28 October 2024
Signature:		Signature	

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## TABLE OF CONTENTS

<b>FOREWORD .....</b>	<b>3</b>
<b>TEMPLATE REVISION HISTORY .....</b>	<b>3</b>
<b>DOCUMENT REVISION HISTORY .....</b>	<b>3</b>
<b>1. EXECUTIVE SUMMARY .....</b>	<b>4</b>
1.1. Background to the Project.....	4
1.2. Interface with associated projects .....	4
1.3. Objectives of the works .....	4
<b>2. SITE INFORMATION.....</b>	<b>4</b>
2.1. Description of the Site and Access .....	4
2.2. Existing infrastructure (buildings, structures, plant & machinery) on the site .....	5
2.3. Subsoil information.....	5
<b>3. DESCRIPTION OF THE WORKS .....</b>	<b>5</b>
3.1. Introduction.....	5
3.2. Works Information: List of Drawings .....	5
3.2.1. Standard Drawings .....	5
3.2.2. Project Specific Drawings.....	5
3.3. Works Information: Standards and Specifications .....	6
3.4. Scope of Work.....	6
3.5. Construction Program and Constraints (Constructability).....	7
3.5.1. Stage 1: Civil Work.....	8
3.5.2. Stage 2: Outages / Live Work & Energisation of the Capacitor Bank .....	8

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<b>1.1. General Specification &amp; Works Info: Makhathini 22-kV Cap Bank Establish</b>	<b>Template Identifier</b>	<b>240-129712383</b>	<b>Rev</b>	<b>2</b>
	<b>Document Identifier</b>	<b>ER00024-00-P05#1.1-01</b>	<b>Rev</b>	<b>1</b>

## FOREWORD

This document is the General Specification and Works Information for the **Makhathini 22-kV Filter Capacitor Bank Establishment** and covers both Civil and Electrical requirements. It also covers the Quality Control and Quality Assurance requirements of the project. It contains information on the scope of works and staging of the project for ease of construction. This document is to be read in conjunction with the Detailed Specification for the Civil and Electrical works.

## TEMPLATE REVISION HISTORY

REV	Date	Compiled by	Comment
0	July 2014	J. K. Raghubir	Previous Detailed specification split into General, Electrical and Civil Sections. Document re-worded. New ISO template used.
1	Sept 2014	J. K. Raghubir	Only one Senior Design Engineer authorisation signature required.
2	October 2019	J. K. Raghubir	Authorisation & Review dates changed

## DOCUMENT REVISION HISTORY

REV	Date	Compiler	Comment
0			

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## **1. EXECUTIVE SUMMARY**

*(Section C3.1 of the NEC3 Engineering and Construction Short Contract)*

### **1.1. Background to the Project**

Eskom Distribution CentralEast Cluster in Kwa-Zulu Natal has severe voltage constraints on certain sections of the high voltage network being supplied from Normandie 400/132/88kV Transmission Substation. The voltages experienced on the 132kV busbars at Candover, Makhathini, Nondabuya, Ndumo and Mkuze substations are below NRS-048 acceptable limits. Network Planning has therefore proposed that strategic filter/capacitor banks be installed for VAR compensation on the MV Busbars at Pongola, Pontus and Makhathini Substations, which will assist with reactive power injection thus improving the HV Busbar voltages on the system. With the current load growth in the areas around these substations and with Gezisa Substation taking load in 2018/19, the busbar voltages will further drop below the minimum NRS acceptable limits until the system collapses.

### **1.2. Interface with associated projects**

The following projects are associated with the works as described:

- a) ET-STM-1712-4441-01 Pongola 10Mvar capacitor bank & filter establish
- b) ET-STM-1712-4442-01 Makhathini 6Mvar capacitor bank & filter establish
- c) ET-STM-1712-4443-01 Pontus 6Mvar capacitor bank & filter establish

### **1.3. Objectives of the works**

The purpose of the works is to establish a 22kV Filter/Capacitor bank at Makhathini substation to improve the voltage on the network.

## **2. SITE INFORMATION**

*(Section C4.1 of the NEC3 Engineering and Construction Short Contract)*

### **2.1. Description of the Site and Access**

Makhathini 132/22kV Substation is situated in the Empangeni Sector and is maintained by Jozini Customer Network Centre. The substation is located north of KZN 5km from the centre of Jozini town. Substation is not accessible using the newly constructed main tarred road as the two levels between Eskom access road and P499 Road are at least 500mm different in terms of height. therefore, low bed or any vehicle will not be able to access. The site may be accessed through the back tarred road (D9) from Jozini to Makhathini and Eskom Access Road will tee off from this tarred road (D9), this new access road may need to be upgraded to meet the requirements of the Lowbed should it be necessary; however, it is fairly in good condition for normal trucks and vehicle, not for low bed or Abnormal vehicles or trucks.

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	Document Identifier	ER00024-00-P05#1.1-01	Rev	1

## **2.2. Existing infrastructure (buildings, structures, plant & machinery) on the site**

Makhathini 132/22kV substation with 132kV line bays, busbar, transformer bays and 22 kV feeder bays with the associated infrastructure exists. Two new 22kV bays are required to be constructed for the capacitor banks. For more details refer to the site, level, and drainage plan.

## **2.3. Subsoil information**

There are boulders and rock on capacitor bank 1 bay. The contractor should anticipate breaking rock and removing boulders closer to the ground surface. The estimated cost should be included in their tendering price. There is existing Subsoil Drainage on Capacitor bank 2 bay as well as earthing in an around where the foundations for capacitor bank 2 are to be installed. The contractor should be careful when installing these foundations. Refer to the Geotech report and Civil Detailed Specifications.

## **3. DESCRIPTION OF THE WORKS**

*(Section C4.1 of the NEC3 Engineering and Construction Short Contract)*

### **3.1. Introduction**

This project shall be carried out in full accordance with this detailed scope of work, all other technical specifications referred to and the relevant drawings provided by Eskom (refer attachments). This project shall conform in all instances to the Occupational, Health and Safety Act and Regulations, No. 85 of 1993, and any amendments thereto, including the Safety Specification referred to in Regulation 4 of these statutory requirements. The contractor shall provide a Health and Safety Plan in compliance with the Occupational, Health and Safety Act and Regulations, No. 85 of 1993, based upon but not limited to the Health & Safety Specification included in this package.

### **3.2. Works Information: List of Drawings**

#### **3.2.1. Standard Drawings**

Refer to addendum 2.4 of the project package for the Civil Standard Drawings and Index and addendum 3.5 for the standard electrical power plant equipment drawings and index.

#### **3.2.2. Project Specific Drawings**

Refer to addendum 1.3, 2.5 and 3.6 of the project package for the Project Specific Drawings Cover sheet. Project specific drawings will further reference standard and detail drawings. Some drawings may contain both Works Information and Site Information.

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	<b>Document Identifier</b>	<b>ER00024-00-P05#1.1-01</b>	<b>Rev</b>	<b>1</b>

### 3.3. Works Information: Standards and Specifications

Refer to addendum 2.6 for the Civil Standards and Specifications Index and addendum 3.7 for the electrical Standards and Specifications Index. All Eskom Standards and Specifications are typically revised every 5 years and available on request.

### 3.4. Scope of Work

- a) Establish the terrace, drainage and extend the existing earthmat for the capacitor bank 1 yard. The terrace for capacitor bank 2 is existing.
- b) Establish foundations with earthing, supply and install steelwork and equipment for 2 x 22kV capacitor bank bays 1 & 2 (busbar isolator and combo breaker with surge arrester).
- c) The Capacitor Bank Bay equipment (22kV isolator and combo breaker with surge arrester) shall be supplied and installed by the contractor in accordance with Eskom equipment specifications.
- d) Supply and install all conductors (jumpers), clamps and associated equipment for the 22kV capacitor bank bays 1 and 2.
- e) Design and construct foundations for the 22kV filter/capacitor banks and associated equipment.
- f) Establish 1.8m wire mesh safety fencing around each capacitor bank with its associated reactor and resistor. This fence shall be connected to the main earth mat.
- g) Establish an oil bund for each capacitor bank with its associated reactor and resistor.
- h) Establish a concrete slab within the bunded area for each capacitor bank with its associated reactor and resistor for prevention of weeds and ease of maintenance.
- i) Supply and install 100mm thick yard stones around the new capacitor bank 1 bay.
- j) Establish additional lighting for the capacitor bank bays on the existing 22kV columns.
- k) Supply and install equipment labels and safety signs around capacitor bank yards 1 & 2 mounted on the wire mesh safety fence.
- l) Trench, install and terminate all LV cables to the capacitor bank bay.
- m) Design, supply, install and commission all control equipment (protection, DC and telecontrol with suitably calculated settings) in the control building and substation yard (lighting, auxiliary supply boxes) as per the Control Plant Scope of Work Document #ER00024-00-P05#4.1b-01 and the Control Plant Detailed Specification and Quality Assurance Document #ER00024-00P05#4.1a-01. The designs including drawings and the settings and settings templates are to be handed over to Eskom and would belong to Eskom thereafter.
- n) The appointed contractor/supplier shall be responsible for the review of the Eskom harmonic studies, completion of switching and other related studies, design, manufacture, testing, supply, installation and commissioning of the shunt filter/capacitor bank installation (*refer to Eskom Document No. 240-64688878, Generic Specification for Shunt/Filter Capacitor Installations, Eskom Group Technology and*

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	<b>Document Identifier</b>	<b>ER00024-00-P05#1.1-01</b>	<b>Rev</b>	<b>1</b>

*ER00024-P05#A1.5-00 Technical Specification for Makhathini Substation 2 X 3MVar, 22kV Shunt Capacitors & C-Type Filter*). The equipment components to be supplied by the Contractor for the complete capacitor installations shall include but not be limited to those specified in ER00024-P05#A1.5-00).

- o) The contractor is to test and commission all installed bay equipment (isolators and breakers).
- p) The contractor for the filter/capacitor bank is to commission the new equipment and complete final checks before energising the filter/capacitor banks as per the *Technical Specification for Makhathini Shunt Filter Capacitors (doc #ER00024-P05#A1.5-00)* and *the Specification for Air Core Reactors (doc #240-42587021)*.
- q) Under an outage or under live work, the contractor is to connect the new 22kV filter/capacitor bank bays to the 22kV busbars.
- r) The filter/capacitor bank may only be energised once the Commissioning, Operating and Safety Earthing Procedure specific to the installation is approved by the Sector/Zone Manager (*refer to example the standard for Safety Earthing of Capacitor Banks doc #240-85660696*).
- s) The Contractor is to manage all interactions with the surrounding community members and interested parties. To this effect the Contractor is to establish and run a “Community Interaction Forum” that will manage all greater community interactions including but not limited to the Traditional Leadership (Inkosi, Indunas, Traditional Council); the Political Leadership (Councillor, Local Council, Ratepayers Association); the local businesses (Business Forums, local business owners); interested parties (Surrounding land occupants, environmental groups, job seekers, opportunists, etc).”
- t) Rehabilitating of the site in accordance with the Environmental Management Plan.

### **3.5. Construction Program and Constraints (Constructability)**

The following stages are recommended as part of the constructability plan. Certain stages can be completed in parallel provided that adequate resources are provided by the Project Manager and/or Contractor. Any deviations and/or changes (for practical reasons or otherwise) must be approved by the Design Engineer/s and/or Section/Zone Manager prior to construction. It must be noted that the staging recommended below may have practical implications and thus needs to be reviewed prior to construction. Where outages are required, this is indicated by an asterisk (\*).

The following is applicable to all stages of the construction program:

- a) Access to site is to be issued by the Project Manager to the contractor.
- b) All required permits are to be issued and risk assessments completed.
- c) The contractor is to comply with all safety standards and procedures.
- d) Reference is to be made to the applicable drawings included in the design package.

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Assumptions and Constraints:

- a) It is assumed that the contractor shall have an authorised person to provide supervision while construction occurs in the substation
- b) Access maybe a challenge when bringing the Equipment on the main Tarred Road (P499)

**3.5.1. Stage 1: Civil Work**

- a) Establish the terrace, drainage and extend the existing earthmat for the capacitor bank 1 yard. The terrace for capacitor bank 2 is existing.
- b) Establish foundations with earthing, steelwork, and equipment for 2 x 22kV capacitor bank bays 1 & 2 (busbar isolator and combo breaker with surge arrestor).
- c) Establish all conductors (jumpers) for 22kV capacitor bank bays 1 and 2.
- d) Establish foundations for the capacitor banks and associated equipment. Foundation details is to be confirmed by the supplier at tender stage but designed by Eskom.
- e) Establish 1.8m wire mesh safety fencing around each capacitor bank with its associated reactor and resistor. This fence shall be connected to the main earth mat and *shall only be established once the capacitor bank design is completed by the supplier. The actual position and length of the safety fence is to be determined once the supplier has completed the detailed designs.*
- f) Establish an oil bund for each capacitor bank with its associated reactor and resistor.
- g) Establish a concrete yard for each capacitor bank with its associated reactor and resistor for prevention of weeds and ease of maintenance.
- h) Establish additional lighting for the capacitor bank bays on the existing 22kV columns.
- i) Install safety signs around capacitor bank yards 1 & 2.
- j) Trench, install and terminate all LV cables to the capacitor bank bay.
- k) Installation and commissioning of all control equipment (protection, metering, DC and telecoms) in the control building and substation yard (lighting, auxiliary supply boxes).
- l) Supply and install 100mm thick yard stones around the new capacitor bank 1 bay
- m) Testing and commissioning of all installed equipment.
- n) The contractor for the filter/capacitor bank is to commission the new equipment and complete final checks before energising the filter/capacitor banks as per the *Technical Specification for Makhathini Shunt Filter Capacitors (doc #ER00024-P05#A1.5-00)* and *the Specification for Air Core Reactors (doc #240-42587021)*.
- o) Rehabilitating of the site in accordance with the Environmental Management Plan.

**3.5.2. Stage 2: Outages / Live Work & Energisation of the Capacitor Bank**

- a) Under an 8-hour outage or under live work, connect the new 22kV filter/capacitor bank bays to the 22kV busbars.
- b) The contractor for the filter/capacitor bank is to commission the new equipment and complete final checks before energising the filter/capacitor banks as per the *Technical*

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*Specification for Makhathini Shunt Filter Capacitors (doc #ER00024-P05#A1.5-00) and the Specification for Air Core Reactors (doc #240-42587021).*

- c) The filter/capacitor bank may only be energised once the Safety Earthing Procedure specific to the installation is approved by the Sector/Zone Manager (*refer to standard for Safety Earthing of Capacitor Banks doc #240-85660696*).

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