

ELECTRICAL GAP ANALYSIS REPORT

STURROCK DRY DOCK ELECTRICAL INFRASTRUCTURE UPGRADE (DETAIL DESIGN)

DOCUMENTATION DISTRIBUTION, REVISION AND APPROVAL HISTORY

REVISION NUMBER	DATE	DISTRIBUTION/ REVISION	PREPARED BY	Reviewed BY	APPROVED BY
000	20/11/'23	TNPA	Khwezi Dingane	Livhalani Ralikhwatha	Zukiswa Mpana

SIGNATORIES:

Prepared by: *K. Dingane* 23/02/2024
K. Dingane Electrical Technician Date

Reviewed by: *L. Ralikhwatha* 23/02/2024
L. Ralikhwatha Pr Eng Senior Eng Date

Approved by: *Z. Mpana* 26/02/2024
Z. Mpana Pr. Tech Eng Lead Engineer Date

Supported by: *S. Dlamini* 26/02/2024
S. Dlamini Engineering Manager Date

Accepted by: _____
L Beveridge Project Manager Date

TABLE OF CONTENTS

1.	ELECTRICAL.....	4
1.1	GAPS OR OBSERVATIONS:.....	4
2.	FINDINGS	5
2.1	DRAWINGS	5
2.2	EQUIPMENT SPECIFICATION	14
2.3	ELECTRICAL EQUIPMENT DATA	15
2.4	DETAILED DESIGN REPORT	15
2.5	DETAILED CALCULATION REPORT.....	16
2.6	BILL OF QUANTITY (BOQ)	16
2.7	GENERAL COMMENT	16
2.9	DESIGN FILES.....	16
3.	RECOMMENDATION.....	17

1. ELECTRICAL

A gap analysis has been conducted on the Sturrock dry dock electrical infrastructure project to identify the differences between the current state of the deliverables and the desired state. The exercise was done to pinpoint areas that need improvement, to check if the deliverables are ready to be taken to construction phase of the project and to identify the ways to bridge the gaps if there are any.

The gap analysis will confirm the construction readiness of the deliverables and confirm the satisfaction of the engineer in relation to taking over the execution part of the project.

1.1 GAPS OR OBSERVATIONS:

The gap analysis was conducted by reviewing the following deliverables.

- ✓ Approved for Construction (AFC) Drawings
- ✓ Specifications
- ✓ Electrical Technical Datasheet
- ✓ Design Report
- ✓ Design Calculations/Simulations

2. FINDINGS

2.1 DRAWINGS

The drawings lack the important information that is critical for construction purposes. Below is the summary of the findings. Also, the drawings have been redlined, for more information always refer to [Redline drawings](#)

Table 1: List of Drawings and Findings

DRAWING NUMBER	DRAWING TITLE	SHEET No.	REV	FINDINGS
TNPA/2020-000-E-ELPS-0001	Earthing and Lightning Protection	001	00	- Does Not align with the Design report and Calculation. - The notes on the drawing states that the results from the soil resistivity shall be used to design an earth termination system but this item is not mentioned under contractor design on the works information.
		002	00	No comments
		003	00	The following drawings indicates the following. - Earthmat shall be done by an earth mat specialist. - Distance between the rods to be determined by specialist earthing design. - The contractor shall design, supply, and install a lightning protection.

Electrical Gap Analysis Report

				- The contractor shall carry out the soil resistivity survey, - Details on this drawing are contradicting with sheet 002 information, the down conductor on sheet 002 is aluminium 50mm², but on this drawing it shows 35mm² copper, and the note on the drawing is calling 35mm² aluminium. The drawings shall contain all the construction details and align with calculations and simulations.
TNPA/2020-000-E-EL-0001	Low Voltage Equipment General Arrangement Layout	001	00	- The drawing provided is not an equipment layout, equipment layout should be shown on the substation building floor plan to represent how equipment will be positioned within the substation. - Should indicate equipment dimension. - Clearances from the walls and to the other equipment
TNPA/2020-000-E-EL-0002	Medium Voltage Equipment Layout	001	00	The general arrangement of the switchgear indicate orange, red, white, and blue cubicles, but no specification that has been submitted for that.

Electrical Gap Analysis Report

				- The drawing provided is not an equipment layout, equipment layout should be shown on the substation building floor plan to represent how equipment will be positioned within the substation. - Should indicate equipment dimension. - Clearances from the walls and to the other equipment
		002		The drawing is not an equipment (comments on the drawing)
		003		- Comments on the drawing - The drawing makes a reference with section c-c, but section c-c is on another drawing. The consultant should add a note “stating that this drawing shall be read in conjunction with TNPA/2020-000-E-EL-004”. - Switchgears are not labelled which one is 3.3kV and 11.75kV.
		004		No Comment

TNPA/2020-000-E-EL-0003	Transformer Equipment Layout	001	00	The drawing makes a reference with section a-a, but section a-a is on another drawing. The drawing should have a note “stating that this drawing shall be read in conjunction with TNPA/2020-000-E-EL-004”
		002		The drawing makes a reference with section b-b, but section b-b is on another drawing. The drawing should have a note “stating that this drawing shall be read in conjunction with TNPA/2020-000-E-EL-004”
TNPA/2020-000-E-EL-004	Overall Substation Layout	001	00	CAD standard not followed
TNPA/2020-000-E-CR-0001	Electrical Substation Site Low Voltage Cable Racking and Routing Layout	001	00	- Routing is not shown on the proper site layout. - No detail has been provided for laying of the cables. - Cable routing should be investigated, and cable should be detailed as to how they enter the tunnel. Voltage drop should be verified
TNPA/2020-000-E-CR-0002	Electrical Substation Site Medium Voltage Cable Racking and Routing Layout	001	00	- Routing is not shown on the proper site layout. - No detail has been provided for laying of the cables.

Electrical Gap Analysis Report

				Cable routing should be investigated, and cable should be detailed as to how they enter the tunnel. Voltage drop should be verified
TNPA/2020-000-E-CR-003	Electrical Substation Cable Racking and Routing Layout	001	00	Should indicate details, the supporting interval, material used etc
		002		Should indicate details, the supporting interval, material used etc
		003		Should indicate details, the supporting interval, material used etc
TNPA/2020-000-E-SLD-0001	Low Voltage Single Line Diagram	001	00	- The consultant has requested Schneider's circuit breaker. The equipment should be specified in a open manner, not to target specific brand. - Technical details of the board are not specified this include colours, material, forms of separation, busbar material earthing details etc. without this information the engineer cannot review properly the contractor's submission, because at that the engineer won't have a document to benchmark the submission.

Electrical Gap Analysis Report

				Drawing is not according to CAD standard.
		002		Same comment as sheet 001
TNPA/2020-000-E-SLD-0002	Medium Voltage Single Line Diagram	001	00	Refer to the drawing for comment
TNPA/2020-000-E-LSP-0001	Lighting and Small Power Layout	001	00	- The drawings notes indicate that only BEKA lights to be used. - The drawings notes indicate that only CBI socket outlets to be used. - Switchgear room, SCADA room and service room lights on the drawing is not the same as the Relux simulation, with some of the lights being missed in the drawing, therefore, these rooms shall be re-simulated to check if the lux level are still within the acceptable range. - CAD standard has not been followed.
		002		✓ No comment
		003		CAD standard has not been followed.

Electrical Gap Analysis Report

				The drawing indicates fault current as xxxxx
		004		✓ No Comment
		005		✓ No comment
TNPA/2020-000-E-GDB-0001	Graving Dock LV Board	001	00	- The main supply to the board is not shown on the SLD. - The Schneider Circuit Breakers has been mentioned. - Cables size from the breaker to the loads are not shown. - Some of the feeders the destination has not been specified. - The distribution board details manufacturing details are missing, this includes material type, mounting type, form of separation etc.
		002		Continuation of sheet 1- therefore comments on sheet 1 are applicable throughout the board.
		03		Details of the panel are insufficient
TNPA/2020-000-E-PDB-0001	Pumphouse LV Board	001	00	The main supply to the board is not shown on the SLD.

Electrical Gap Analysis Report

				The Schneider Circuit Breakers has been mentioned.
		002		Details of the panel are insufficient
TNPA/2020-000-E-BKB-0001	BERRIO Road Kiosk	001	00	- The main supply to the board is not shown on the SLD. - The Schneider Circuit Breakers has been mentioned. - Cables size from the breaker to the loads are not shown. - Some of destinations are indicated as unknown. clarity should be given.
		002		General arrangement does not correspond with the SLD.

2.2 EQUIPMENT SPECIFICATION

The following specification has been submitted as part of the design package. It is important to note that the specifications need to be updated and provide enough details. The table below shall be read with comments on the specification documents.

Table 2 of Specifications and Findings

Specification No	Title	Findings
TNPA/2020-E-SPC-0001	400V MOTOR CONTROL CENTRE SPECIFICATION	This specification does not mention/detail specific requirements for MCC as titled MCC specification. This specification is a high-level document that covers lighting, socket outlet, transformer, switchgear and cables. Insufficient information in all the aspects that are covered in this document.
TNPA/2020-E-SPC-0002	MEDIUM VOLTAGE SWITCHGEAR SPECIFICATION	See redlines on the actual document
TNPA/2020-E-SPC-0003	OIL FILLED TRANSFORMER SPECIFICATION	Refer to the redlines on the actual document
TNPA/2020-E-SPC-0004	BATTERY TRIPPING UNIT SPECIFICATION	This is the copy and paste of TNPA/2020-E-SPC-0001. This specification does not give details or specific requirements for battery tripping unit as per the title only duplicate the information from the TNPA/2020-E-SPC-0001.

According to the PLP process for the construction stage, all technical specifications must be developed and include comprehensive details. But, for this package the specifications provided do not carry sufficient information for construction purposes. The specifications provided still need to be developed further and attention shall be given throughout the development processes. Furthermore, the following specifications are not included in the design package:

- a) MV and LV Cable Specification (this shall include terminations, joints, technical details of the required cable management system)
- b) Kiosk and LV DB Specification
- c) Lighting and Power specification
- d) Earthing and Lightning Protection

Therefore, it is recommended the specifications shall be detailed and ensure that they contain enough details, or the Project Manager shall explore alternatives to make them available for tender and construction. Without the above specifications the engineer cannot benchmark the quality and technical functionality of the final product.

2.3 ELECTRICAL EQUIPMENT DATA

The provided datasheet appears to be incomplete, lacking comprehensive technical information. To ensure a successful project outcome, it is important to provide a detailed and accurate datasheet that includes all relevant technical specifications.

2.4 DETAILED DESIGN REPORT

The report mentioned that “An earthing system consisting of a grid of network of medium-hard drawn bare copper conductors will be provided”- However, the drawing is not showing a grid earthmat.

The report states that the soil resistivity test results were used to design a substation earthing system, but the earthmat drawing states that the results from the soil resistivity tests shall be used to design an earth termination system. And the notes on the drawings state that the specialist shall conduct an earth resistivity test. So, clarity should be provided by the consultant in relation to this matter.

In summary, there is a discrepancy between the report, earthing calculations, drawings, and scope of work, therefore clarity is required from the consultant.

2.5 DETAILED CALCULATION REPORT

- No comment

2.6 BILL OF QUANTITY (BOQ)

- On the bill an allowance shall be made for testing of existing PILC.

2.7 GENERAL COMMENT

- Drawing to fully comply with Cad standard, and contain all the technical details as required for construction purposes.
- All calculations and test result shall be signed off by a person registered with the Engineering Council of South Africa (ECSA) or an equivalent institution recognised by ECSA.
- All test results shall be submitted and be accompanied by the calibration certificate of the equipment that was used to perform the test., results to be signed off by the tester.

2.9 DESIGN FILES

All native files to be handed over to Transnet, this include but not limited to the following,

- Relux- lighting
- Cad- for drawings
- Excel -substation earthing design.
- eTap- flow studies
- Protection Setting Simulations

3. RECOMMENDATION

It is recommended that the submission from Z.M.L Africa Group be taken further and include all the technical details. Besides looking at this gap analysis the engineer appointed to close the identified gaps shall also conduct a further peer review to ensure that the designs are fit for purpose. The engineer shall develop a detailed technical specification, this will help to guide the contractor, and this will help an engineer to benchmark the contractor's submission.

Furthermore, is it advisable that a proper coordination should be done between the Sturrock dry dock electrical infrastructure upgrade and the pump house project. An engineer shall familiarize him/herself with the condition of the site. A protection study shall be conducted to ensure proper coordination of this proposed substation into existing electrical infrastructure shall be carried out. The submission from the person who will be closing the shall be reviewed, and accepted by Transnet engineer.