



## EMALAHLENI LOCAL MUNICIPALITY

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 -  
CONSTRUCTION OF A 11,5 km, 132 kV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**CIDB REFERENCE NUMBER: 100077146**

|                                     |       |
|-------------------------------------|-------|
| <b>TENDERER:</b>                    | ..... |
| <b>TENDER PRICE (INCL. VAT):</b>    | ..... |
| <b>CIDB REGISTRATION NUMBER:</b>    | ..... |
| <b>CIDB GRADING:</b>                | ..... |
| <b>BBBEE LEVEL OF CONTRIBUTION:</b> | ..... |
| <b>CSD REGISTRATION NUMBER:</b>     | ..... |

**EMPLOYER:**  
**EMALAHLENI LOCAL MUNICIPALITY**  
PO Box 3  
Emalahleni, Mpumalanga,  
1039

Contact Person: **Mr E. Sedupane**

Tel No.: +27 (13) 690 6298  
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**COMPILED BY:**  
**LYON AND PARTNERS (PTY) LTD**  
P.O. Box 3925  
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# EMALAHLENI LOCAL MUNICIPALITY

## 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

| <b><u>DESCRIPTION</u></b>                  |  | <b><u>COLOUR</u></b> | <b><u>PAGE</u></b> |
|--|--|----------------------|--------------------|
| <b>(a) Foreword</b>                        |  | white                | 2                  |
| <b>Summary for tender opening purposes</b> |  | white                | 3                  |
| <b>(b) TENDER</b>                          |  |                      |                    |
| <b>T1</b>                                  | <b>TENDERING PROCEDURES</b>                          | white                | <b>5</b>           |
| T1.1                                       | Tender Notice and Invitation to Tender               | white                | 6                  |
| T1.2                                       | Tender Data  | pink                 | 7                  |
| <b>T.2</b>                                 | <b>RETURNABLE DOCUMENTS</b>                          | white                | 16                 |
| T2.1                                       | List of Returnable Documents                         | white                | 17                 |
| T2.2                                       | Returnable Schedules and Forms                       | white                | 19                 |
| <b>(c) CONTRACT</b>                        |  |                      |                    |
| <b>C1</b>                                  | <b>AGREEMENTS AND CONTRACT DATA</b>                  | white                | <b>78</b>          |
| C1.1                                       | Form of offer and Acceptance                         | white                | 79                 |
| C1.2                                       | General Conditions of Contract (Part 1)              | white                | 82                 |
| C1.3                                       | Particular Conditions (Part 2A) – Contract Data      | white                | 83                 |
| C1.4                                       | Particular Conditions (Part 2B) – Special Provisions | white                | 88                 |
| C1.5                                       | Contract Price Adjustment                            | white                | 98                 |
| C1.6                                       | Rate of Exchange                                     | white                | 102                |
| C1.7                                       | Safety Agreement                                     | white                | 103                |
| <b>C2</b>                                  | <b>PRICING DATA</b>                                  | yellow               | <b>109</b>         |
| C2.1                                       | Pricing Instructions                                 | yellow               | 110                |
| C2.2                                       | Bill of Quantities                                   | yellow               | 112                |
| <b>C3</b>                                  | <b>SCOPE OF WORK</b>                                 |                      | <b>139</b>         |
| C3.1                                       | Project Specifications                               | Blue                 | 146                |
| C3.2                                       | Technical Schedules                                  | Blue                 | 215                |
| C3.3                                       | General Specifications                               | Blue                 | 218                |
| <b>C4</b>                                  | <b>SITE INFORMATION</b>                              | Blue                 | <b>224</b>         |
| <b>C5</b>                                  | <b>ANNEXURES AND DRAWINGS</b>                        | Blue                 | <b>227</b>         |
|  | ANNEXURE 1: EMPLOYER H & S SPECIFICATION             | Blue                 | 228                |
|  | ANNEXURE 2: EMPLOYER ENVIRONMENTAL SPECIFICATION     | Blue                 | 229                |
|  | ANNEXURE 3: DRAWINGS                                 | Blue                 | 230                |

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### (a) PROCUREMENT DOCUMENT

##### FOREWORD

This document consists of two distinct clusters, namely the TENDER and the CONTRACT.

The **TENDER** consists of two parts, namely:

- **T1: Tendering Procedures** to be complied with by every tenderer submitting a tender offer; and
- **T2: Documents to be Returned by the Tenderer**, including the returnable schedules and forms to be completed by each tenderer, some of which will eventually be incorporated into the contract between the successful tenderer and the Employer.

The **CONTRACT** consists of four parts, namely:

- **C1: Contract Data and Agreements;**
- **C2: Pricing Data;**
- **C3: Scope of Work** (*specifications*);
- **C4: Site Information**
- **C5: Annexures and Drawings**

Each part of each cluster or volume is preceded by its own table of contents.

**Note:** *Each tenderer must complete the summary for tender opening purposes included hereafter.*

EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

(b) SUMMARY FOR TENDER OPENING PURPOSES FIRST ENVELOPE

*[To facilitate the reading out of tender parameters at the opening of tenders, the tenderer shall complete this form and submit it with Schedules 2A, 1E, 1F and 1H]*

Name of Contractor submitting the tender: .....

Details of contract person:

Name (*print*): .....

Telephone No:..... Fax No: .....

e-mail address: .....

**Note:** *In the event of conflict between the data provided in this summary and that given in the tender, the latter shall prevail.*

**SIGNATURE:** .....

*(of person authorised to sign the tender)*



**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**(c) SUMMARY FOR TENDER OPENING PURPOSES SECOND ENVELOPE**

***[To facilitate the reading out of tender parameters at the opening of tenders, the tenderer shall complete this form and submit it with his financial offer]***

**Name of Contractor submitting the tender:** .....

**Tender amount** (*as stated in the Form of Offer*): R .....

**Alternative Tender offered?** ..... (*Yes/No*)

If "Yes" state amount: R.....

**Preference points:** (a) BBBEE level of contribution: .....

(b) BBBEE points claimed.....

**Specified Time for Completion:** .....

**Alternative time for completion offered?** ..... (*Yes or No*)

If "Yes", state time offered .....

**Discounts offered?** ..... (*Yes/No*)

Details of discounts offered: .....  
.....

**Details of contract person:**

Name (*print*): .....

Telephone No:..... Fax No: .....

e-mail address: .....

**Note:** *In the event of conflict between the data provided in this summary and that given in the tender, the latter shall prevail.*

**SIGNATURE:** .....  
(*of person authorised to sign the tender*)

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**PART T1: TENDERING PROCEDURES**

- T1.1      Tender Notice and Invitation to Tender**
- T1.2      Tender Data**

# EMALAHLENI LOCAL DISTRICT MUNICIPALITY

## 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE. CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

### T1.1 TENDER NOTICE AND INVITATION TO TENDER

The Emalahleni Local Municipality invites tenders for the construction of a 11,5 km, 132 kV Overhead Line from Eskom Vulcan MTS to Siyanqoba Substation and the installation of a 20 MVA, 132/11 kV Power Transformer at Siyanqoba Substation.

It is a condition of contract that tenderers should have a CIDB contractor grading designation of 7EP or higher.

Preferences are offered to tenderers who enhance the local and regional economy (local contractors) and who promote broad-based black economic empowerment (BBBEE).

Only tenderers who employ staff which satisfy EPWP requirements are eligible to submit tenders.

- **The stipulated minimum threshold(s) for local production and content for this bid is/are as follows:**

| Description of services, works or goods | Stipulated minimum threshold |
|---|------------------------------|
| Monopole Pylons                         | 100 %                        |
| Powerline Hardware                      | 100 %                        |
| Electrical and telecom cables           | 90 %                         |
| Transformers (Class 1)                  | 80 %                         |

- **Mandatory Subcontracting of 30% is required from supplies.**

Tenders submitted during office hours, Monday – Thursday from 08:00 to 16:00 hours and on Friday's 08:00 to 13:30.

Tender documents will be made available on the following websites:

[www.emalahleni.gov.za](http://www.emalahleni.gov.za)

[www.etenders.gov.za](http://www.etenders.gov.za)

Queries relating to the issue of these documents and administrative matters may be addressed to: The ELM PMU Manager, Mr Edwin.

Sedupane, Tel No.: (013) 690 6298; Cell No.: 071 602 2354;

E-mail: [sedupaneme@emalahleni.gov.za](mailto:sedupaneme@emalahleni.gov.za)

Technical queries may be addressed to: Mr. C de Beer, Tel No.: (016) 981 6270; Fax No.: 016 933 0277,

E-mail: [christo@lyon.co.za](mailto:christo@lyon.co.za)

A non-compulsory clarification meeting with representatives of the Employer will take place on Tuesday, 07 June 2022 at 11h00 on Microsoft Teams. Tenderers are required to register for attending the virtual briefing to be conducted by the Clients Representative by sending details (email address and representative name and surname) of the bidding entity to [christo@lyon.co.za](mailto:christo@lyon.co.za). A Microsoft Teams invite will be sent to the bidding entities registered not later than 06 June 2022 at 12:00.

Duly completed tenders/bids must be sealed in an envelope clearly marked: **"PROJECT NO. ELM 20/2021 (RE-ADVERT): '40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 km, 132 kV OVERHEAD LINE'"** with **"NAME of TENDERER"** and placed in the **tender box** on the **First floor**, Emalahleni Local Municipality, Civic Centre, Corner Mandela & Arras Street, eMalahleni 1039 **by no later than 11h00 on Friday, 8 July 2022**, the closing date, where they will be opened in public.

The closing time for receipt of tenders is **11:00 hrs on Friday, 8 July 2022**. It should be noted that the closing of the tender will only be administered at EMALAHLENI LOCAL MUNICIPALITY REGIONAL OFFICE, Civic Centre Mandela Street, Emalahleni. Tenders may only be submitted on the tender documentation that is issued. Telegraphic, telephonic, telex, facsimile, e-mail, unmarked and **late tenders** will under no circumstances be considered and accepted. Tenders may only be submitted on the tender documentation that is issued. The tender box will be emptied just after closing time on the closing date. Thereafter all bids will be opened in public.

The municipality reserves the right to withdraw any invitation to tender and/or to re-advertise or to reject any tender or to accept a part of it. The municipality does not bind itself to accepting the lowest tender or award a contract to the bidder scoring the highest number of points.

**Mr H.S. Mayisela**

**MUNICIPAL MANAGER**

**EMALAHLENI LOCAL MUNICIPALITY**

**Civic Centre P.O Box 3, 29 Mandela Street, eMalahleni, 1039 [www.emalahleni.gov.za](http://www.emalahleni.gov.za)**

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### T1.2: TENDER DATA

The Conditions of Tender are the Standard Conditions of Tender as contained in Annex F of the CIDB Standard for Uniformity in Construction Procurement (refer: [www.cidb.co.za](http://www.cidb.co.za)) and included as Appendix A in this document. The Standard Conditions of Tender make several references to the Tender Data. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender. Each item of data given below is cross-referenced to the clause in the Standard Conditions of Tender to which it mainly applies.

The following variations, amendments and additions to the Standard Conditions of Tender as set out in the Tender Data below shall apply to this tender:

| Clause      | Addition or Variation to Standard Conditions of Tender  |
|-------------|---|
| F.1<br>F1.1 | <b>General</b><br>Actions<br>The Employer is:<br>EMALAHLENI LOCAL MUNICIPALITY.   |
| F.1.2       | <b>Tender Documents</b><br>The tender documents issued by the employer comprise:<br><b>PART T1: TENDERING PROCEDURES</b><br>T1.1: Tender Notice and Invitation to Tender<br>T1.2: Tender Data<br><b>PART T2: RETURNABLE DOCUMENTS</b><br>T2.1: List of Returnable Documents<br>T2.2: Returnable Schedules<br><b>PART C1: AGREEMENTS AND CONTRACT DATA</b><br>C1.1: Form of Offer and Acceptance<br>C1.2: Contract Data<br>C1.3: Form of Guarantee<br>C1.4: Adjudicator's Agreement (if applicable)<br><b>PART C2: PRICING DATA</b><br>C2.1: Pricing Instructions<br>C2.2: Bills of Quantities<br><b>PART C3: SCOPE OF WORKS</b><br>C3 Scope of Works<br>C3.1 Project Specifications<br>C3.2 Technical Schedules<br>C3.3 General Specification |

| Clause | Addition or Variation to Standard Conditions of Tender  |
|--------|---|
|        | <p><b>PART C4: SITE INFORMATION</b></p> <p><b>PART C5: ANNEXURES AND DRAWINGS</b></p> <p>Annexure 1: Employer H &amp; S Specification</p> <p>Annexure 2: Employer Environmental Specification</p> <p>Annexure 3: Drawings</p>   |
| F.1.4  | <p>The Employer's agent is:</p> <p><b>LYON AND PARTNERS (PTY) LTD</b></p> <p>P.O. Box 3925</p> <p>Vanderbijlpark</p> <p>1900</p>  |
| F.1.5  | <p><b>The Employer's right to accept or reject any tender offer</b></p> <p>The Employer is not obliged to accept the lowest or any tender offer.</p>  |
| F.2.1  | <p>Only those tenderers who satisfy the following eligibility criteria are eligible to submit tenders:</p> <p>Availability of resources.</p> <p>Availability of skills to manage and perform the contract – including staffs which satisfy EPWP requirements.</p> <p>Previous experience on contracts of a similar value and nature.</p> <p>a) Financial standing and capability.</p> <p>b) Cost effective and practical method statement.</p> <p>A Tenderer will not be eligible to submit a tender if:</p> <p>a. The Contractor submitting the tender is under restrictions or has principals who are under restriction to participate in the Employer's procurement due to corrupt or fraudulent practices;</p> <p>b. The Tenderer does not have the legal capacity to enter into the contract;</p> <p>c. The Contractor submitting the tender is insolvent, in receivership, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, under Business Rescue as provided for in chapter 6 of the Companies Act 2008, or is subject to legal proceedings in respect of the foregoing;</p> <p>d. The Tenderer does not comply with the legal requirements stated in the Employer's procurement policy;</p> <p>e. The Tenderer cannot demonstrate that he possesses the necessary professional and technical qualifications and competent, financial resources, equipment and other physical facilities, managerial capability, personnel, experience and reputation to perform the contract;</p> <p>f. The Tenderer cannot provide proof that he is in good standing with respect to duties, taxes, levies and contributions required in terms of legislation applicable to the work in the contract.</p> <p>Only those Tenderers who are registered with the Construction Industry Development Board (CIDB) in a contractor-grading equal to or higher than a contractor grading designation <b>7EP or higher</b> as defined in the Regulations (09 June 2004 and 22 July 2005), in terms of the CIDB Act No 38 of 2000, are eligible to submit tenders for this contract.</p> <p>Joint ventures are eligible to submit tenders provided that:</p> <ol style="list-style-type: none"> <li>1. Every member of the joint venture is registered with CIDB</li> <li>2. the lead partner has a contractor grading designation in the EP class of construction work; and</li> <li>3. the combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a CE class of construction works.</li> </ol> |

| Clause               | Addition or Variation to Standard Conditions of Tender  |
|----------------------|---|
|                      | Tenderers are advised to study Appendix B: EMALAHLENI LOCAL MUNICIPALITY – SUPPLY CHAIN MANAGEMENT PROCUREMENT POLICY when completing Schedule and claiming points.   |
| F.2.7                | <p>c) The arrangements for a compulsory clarification meeting are:</p> <p>d) A non-compulsory clarification meeting with representatives of the Employer will take place on Tuesday, 07 June 2022 Microsoft Teams.</p> <p>Starting time: 10h00</p> <hr/> <p><b>Microsoft Teams meeting</b></p> <p><b>Join on your computer or mobile app</b></p> <p><a href="#">Click here to join the meeting</a></p> <p><a href="#">Learn More</a>   <a href="#">Meeting options</a></p> <hr/>  |
| F.2.10               | <p><u>Value Added Tax</u></p> <p>(a) The Valued Added Tax (VAT) rate shall be 15% or as otherwise provided for by legislation.</p> <p>(b) The successful Tenderer shall be required to produce a VAT invoice that shall only be prepared once measurements and valuations for work done in terms of the contract offer have been agreed with the Employers agent and a certificate of payment issued.</p> <p>Payment of VAT to non-VAT vendors shall be processed from the month in which the Tenderers liability with the South African Revenue Services is effective</p>  |
| F.2.11               | <p>Add the following:</p> <p>To correct errors made, draw a line through the incorrect entry and write the correct entry above in black ink and place the full signatures of the authorised signatories next to the correct entry. The use of tippex or pencil will not be accepted.</p>  |
| F.2.12               | Alternative tender offers will <b>NOT</b> be considered.  |
| F.2.13.3             | (c) Parts of each tender offer communicated on paper shall be submitted as an original, plus 0 (nil) copies.  |
| F.2.13.5<br>F.2.15.1 | <p>The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package are:</p> <p>Location of tender box: EMALAHLENI LOCAL MUNICIPALITY HEAD OFFICE</p> <p>Physical address : Civic Centre P.O Box 3, 29 Mandela Street eMalahleni, eMalahleni, 1039</p> <p>Identification details : MUNICIPAL MANAGER,<br/>EMALAHLENI LOCAL MUNICIPALITY,<br/>PROJECT NO. ELM 20/2021 (RE-ADVERT) - 40 MVA/132/11 KV, SIYANQOBA SUBSTATION<br/>PHASE 5 - CONSTRUCTION OF A 11,5 km, 132 kV OVERHEAD LINE.</p> <p>Postal address : EMALAHLENI LOCAL MUNICIPALITY<br/>PO BOX 3, EMALAHLENI, 1039</p> |
| F.2.13.9             | Telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted.   |
| F.2.15               | The closing time for submission of tender offers is stated in the Tender Notice/Invitation to Tender. Only the first envelope containing functionality assessment to be opened during the public sitting.   |
| F.2.16               | The tender offer validity period is one hundred and twenty (120) days.  |
| F2.18                | The tender shall, when requested by the Employer to do so, submit the names of all management and supervisory staff that will be employed to supervise the labour-intensive   |

| Clause   | Addition or Variation to Standard Conditions of Tender  |
|----------|---|
|          | portion of the works together with satisfactory evidence that such staff members satisfy the eligibility requirements   |
| F.2.23   | <p>The tenderer is required to submit the following certificates with his tender:</p> <ol style="list-style-type: none"> <li>1) Joint Venture Agreement and Power of Attorney in case of Joint Ventures;</li> <li>2) Broad Based Black Economic Empowerment Verification Certificate</li> <li>3) CSD report</li> <li>4) Proof of Construction Industry Development Board (CIDB) grading</li> <li>5) Workmen's Compensation Registration Certificate (or proof of payment of contributions in terms of the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993);</li> <li>6) Form of intent by a bank or insurance company to provide a performance guarantee; (for open Tenders)</li> </ol> <p>A Certified Copy of the Company registration documents; and</p>  |
|          | <p>Water and light bill for the company and directors not older than 3 months;</p> <p>particulars of any contracts awarded by an organ of state during the last five years including particulars of any material non-compliance or dispute concerning their execution over this period (if &gt;R25 million incl. VAT)</p>   |
| F.3.4    | The time and location for opening of the tender offers are in accordance with F.2.15  |
| F.3.5    | The two-envelope system will apply to this tender. The first envelope will contain the Functionality assessment and the second will contain the Financial and Preference assessment along with all the other returnable schedules and documents not provided in the first envelope.   |
| F.3.11.1 | <p>The procedure for the evaluation of responsive tenders is <b>Method 2: Functionality, Price and Preference</b>. The responsive tender with the highest total points as defined below is the preferred tender.</p> <p><b>Method 2: Functionality, Price and Preference</b></p> <p><b>Evaluation Methodology</b></p> <p>Tenders will be evaluated on price and preference. It is important that the relevant information is included to enable the tenders to be evaluated in accordance with the procedure outlined below. All information must be submitted in a separate file. Tampering with the original tender document will render the tender non-responsive. Failure to comply with the above requirements will result in the Tender being disqualified.</p>   |
| F3.11.3  | <p><b>1) Scoring functionality:</b></p> <p>The following criteria will be used to calculate points for the functionality of tenders and bidders should ensure that they submit all relevant information in order to be pre-evaluated on the criteria mentioned below:</p> <p><b>NB. TENDERERS WHO FAIL TO MEET THE MINIMUM THRESHOLD CRITERIA OF 65 POINTS FOR OVERALL FUNCTIONALITY WILL NOT BE CONSIDERED FOR FURTHER EVALUATION, BASED ON PRICE AND PREFERENCE.</b></p> <p>Incomplete forms will be disregarded and will be considered as non-responsive.</p> <p><b>TENDERERS MUST COMPLETE SCHEDULES 1E, 1F, 1G, 1H, 1M AND SUBMIT DOCUMENTS AS DESCRIBED IN 2C, 2E, 2G, 2J, 3C, 3E AND 3F BELOW IN ORDER TO BE AWARDED POINTS.</b></p> <p><u>1) Company's relevant experience – 20 points</u></p> <p>Note: Failure to provide completion certificate(s) and Schedule 1E will result in no points being awarded. Tenderer's High Voltage (88 kV or higher) overhead line works experience completed successfully on or after 30 June 2016 (Maximum 20 points).</p> <ul style="list-style-type: none"> <li>• 1 project = 5 points</li> </ul> |

| Clause | Addition or Variation to Standard Conditions of Tender   |
|--------|--|
|        | <ul style="list-style-type: none"> <li>• 2 projects = 10 points</li> <li>• 3 projects = 15 points</li> <li>• 4 or more projects = 20 points</li> </ul> <p><u>2) Relevant Key Personnel Experience – 20 points</u></p> <p>This project is estimated to require the following personnel:</p> <p>2.1 Site Agent – Points will only be awarded for one of the Site Agent sections (2.1.1 OR 2.1.2) below:</p> <p>2.1.1 Site Agent / Project Manager with a relevant technical qualification in Electrical Engineering or Project Management with relevant High Voltage (88 kV or higher) overhead line works experience in the capacity as the Site Agent / Project Manager (Maximum 8 points) – Schedule 1M:</p> <p>Maximum 8 points for projects:</p> <ul style="list-style-type: none"> <li>• 0 project = 0 points</li> <li>• 1 project = 1.5 points</li> <li>• 2 projects = 3 points</li> <li>• 3 projects = 4 points</li> <li>• 4 points will be allocated for the relevant qualification.</li> </ul> <p>2.1.2 Site Agent / Project Manager with no relevant technical qualification in Electrical Engineering or Project Management with relevant High Voltage (88 kV or higher) overhead line works experience in the capacity as the Site Agent / Project Manager</p> <p>Maximum 4 points for projects:</p> <ul style="list-style-type: none"> <li>• 0 project = 0 points</li> <li>• 1 project = 1.5 points</li> <li>• 2 projects = 3 points</li> <li>• 3 projects = 4 points</li> </ul> <p>2.2 Construction Manager / General Foreman with a relevant qualification with High Voltage (88 kV or higher) overhead line works experience in the capacity as general foreman (Maximum 3 points) – Schedule 1M:</p> <ul style="list-style-type: none"> <li>• 0 project = 0 points</li> <li>• 1 project = 1 points</li> <li>• 2 projects = 2 points</li> <li>• 3 projects = 3 points</li> </ul> <p>2.3 Safety Officer registered with SACPCMP as a Construction Health and Safety Officer (Maximum 3 points) – Schedule 1M:</p> <p>3 points allocated for Safety Officer being registered with SACPCMP. Note: Failure to provide proof of Registration will result in no points being awarded (0 out of 3 for Registration).</p> <p>2.4 Civil Engineer with a relevant qualification with High Voltage (88 kV or higher) overhead line works experience (Maximum 3 points) – Schedule 1M:</p> <ul style="list-style-type: none"> <li>• 0 project = 0 points</li> <li>• 1 project = 1 points</li> <li>• 2 projects = 2 points</li> <li>• 3 projects = 3 points</li> </ul> <p>2.5 Foremen with a relevant qualification with High Voltage (88 kV or higher) overhead line works experience in the capacity as general foreman (Maximum 3 points) – Schedule 1M:</p> <ul style="list-style-type: none"> <li>• 0 project = 0 points</li> </ul> |



| Clause | Addition or Variation to Standard Conditions of Tender   |
|--------|--|
|        | <ul style="list-style-type: none"> <li>• 1 project = 1 points</li> <li>• 2 projects = 2 points</li> <li>• 3 projects = 3 points</li> </ul> <p><u>3) Generic Method Statement for the Construction of a High Voltage (88 kV or higher) overhead line (Maximum 25 points) – Schedule 1M: + risk management</u></p> <p>Provide a generic method statement to describe the typically steps, methods, practices, and techniques followed in the construction of High Voltage (88 kV or higher) overhead lines based on the Contractors experience and knowledge, including the critical quality check points. Please include the preliminary concrete mix design and formwork system. (Schedule 1H).</p> <p>The method statements will be evaluated based on:</p> <ol style="list-style-type: none"> <li>1. If the method statement submitted relates to the construction of High Voltage (88 kV or higher) overhead lines,</li> <li>2. If the critical points were identified and adequate control measures are described,</li> <li>3. If the techniques described is specific to the construction of high voltage (88 kV or higher) overhead lines. <ul style="list-style-type: none"> <li>• 0 points will be awarded if none of the above points were met,</li> <li>• 7 points will be awarded if one of the above points were met,</li> <li>• 12 points will be awarded if two of the above points were met,</li> <li>• 17 points will be awarded if three of the above points were met,</li> <li>• 25 points will be awarded if all the above points were met.</li> </ul> </li> </ol> <p><u>4) Ownership of Plant and equipment available to use for this project (Maximum points 10) – Schedule 1G</u></p> <ul style="list-style-type: none"> <li>• 0 points will be awarded if the specified plant/equipment is not available for the execution of the project.</li> <li>• 2 points will be awarded for the ownership and availability of a 5 ton crane truck (or larger).</li> <li>• 2 points will be awarded for the ownership and availability of two 1 ton LDV.</li> <li>• 3 points will be awarded for the ownership and availability of a hydraulic crimper with at least 60 tons crimping capacity. Photo of crimper with proof of serial number and calibration certificate.</li> <li>• 3 point will be awarded for the ownership and availability of tension stringing equipment. Photo of tension stringing equipment with proof of serial number and calibration certificate.</li> <li>• 1 point will be awarded if the 5 ton crane truck (or larger) is rented.</li> <li>• 1 points will be awarded if the two 1 ton LDV's are rented.</li> <li>• 1.5 points will be awarded if a hydraulic crimper with at least 60 tons crimping capacity is rented. Photo of crimper with proof of serial number and calibration certificate.</li> <li>• 1.5 will be awarded of the tension stringing equipment is rented. Photo of tension stringing equipment with proof of serial number and calibration certificate.</li> </ul> <p>Note: Failure to provide a duly completed Lease Agreement for all rental equipment between the rental company and the tender, will result in no points being awarded.</p> <p><u>5) Social development Plan (Maximum points 5) – Schedule 2K</u></p> <p>The Tenderer must attach at Schedule 2K their Social Development Plan which outlines how the Tenderer will address the critical challenges of poverty, unemployment and inequality, over the short and medium term, with a focus on deepening social assistance and extending the scope of social security; reforming the social welfare sector and its services to deliver better results and strengthening community development. A maximum of 5 points will be awarded for this section, based on how detailed and well developed the Social Development Plan is.</p> <ul style="list-style-type: none"> <li>• 5 points will be awarded for a detailed, well developed Plan,</li> <li>• 4 points will be awarded for a detailed Plan,</li> <li>• 3 points will be awarded for a basic Plan,</li> </ul> |

| Clause  | Addition or Variation to Standard Conditions of Tender  |
|---------|---|
|         | <ul style="list-style-type: none"> <li>• 2 points will be awarded for a generic Plan,</li> <li>• 1 point will be awarded for a Plan,</li> <li>• 0 points will be awarded for no Plan.</li> </ul> <p><u>6) Health and Safety Plan (Maximum points 5) – Schedule 3C</u></p> <p>The Tenderer must attach at Schedule 3C their Health and Safety Plan. A maximum of 5 points will be awarded for this section, based on how detailed and well developed the Health and Safety Plan is.</p> <ul style="list-style-type: none"> <li>• 5 points will be awarded for a detailed, well developed Plan,</li> <li>• 4 points will be awarded for a detailed Plan,</li> <li>• 3 points will be awarded for a basic Plan,</li> <li>• 2 points will be awarded for a generic Plan,</li> <li>• 1 point will be awarded for a Plan,</li> <li>• 0 points will be awarded for no Plan.</li> </ul> <p><u>7) Quality Control Plan (Maximum points 5) – Schedule 3E</u></p> <p>The Tenderer must attach at Schedule 3E their Quality Control Plan. A maximum of 5 points will be awarded for this section, based on how detailed and well developed the Quality Control is.</p> <ul style="list-style-type: none"> <li>• 5 points will be awarded for a detailed, well developed Plan or ISO 9001 accreditation,</li> <li>• 4 points will be awarded for a detailed Plan,</li> <li>• 3 points will be awarded for a basic Plan,</li> <li>• 2 points will be awarded for a generic Plan,</li> <li>• 1 point will be awarded for a Plan,</li> <li>• 0 points will be awarded for no Plan.</li> </ul> <p><u>8) Bank rating and 3-years financial statements (Maximum points 10) – Schedule 2C &amp; 2E</u></p> <p>The Tenderer must attach at Schedule 2C &amp; 2E their audited financial statements for the past 3-years and a CSD report which is not older than May 2021. A maximum of 10 points will be awarded for this section, should it be found that the company's financial standing is healthy.</p> <ul style="list-style-type: none"> <li>• 10 points will be awarded if both the CSD report and the 3-year financial statements are found to be in good order.</li> <li>• 7 points will be awarded if only the 3-year financial statements is found to be in good order.</li> <li>• 3 points will be awarded if only the CSD report is found to be in good order.</li> </ul> <p>0 points will be awarded for unfavourable results or no documentation provided for both the CSD report and the 3-year financial statements.</p> |
| F3.11.6 | Score price, preference and functionality, as relevant to one (1) decimal place.  |
| F3.11.7 | <p><b>It is estimated that the value of this Tender will exceed R 50 000 000.00, therefore the 90/10 preference points system for acquisition of services will be used.</b></p> <p>The Tender evaluation will be conducted as follows:</p> <ul style="list-style-type: none"> <li>• Price = 90,</li> <li>• B-BBEE = 10</li> </ul> <p>Score price of remaining responsive tender offers using the following formula:<br/> <math>N_{FO} = W_1 \times A</math></p> <p>where: <math>N_{FO}</math> is the number of tender evaluation points awarded for price. <math>W_1</math> is the maximum possible number of tender evaluation points awarded for price as stated in the Tender Data. <math>A</math> is a number calculated using formula 2 option 1 as described in Table F.1 in the Standard for Uniformity in Construction Procurement published in July 2015.</p>  |
|         | <p><math>N_{FO} = W_1 \times A</math></p> <p>Where:</p> <p><math>N_{FO}</math> = number of tender evaluation points awarded for the financial offer;</p>  |

| Clause    | Addition or Variation to Standard Conditions of Tender  |
|-----------|---|
|           | <p>W1 = 90 points for rand value under R 50 000 000.00;</p> <p>A = <math>[1-(P-P_m)/P_m]</math> (a negative A will be regarded as unrealistically high)</p> <p>Pm = the rand value of the lowest comparative offer;</p> <p>P = the rand value of the Tender Offer under consideration</p>   |
| F.3.11.8  | Scoring Preferences will be done in accordance with Schedule MBD 6.1  |
| F.3.11.10 | <p><b>Risk Analysis</b></p> <p>Notwithstanding compliance with regard to CIDB registration or any other requirements of the tender, the Employer will perform a risk analysis in respect of the following:</p> <ul style="list-style-type: none"> <li>(a) Reasonableness of the financial offer</li> <li>(b) Reasonableness of the unit rates and prices</li> <li>(c) The tenderers ability to fulfil its obligations in terms of the tender document, that is, that the tenderer can demonstrate competence in both professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience, reputation, personnel to perform the contract etc.</li> <li>(d) Financial Bank Rating</li> </ul> <p>No tenderer will be recommended for an award unless the tenderer has demonstrated that he/she has the resources, skills and competence.</p>  |
| F.3.13.1  | <p>Tender offers will only be accepted on condition that the tenderer:</p> <p>Has in <u>his or her possession</u> an original valid Tax Clearance Certificate issued by the South African Revenue Services;</p> <ul style="list-style-type: none"> <li>a) Is registered with the Construction Industry Development Board in an appropriate contractor grading designation;</li> </ul> <p>Has attached company registration documents</p> <ul style="list-style-type: none"> <li>b) the tenderer or any of its directors is not listed in the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector; and</li> <li>c) the tenderer has not:</li> <li>d) abused the Employer's Supply Chain Management System; or <ul style="list-style-type: none"> <li>i) failed to perform on any previous contract and has been given a written notice to this effect;</li> </ul> </li> <li>e) The tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the employer or potentially comprise the tender process.</li> <li>f) The tenderer attended a compulsory site inspection.</li> <li>g) The tenderer has completed the form of offer in words and figures and is signed.</li> </ul> |
| F.3.13.2  | <ul style="list-style-type: none"> <li>ii) The Employer does not bind himself to accept the lowest priced tender, highest points tender or any tender offer. The Employer has the right to accept any part of a tender as he may deem expedient subject to negotiation with the successful tenderer for the whole tender.</li> </ul>  |
| F.3.18    | The number of paper copies of the signed contract to be provided by the Employer is ONE (1).  |
| F.4       | <b>Additional Conditions of Tender</b>  |
| F.4.1     | <p><b>Compliance with Occupational Health and Safety Act 1993 and the 2014 Construction Regulations</b></p> <p>Tenderers are to note the requirements of the Occupational Health and Safety Act No. 85 of 1993 and the Construction Regulations 2014 issued in terms of Section 43 of the Act. The tenderer shall be deemed to have read and fully understood the requirements of the above Act and Regulations and to have allowed for all costs in compliance therewith. Tenderers are to note that the Contractor is required to ensure that all sub-contractors or others engaged in the performance of the contract also comply with the above requirements.</p>   |
| F.4.2     | <b>Claims arising after submission of tender</b>  |

| Clause | Addition or Variation to Standard Conditions of Tender   |
|--------|--|
|        | <p>No claim for any extras arising out of any doubt or obscurity as to the true intent and meaning of anything shown on the Contract Drawings or contained in the Conditions of Contract, Scope of Work and Pricing Data will be admitted by the Employer/Employer's Agent after the submission of any tender and the Tenderer shall be deemed to have:</p> <ol style="list-style-type: none"> <li>1) Inspected the Contract Drawings and read and fully understood the Conditions of Contract.</li> <li>2) Read and fully understood the whole text of the Scope of Work and Pricing Data and thoroughly acquainted himself with the nature of the works proposed and generally of all matters which may influence the Contract.</li> <li>3) Visited the site of the proposed works, carefully examined existing conditions, the means of access to the site, the conditions under which the work is to be done and acquainted himself with any limitations or restrictions that may be imposed by the Municipal or other Authorities in regard to access and transport of materials, plant and equipment to and from the site and made the necessary provisions for any additional cost involved thereby in the P&amp;G's</li> <li>4) Requested the Employer or his duly authorised agent to make clear the actual requirements of anything shown on the Contract Drawings or anything contained in the Scope of Work and Pricing Data, the exact meaning or interpretation of which is not clearly intelligible to the Tenderer.</li> <li>5) Received any Addenda to the tender documents which have been issued in accordance with the Employer's Supply Chain Management Policy.</li> </ol> <p>Before submission of any tender, the Tenderer should check the numbers of pages, and if any are found to be missing or duplicated, or the figures or writing indistinct, or if the Pricing Data contain any obvious errors, the tenderer must apply to the Employer/Employer's Agent at once to have the same rectified, as liability will be admitted by the Employer/Employer's Agent in respect of errors in any tender due to the foregoing.</p> |
| F.4.3  | <p><b>Imbalance in tendered rates</b></p> <p>In the event of tendered rates or lump sums being declared by the Employer to be unacceptable to it because they are either excessively low or high or not in proper balance with other rates or lump sums, the Tenderer may be required to produce evidence and advance argument in support of the tendered rates or lump sums objected to. If, after submission of such evidence and any further evidence requested, the Employer is still not satisfied with the tendered rates or lump sums objected to, it may request the tenderer to amend these rates and lump sums along the lines indicated by it. The Tenderer will then have the option to alter and/or amend the rates and lump sums objected to and such other related amounts as are agreed on by the Employer, but this shall be done without altering the tender offer as tendered or, if applicable, the corrected total of prices in accordance with F.3.9.3</p> <p>Should the Tenderer fail to amend his Tender in a manner acceptable to the Employer, the Employer may reject the Tender.</p>   |
| F.4.4  | <p><b>Project Funding</b></p> <p>The Employer receives yearly funding from various government institutions one being DMRE. As such the Employer will make funding available over two financial years (two contractual years) and the first financial year, ending at the end of June 2022, with possible additional funding depending on the performance of all municipal contracts. The next financial year's funding allocation will be communicated to the appointed Contractor as soon as the Employer has the confirmed funding information at the beginning of each financial year. The Tenderer should allow in his cost and program for the limited yearly funding. The works performed should comply to the Local procurement and development of Local Enterprise requirements as agreed to in form <b>MBD 6.2</b></p>  |

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|                                      |
|--------------------------------------|
| <b>PART T2: RETURNABLE DOCUMENTS</b> |
|--------------------------------------|

**T2.1 List of Returnable Documents**

**T2.2 Returnable Schedules**

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### T2.1: LIST OF RETURNABLE DOCUMENTS

The following documents are to be completed and returned as they constitute the tender. Whilst many of the returnable documents are required for the purpose of evaluating the tenders, some will form part of the subsequent contract, as they form the basis of the tender offer. For this reason, it is very important that tenderers return **all information requested**.

#### MBD FORMS

|              |  |
|--------------|--|
| <b>1.</b>    | <b>RETURNABLE SCHEDULES REQUIRED FOR TENDER EVALUATION PURPOSES<br/>(included hereafter for completion)</b>  |
| Schedule: 1A | Compulsory Enterprise Questionnaire - <b>Compulsory</b>  |
| Schedule: 1B | Authority of Signatory - <b>Compulsory</b>   |
| Schedule: 1C | Certificate of Authority for Joint Ventures (if applicable) - <b>Compulsory</b>  |
| Schedule: 1D | Record of Addenda to Tender Documents - <b>Compulsory</b>  |
| Schedule: 1E | Company's Relevant Experience in South Africa - <b>Evaluation</b>  |
| Schedule: 1F | Personnel Schedule and format of curriculum vitae (if applicable) - <b>Evaluation</b>  |
| Schedule: 1G | Schedule of Plant and Equipment available for the Contract – <b>Evaluation</b>   |
| Schedule: 1H | Schedule of Method Statement for High Voltage (88 kV or higher) overhead line works – <b>Evaluation</b>  |
| Schedule: 1I | Schedule of Proposed Subcontractors - <b>Evaluation</b>  |
| Schedule: 1J | Certificate of Attendance at Clarification Meeting - <b>Compulsory</b>   |
| Schedule: 1K | Proposed Amendments and Qualifications – <b>Compulsory</b>   |
| Schedule: 1L | Workmen's Compensation Registration – <b>Compulsory</b>  |
| Schedule: 1M | Functionality Points Claimed - <b>Compulsory</b>   |
| <b>2.</b>    | <b>OTHER DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES</b>   |
| Schedule: 2A | Certificate of Contractor Registration issued by the CIDB - <b>Compulsory</b>  |
| Schedule: 2B | Financial Statements - <b>Compulsory</b>   |
| Schedule: 2C | Proof of Authority of Signatory - <b>Compulsory</b>  |
| Schedule: 2D | CSD Report - <b>Compulsory</b>   |
| Schedule: 2E | Joint Venture Agreement, if applicable - <b>Compulsory</b>   |
| Schedule: 2F | Municipal Levy Payment for company and its directors - <b>Compulsory</b>   |
| Schedule: 2G | A certificate certifying that the enterprise has no undisputed commitments to a municipality or other service provider in respect of which payment is overdue by more than 30 days - <b>Compulsory</b> |
| Schedule: 2H | Form of Intent to provide a Performance Guarantee – <b>Contractual</b>   |
| Schedule: 2I | Risk Management Plan – <b>Contractual</b>  |

|              |  |  |
|--------------|--|--|
| <b>3.</b>    | <b>RETURNABLE SCHEDULES THAT WILL BE INCORPORATED INTO THE CONTRACT<br/>(to be attached with submission)</b>                               |  |
| Schedule: 3A | Execution Programme - <b>Evaluation</b>  |  |
| Schedule: 3B | Contractor's Health and Safety Declaration - <b>Evaluation</b>   |  |
| Schedule: 3C | Contractor's Safety Plan - <b>Evaluation</b>   |  |
| Schedule: 3D | Pro forma Notification form in terms of the Occupational Health and Safety Act 1993,<br>Construction Regulations, 2003 - <b>Evaluation</b> |  |
| Schedule: 3E | Quality Control Plan - <b>Evaluation</b>   |  |
| Schedule: 3F | Social Development Plan - <b>Evaluation</b>  |  |
| <b>4.</b>    | <b>OTHER SCHEDULES AND AFFIDAVITS THAT WILL BE INCORPORATED INTO THE<br/>CONTRACT (included hereafter for completion)</b>                  |  |
| C1.1:        | The offer portion of the Form of Offer and Acceptance - <b>Compulsory</b>  |  |
| C1.2:        | Contract Data (Part 2) – <b>Contractual</b>  |  |
| C2.2:        | Bill of Quantities – <b>Compulsory</b>   |  |

## PART A INVITATION TO BID

### YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE EMALAHLENI LOCAL MUNICIPALITY

|             |                             |               |             |               |       |
|-------------|-----------------------------|---------------|-------------|---------------|-------|
| BID NUMBER: | ELM 20/2021<br>(RE- ADVERT) | CLOSING DATE: | 8 JULY 2022 | CLOSING TIME: | 11:00 |
|-------------|-----------------------------|---------------|-------------|---------------|-------|

|             |   |
|-------------|---|
| DESCRIPTION | 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 km, 132 kV OVERHEAD LINE. |
|-------------|---|

**THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT FORM (MBD7).**

BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE  
BID BOX SITUATED AT

**EMALAHLENI LOCAL MUNICIPALITY, CIVIC CENTRE, MANDELA STREET, eMALAHLENI**

#### SUPPLIER INFORMATION

|  |   |  |  |         |  |
|--|---|--|--|---------|--|
| NAME OF BIDDER   |   |  |  |         |  |
| POSTAL ADDRESS   |   |  |  |         |  |
| STREET ADDRESS   |   |  |  |         |  |
| TELEPHONE NUMBER   | CODE  |  | NUMBER   |         |  |
| CELLPHONE NUMBER   |   |  |  |         |  |
| FACSIMILE NUMBER   | CODE  |  | NUMBER   |         |  |
| E-MAIL ADDRESS   |   |  |  |         |  |
| VAT REGISTRATION NUMBER  |   |  |  |         |  |
| TAX COMPLIANCE STATUS  | TCS PIN:  |  | OR   | CSD No: |  |
| B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE [TICK APPLICABLE BOX] | <input type="checkbox"/> Yes<br><input type="checkbox"/> No |  | B-BBEE STATUS LEVEL SWORN AFFIDAVIT<br><input type="checkbox"/> Yes<br><input type="checkbox"/> No |         |  |

**[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT (FOR EMES & QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]**

|   |   |  |   |
|---|---|--|---|
| ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED? | <input type="checkbox"/> Yes<br><input type="checkbox"/> No<br>[IF YES ENCLOSE PROOF] | ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES /WORKS OFFERED? | <input type="checkbox"/> Yes<br><input type="checkbox"/> No<br>[IF YES, ANSWER PART B:3 ] |
|---|---|--|---|

|                               |  |                 |   |
|-------------------------------|--|-----------------|---|
| TOTAL NUMBER OF ITEMS OFFERED |  | TOTAL BID PRICE | R |
|-------------------------------|--|-----------------|---|

|                     |      |
|---------------------|------|
| SIGNATURE OF BIDDER | DATE |
|---------------------|------|

**CAPACITY UNDER WHICH THIS BID IS SIGNED**

**BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:**

**TECHNICAL INFORMATION MAY BE DIRECTED TO:**

|                  |                           |                  |                    |
|------------------|---------------------------|------------------|--------------------|
| DEPARTMENT       | PMU                       | CONTACT PERSON   | MR C DE BEER       |
| CONTACT PERSON   | MR ME SEDUPANE            | TELEPHONE NUMBER | (016) 981 6270     |
| TELEPHONE NUMBER | (013) 690 6497            | FACSIMILE NUMBER | (016) 933 0277     |
| FACSIMILE NUMBER | (013) 690 6207            | E-MAIL ADDRESS   | christo@lyon.co.za |
| E-MAIL ADDRESS   | S302695@Emalahleni.gov.za |                  |                    |



## PART B

### TERMS AND CONDITIONS FOR BIDDING

#### 1. BID SUBMISSION:

- 1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION.
- 1.2. **ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED) OR ONLINE**
- 1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.

#### 2. TAX COMPLIANCE REQUIREMENTS

- 2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.
- 2.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS.
- 2.3 APPLICATION FOR THE TAX COMPLIANCE STATUS (TCS) CERTIFICATE OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA.
- 2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.
- 2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.
- 2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.
- 2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.

#### 3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

- 3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)?  
☐ YES ☐ NO
- 3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA?  
☐ YES ☐ NO
- 3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?  
☐ YES ☐ NO
- 3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?  
☐ YES ☐ NO
- 3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?  
☐ YES ☐ NO

**IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.**

**NB: FAILURE TO PROVIDE ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.**

**NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.**

SIGNATURE OF BIDDER: .....

CAPACITY UNDER WHICH THIS BID IS SIGNED: .....

DATE:.....

## **BROAD-BASED BLACK ECONOMIC EMPOWERMENT (B-BBEE) STATUS LEVEL CERTIFICATES**

Bidders are required to submit original and valid B-BBEE Status Level Verification Certificates or certified copies thereof together with their bids, to substantiate their B-BBEE rating claims.

Bidders who do not submit B-BBEE Status T Level Verification Certificates or are noncompliant contributors to B-BBEE do not qualify for preference points for B-BBEE but should not be disqualified from the bidding process. They will score points for out of 90 or 80 for price only and **zero** points out of 10 or 20 for B-BBEE.

## DECLARATION OF INTEREST

1. Any legal person, including persons employed by the state<sup>1</sup>, or persons having a kinship with persons employed by the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid (includes a price quotation, advertised competitive bid, limited bid or proposal). In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons employed by the state, or to persons connected with or related to them, it is required that the bidder or his/her authorised representative declare his/her positioning relation to the evaluating/adjudicating authority where-
  - the bidder is employed by the state; and/or
  - the legal person on whose behalf the bidding document is signed, has a relationship with persons/a person who are/is involved in the evaluation and or adjudication of the bid(s), or where it is known that such a relationship exists between the person or persons for or on whose behalf the declaring acts and persons who are involved with the evaluation and or adjudication of the bid.
2. **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**
  - 2.1 Full Name of bidder or his or her representative: .....
  - 2.2 Identity Number: .....
  - 2.3 Position occupied in the Company (director, trustee, shareholder<sup>2</sup>): .....
  - 2.4 Company Registration Number: .....
  - 2.5 Tax Reference Number: .....
  - 2.6 VAT Registration Number: .....
  - 2.6.1 The names of all directors / trustees / shareholders / members, their individual identity numbers, tax reference numbers and, if applicable, employee / persal numbers must be indicated in paragraph 3 below.

<sup>1</sup>"State" means –

- (a) any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No. 1 of 1999);
- (b) any municipality or municipal entity;
- (c) provincial legislature;
- (d) national Assembly or the national Council of provinces; or
- (e) Parliament.

<sup>2</sup>"Shareholder" means a person who owns shares in the company and is actively involved in the management of the enterprise or business and exercises control over the enterprise.

- 2.7 Are you or any person connected with the bidder  
presently employed by the state? **YES / NO**

2.7.1 If so, furnish the following particulars:

Name of person / director / trustee / shareholder/ member: .....

.....

Name of state institution at which you or the person connected to the bidder is employed:

.....

Position occupied in the state institution:.....

Any other particulars:.....

.....

.....

2.7.2 If you are presently employed by the state, did you obtain the appropriate authority to undertake remunerative work outside employment in the public sector? **YES / NO**

2.7.2.1 If yes, did you attached proof of such authority to the bid document? **YES / NO**

(Note: Failure to submit proof of such authority, where applicable, may result in the disqualification of the bid.

2.7.2.2 If no, furnish reasons for non-submission of such proof:.....

.....

.....

2.8 Did you or your spouse, or any of the company's directors / trustees / shareholders / members or their spouses conduct business with the state in the previous twelve months? **YES / NO**

2.8.1 If so, furnish particulars: .....

.....

.....

2.9 Do you, or any person connected with the bidder, have any relationship (family, friend, other) with a person employed by the state and who may be involved with the evaluation and or adjudication of this bid? **YES / NO**

2.9.1If so, furnish particulars: .....

.....

.....

2.10 Are you, or any person connected with the bidder, **YES/NO**  
 aware of any relationship (family, friend, other) between  
 any other bidder and any person employed by the state  
 who may be involved with the evaluation and or adjudication  
 of this bid?

2.10.1 If so, furnish particulars .....

.....

.....

2.11 Do you or any of the directors / trustees / shareholders / members **YES/NO**  
 of the company have any interest in any other related companies  
 whether or not they are bidding for this contract?

2.11.1 If so, furnish particulars: .....

.....

.....

**3 Full details of directors / trustees / members / shareholders.**

| Full Name | Identity<br>Number | Personal Tax<br>Reference Number | State Employee<br>Number / Persal<br>Number |
|-----------|--------------------|----------------------------------|---|
|           |                    |                                  |   |
|           |                    |                                  |   |
|           |                    |                                  |   |
|           |                    |                                  |   |
|           |                    |                                  |   |
|           |                    |                                  |   |
|           |                    |                                  |   |
|           |                    |                                  |   |
|           |                    |                                  |   |

#### 4 DECLARATION

I, THE UNDERSIGNED (NAME).....

CERTIFY THAT THE INFORMATION FURNISHED IN PARAGRAPHS 2 AND 3 ABOVE IS CORRECT.

I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME IN TERMS OF PARAGRAPH 23 OF THE GENERAL CONDITIONS OF CONTRACT SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....  
Signature

.....  
Date

.....  
Position

.....  
Name of bidder

## DECLARATION FOR PROCUREMENT ABOVE R 10 MILLION (ALL APPLICABLE TAXES INCLUDED)

For all procurement expected to exceed R100 million (all applicable taxes included), bidders must complete the following questionnaire:

- |     |  |                |
|-----|--|----------------|
| 1   | Are you by law required to prepare annual financial statements for auditing?   | <b>*Yes/No</b> |
| 1.1 | If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the past three years.<br><br>.....<br><br>.....   |                |
| 2   | Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days?                      | <b>*Yes/No</b> |
| 2.1 | If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than three months or other service provider in respect of which payment is overdue for more than 30 days. |                |
| 2.2 | If yes, provide particulars.<br><br>.....<br><br>.....   |                |
| 3   | Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract?   | <b>*Yes/No</b> |
| 3.1 | If yes, furnish particulars<br><br>.....<br><br>.....  |                |
| 4.  | Will any portion of goods or services be sourced from outside the Republic, and, if so, what portion and whether any portion of payment from the municipality / municipal entity is expected to be transferred out of the Republic?            | <b>*Yes/No</b> |
| 4.1 | If yes, furnish particulars<br><br>.....<br><br>.....  |                |

\* Delete that which if not applicable

CERTIFICATION

I, THE UNDERSIGNED (NAME) .....

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....  
Signature

.....  
Date

.....  
Position

.....  
Name of Bidder



## PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2017

This preference form must form part of all bids invited. It contains general information and serves as a claim form for preference points for Broad-Based Black Economic Empowerment (B-BBEE) Status Level of Contribution

**NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017.**

### 1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2

- a) The value of this bid is estimated to exceed R50 000 000 (all applicable taxes included), and therefore the 90/10 preference point system shall be applicable.

1.3 Points for this bid shall be awarded for:

- (a) Price; and
- (b) B-BBEE Status Level of Contributor.

1.4 The maximum points for this bid are allocated as follows:

|  | POINTS     |
|--|------------|
| PRICE  | 90         |
| B-BBEE STATUS LEVEL OF CONTRIBUTOR                       | 10         |
| <b>Total points for Price and B-BBEE must not exceed</b> | <b>100</b> |

1.5 Failure on the part of a bidder to submit proof of B-BBEE Status level of contributor together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

1.6 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

**2.**

- (a) **“B-BBEE”** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;
- (b) **“B-BBEE status level of contributor”** means the B-BBEE status of an entity in terms of a code of good practice on black economic empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;
- (c) **“bid”** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the provision of goods or services, through price quotations, advertised competitive bidding processes or proposals;
- (d) **“Broad-Based Black Economic Empowerment Act”** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);
- (e) **“EME”** means an Exempted Micro Enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;
- (f) **“functionality”** means the ability of a tenderer to provide goods or services in accordance with specifications as set out in the tender documents.
- (g) **“prices”** includes all applicable taxes less all unconditional discounts;
- (h) **“proof of B-BBEE status level of contributor”** means:
  - 1) B-BBEE Status level certificate issued by an authorized body or person;
  - 2) A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice;
  - 3) Any other requirement prescribed in terms of the B-BBEE Act;
- (i) **“QSE”** means a qualifying small business enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;
- (j) **“rand value”** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;

### 3.

### 3.1

A maximum of 80 or 90 points is allocated for price on the following basis:

**or**

$$P_s = 80 \left( 1 - \frac{Pt - P_{\min}}{P_{\min}} \right) \quad \text{or} \quad P_s = 90 \left( 1 - \frac{Pt - P_{\min}}{P_{\min}} \right)$$

Where

Ps = Points scored for price of bid under consideration

Pt = Price of bid under consideration

$P_{min}$  = Price of lowest acceptable bid

#### 4. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTOR

- 4.1 In terms of Regulation 6 (2) and 7 (2) of the Preferential Procurement Regulations, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

| B-BBEE Status Level of Contributor | Number of points (90/10 system) | Number of points (80/20 system) |
|------------------------------------|---------------------------------|---------------------------------|
| 1                                  | 10                              | 20                              |
| 2                                  | 9                               | 18                              |
| 3                                  | 6                               | 14                              |
| 4                                  | 5                               | 12                              |
| 5                                  | 4                               | 8                               |
| 6                                  | 3                               | 6                               |
| 7                                  | 2                               | 4                               |
| 8                                  | 1                               | 2                               |
| Non-compliant contributor          | 0                               | 0                               |

#### 5. BID DECLARATION

- 5.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

#### 6. B-BBEE STATUS LEVEL OF CONTRIBUTOR CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 4.1

- 6.1 B-BBEE Status Level of Contributor: ..... = .....(maximum of 10 or 20 points)  
(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 4.1 and must be substantiated by relevant proof of B-BBEE status level of contributor.)

#### 7. SUB-CONTRACTING

- 7.1 Will any portion of the contract be sub-contracted?

(***Tick applicable box***)

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

- 7.1.1 If yes, indicate:

- i) What percentage of the contract will be subcontracted.....%
- ii) The name of the sub-contractor.....
- iii) The B-BBEE status level of the sub-contractor.....
- iv) Whether the sub-contractor is an EME or QSE

(***Tick applicable box***)

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

- v) Specify, by ticking the appropriate box, if subcontracting with an enterprise in terms of Preferential Procurement Regulations, 2017:

| <b>Designated Group: An EME or QSE which is at last 51% owned by:</b> | <b>EME</b><br>√ | <b>QSE</b><br>√ |
|---|-----------------|-----------------|
| Black people  |                 |                 |
| Black people who are youth  |                 |                 |
| Black people who are women  |                 |                 |
| Black people with disabilities  |                 |                 |
| Black people living in rural or underdeveloped areas or townships     |                 |                 |
| Cooperative owned by black people                                     |                 |                 |
| Black people who are military veterans                                |                 |                 |
| <b>OR</b>   |                 |                 |
| Any EME   |                 |                 |
| Any QSE   |                 |                 |

**8. DECLARATION WITH REGARD TO COMPANY/FIRM**

8.1 Name of company/firm:.....

8.2 VAT registration number:.....

8.3 Company registration number:.....

**8.4 TYPE OF COMPANY/ FIRM**

- ☐ Partnership/Joint Venture / Consortium
- ☐ One person business/sole propriety
- ☐ Close corporation
- ☐ Company
- ☐ (Pty) Limited

[TICK APPLICABLE BOX]

**8.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES**

.....  
.....  
.....  
.....

**8.6 COMPANY CLASSIFICATION**

- ☐ Manufacturer
- ☐ Supplier
- ☐ Construction service provider
- ☐ Other service providers, e.g. transporter, etc.

[TICK APPLICABLE BOX]

**8.7 MUNICIPAL INFORMATION**

Municipality where business is situated: .....

Registered Account Number: .....

Stand Number:.....

8.8 Total number of years the company/firm has been in business:.....

8.9 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBEE status level of contributor indicated in paragraphs 1.4 and 6.1 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

- i) The information furnished is true and correct;
- ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;
- iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 6.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;
- iv) If the B-BBEE status level of contributor has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –
  - (a) disqualify the person from the bidding process;
  - (b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;
  - (c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;
  - (d) recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and
  - (e) forward the matter for criminal prosecution.

WITNESSES

1. ....

2. ....

.....  
SIGNATURE(S) OF BIDDERS(S)

DATE: .....

ADDRESS:

.....

.....

.....

## DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT

This Municipal Bidding Document (MBD) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

Before completing this declaration, bidders must study the General Conditions, Definitions, Directives applicable in respect of Local Content as prescribed in the Preferential Procurement Regulations, 2011 and the South African Bureau of Standards (SABS) approved technical specification number SATS 1286:201x.

### 1. General Conditions

- 1.1. Preferential Procurement Regulations, 2011 (Regulation 9.(1) and 9.(3) make provision for the promotion of local production and content.
- 1.2. Regulation 9.(1) prescribes that in the case of designated sectors, where in the award of bids local production and content is of critical importance, such bids must be advertised with the specific bidding condition that only locally produced goods, services or works or locally manufactured goods, with a stipulated minimum threshold for local production and content will be considered.
- 1.3. Regulation 9.(3) prescribes that where there is no designated sector, a specific bidding condition may be included, that only locally produced services, works or goods or locally manufactured goods with a stipulated minimum threshold for local production and content, will be considered.
- 1.4. Where necessary, for bids referred to in paragraphs 1.2 and 1.3 above, a two-stage bidding process may be followed, where the first stage involves a minimum threshold for local production and content and the second stage price and B-BBEE.
- 1.5. A person awarded a contract in relation to a designated sector, may not sub-contract in such a manner that the local production and content of the overall value of the contract is reduced to below the stipulated minimum threshold.
- 1.6. The local content (LC) as a percentage of the bid price must be calculated in accordance with the SABS approved technical specification number SATS 1286: 201x as follows:

$$LC = 1 - \left( \frac{x}{y} \right) \times 100$$

Where

x imported content

y bid price excluding value added tax (VAT)

Prices referred to in the determination of x must be converted to Rand (ZAR) by using the exchange rate published by the South African Reserve Bank (SARB) at 12:00 on the date, one week (7 calendar days) prior to the closing date of the bid as required in paragraph 4.1 below.

1.7. A bid will be disqualified if:

- the bidder fails to achieve the stipulated minimum threshold for local production and content indicated in paragraph 3 below; and.
- this declaration certificate is not submitted as part of the bid documentation.

## 2. Definitions

2.1. **“bid”** includes advertised competitive bids, written price quotations or proposals;

2.2. **“bid price”** price offered by the bidder, excluding value added tax (VAT);

2.3. **“contract”** means the agreement that results from the acceptance of a bid by an organ of state;

2.4. **“designated sector”** means a sector, sub-sector or industry that has been designated by the Department of Trade and Industry in line with national development and industrial policies for local production, where only locally produced services, works or goods or locally manufactured goods meet the stipulated minimum threshold for local production and content;

2.5. **“duly sign”** means a Declaration Certificate for Local Content that has been signed by the Chief Financial Officer or other legally responsible person nominated in writing by the Chief Executive, or senior member / person with management responsibility (close corporation, partnership or individual).

2.6. **“imported content”** means that portion of the bid price represented by the cost of components, parts or materials which have been or are still to be imported (whether by the supplier or its subcontractors) and which costs are inclusive of the costs abroad, plus freight and other direct importation costs, such as landing costs, dock duties, import duty, sales duty or other similar tax or duty at the South African port of entry;

2.7. **“local content”** means that portion of the bid price which is not included in the imported content, provided that local manufacture does take place;

2.8. **“sub-contract”** means the primary contractor’s assigning, leasing, making out work to, or employing another person to support such primary contractor in the execution of part of a project in terms of the contract.

## 3. The stipulated minimum threshold(s) for local production and content for this bid is/are as follows:

| <u>Description of services, works or goods</u> | <u>Stipulated minimum threshold</u> |
|--|-------------------------------------|
| Monopole Pylons                                | 100 %                               |
| Powerline Hardware                             | 100 %                               |
| Electrical and telecom cables                  | 90 %                                |
| Transformers (Class 1)                         | 80 %                                |

4. Does any portion of the services, works or goods offered have any imported content?

YES / NO

4.1 If yes, the rate(s) of exchange to be used in this bid to calculate the local content as prescribed in paragraph 1.6 of the general conditions must be the rate(s) published by the

SARB for the specific currency at 12:00 on the date, one week (7 calendar days) prior to the closing date of the bid.

The relevant rates of exchange information are accessible on [www.reservebank.co.za](http://www.reservebank.co.za).

Indicate the rate(s) of exchange against the appropriate currency in the table below:

| Currency       | Rates of exchange |
|----------------|-------------------|
| US Dollar      |                   |
| Pound Sterling |                   |
| Euro           |                   |
| Yen            |                   |
| Other          |                   |

NB: Bidders must submit proof of the SARB rate (s) of exchange used.

**LOCAL CONTENT DECLARATION BY CHIEF FINANCIAL OFFICER OR OTHER  
LEGALLY RESPONSIBLE PERSON NOMINATED IN WRITING BY THE CHIEF  
EXECUTIVE OR SENIOR MEMBER/PERSON WITH MANAGEMENT RESPONSIBILITY  
(CLOSE CORPORATION, PARTNERSHIP OR INDIVIDUAL)**

**IN RESPECT OF BID No.** .....

**ISSUED BY:** (Procurement Authority / Name of Municipality / Municipal Entity):

NB The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.

I, the undersigned, ..... (full names),

do hereby declare, in my capacity as .....

of .....(name of bidder entity), the following:

- (a) The facts contained herein are within my own personal knowledge.
- (b) I have satisfied myself that the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS 1286.
- (c) The local content has been calculated using the formula given in clause 3 of SATS 1286, the rates of exchange indicated in paragraph 4.1 above and the following figures:

|  |   |
|--|---|
| Bid price, excluding VAT (y)                                       | R |
| Imported content (x)   | R |
| Stipulated minimum threshold for Local content (paragraph 3 above) |   |
| Local content % as calculated in terms of SATS 1286                |   |

If the bid is for more than one product, a schedule of the local content by product shall be attached.



- (d) I accept that the Procurement Authority / Municipality /Municipal Entity has the right to request that the local content be verified in terms of the requirements of SATS 1286.
- (e) I understand that the awarding of the bid is dependent on the accuracy of the information furnished in this application. I also understand that the submission of incorrect data, or data that are not verifiable as described in SATS 1286, may result in the Procurement Authority / Municipal / Municipal Entity imposing any or all of the remedies as provided for in Regulation 13 of the Preferential Procurement Regulations, 2011 promulgated under the Policy Framework Act (PPPFA), 2000 (Act No. 5 of 2000).

**SIGNATURE:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**WITNESS No. 1** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**WITNESS No. 2** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES**

- 1 This Standard Bidding Document must form part of all bids invited.
- 2 It serves as a declaration to be used by institutions in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.
- 3 The bid of any bidder may be disregarded if that bidder, or any of its directors have-
  - a. abused the institution's supply chain management system;
  - b. committed fraud or any other improper conduct in relation to such system; or
  - c. failed to perform on any previous contract.
- 4 **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**

| Item  | Question   | Yes                             | No                             |
|-------|--|---------------------------------|--------------------------------|
| 4.1   | Is the bidder or any of its directors listed on the National Treasury's database as companies or persons prohibited from doing business with the public sector?<br><br>(Companies or persons who are listed on this database were informed in writing of this restriction by the National Treasury after the <i>audi alteram partem</i> rule was applied).   | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| 4.1.1 | If so, furnish particulars:  |                                 |                                |
| 4.2   | Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)?<br><b>To access this Register enter the National Treasury's website, <a href="http://www.treasury.gov.za">www.treasury.gov.za</a>, click on the icon "Register for Tender Defaulters" or submit your written request for a hard copy of the Register to facsimile number (012) 3265445.</b> | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| 4.2.1 | If so, furnish particulars:  |                                 |                                |
| 4.3   | Was the bidder or any of its directors convicted by a court of law (including a court outside of the Republic of South Africa) for fraud or corruption during the past five years?   | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| 4.3.1 | If so, furnish particulars:  |                                 |                                |
| 4.4   | Was any contract between the bidder and any organ of state terminated during the past five years on account of failure to perform on or comply with the contract?  | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| 4.4.1 | If so, furnish particulars:  |                                 |                                |

**CERTIFICATION**

**I, THE UNDERSIGNED (FULL NAME).....**

**CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS TRUE AND CORRECT.**

**I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.**

.....

**Signature**

.....

**Date**

.....

**Position**

.....

**Name of Bidder**

## CERTIFICATE OF INDEPENDENT BID DETERMINATION

- 1 This Municipal Bidding Document (MBD) must form part of all bids<sup>1</sup> invited.
- 2 Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).<sup>2</sup> Collusive bidding is a *per se* prohibition meaning that it cannot be justified under any grounds.
- 3 Treasury Regulation 16A9 prescribes that accounting officers and accounting authorities must take all reasonable steps to prevent abuse of the supply chain management system and authorizes accounting officers and accounting authorities to:
  - a. disregard the bid of any bidder if that bidder, or any of its directors have abused the institution's supply chain management system and or committed fraud or any other improper conduct in relation to such system.
  - b. cancel a contract awarded to a supplier of goods and services if the supplier committed any corrupt or fraudulent act during the bidding process or the execution of that contract.
- 4 This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.
- 5 In order to give effect to the above, the attached Certificate of Bid Determination (MBD 9) must be completed and submitted with the bid:

<sup>1</sup> Includes price quotations, advertised competitive bids, limited bids and proposals.

<sup>2</sup> Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

# **CERTIFICATE OF INDEPENDENT BID DETERMINATION**

I, the undersigned, in submitting the accompanying bid:

---

(Bid Number and Description)

in response to the invitation for the bid made by:

---

(Name of Institution)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: \_\_\_\_\_ that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
  - (a) has been requested to submit a bid in response to this bid invitation;
  - (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
  - (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder

6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium<sup>3</sup> will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
  - (a) prices;
  - (b) geographical area where product or service will be rendered (market allocation)
  - (c) methods, factors or formulas used to calculate prices;
  - (d) the intention or decision to submit or not to submit, a bid;
  - (e) the submission of a bid which does not meet the specifications and conditions of the bid; or
  - (f) bidding with the intention not to win the bid.
8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

**<sup>3</sup> Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill, and knowledge in an activity for the execution of a contract.**

10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

.....  
**Signature**

.....  
**Date**

.....  
**Position**

.....  
**Name of Bidder**

## CERTIFICATE FOR PAYMENT OF MUNICIPAL SERVICES

### DECLARATION IN TERMS OF CLAUSE 112(1) OF THE MUNICIPAL FINANCE MANAGEMENT ACT (NO.56 OF 2003) - (To be signed in the presence of a Commissioner of Oaths)

I, \_\_\_\_\_ (full name and ID no.), hereby acknowledge that according to SCM Regulation 38(1)(d)(i), the Municipality may reject the tender of the tenderer if any municipal rates and taxes or municipal service charges owed by the Tenderer or any of its directors/members/partners to the Great Kei Municipality, or to any other municipality or municipal entity, are in arrears for more than 3 (three) months.

I declare that I am duly authorised to act on behalf of \_\_\_\_\_ (name of the firm) and hereby declare, that to the best of my personal knowledge, neither the firm nor any director/member/partner of said firm is in arrears on any of its municipal accounts with any municipality in the Republic of South Africa, for a period longer than 3 (three) months.

I further hereby certify that the information set out in this schedule and/or attachment(s) hereto is true and correct. The Tenderer acknowledges that failure to properly and truthfully complete this schedule may result in the tender being disqualified, and/or in the event that the tenderer is successful, the cancellation of the contract.

| PHYSICAL BUSINESS ADDRESS(ES) OF THE TENDERER | MUNICIPAL ACCOUNT NUMBER |
|---|--------------------------|
|   |                          |
|   |                          |

#### FURTHER DETAILS OF THE BIDDER'S Director / Shareholder / Partners, etc.:

| Director / Shareholder / partner | Physical address of the Business | Municipal Account number(s) | Physical residential address of the Director / shareholder / partner | Municipal Account number(s) |
|----------------------------------|----------------------------------|-----------------------------|--|-----------------------------|
|                                  |                                  |                             |  |                             |
|                                  |                                  |                             |  |                             |
|                                  |                                  |                             |  |                             |
|                                  |                                  |                             |  |                             |
|                                  |                                  |                             |  |                             |
|                                  |                                  |                             |  |                             |
|                                  |                                  |                             |  |                             |

**NB:** Please attach certified copy(ies) of ID document(s)

If the entity or any of its Directors/Shareholders/Partners, etc. rents/leases premises, a copy of the rental/lease agreement must be submitted with this tender.

| Signature | Position | Date |
|-----------|----------|------|



**COMMISSIONER OF OATHS**

Signed and sworn to before me at \_\_\_\_\_ ,  
on this \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_

by the Deponent, who has acknowledged that he/she knows and understands the contents of this Affidavit, it is true and correct to the best of his/her knowledge and that he/she has no objection to taking the prescribed oath, and that the prescribed oath will be binding on his/her conscience.

**COMMISSIONER OF OATHS:-**

Position:

Address:

Tel:

**Apply official stamp of authority on this page:**

# EMALAHLENI LOCAL MUNICIPALITY

## 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

### SCHEDULE 1A: COMPULSORY ENTERPRISE QUESTIONNAIRE

The following particulars must be furnished. In the case of a joint venture, **separate** enterprise questionnaires in respect of each partner must be completed and submitted.

**Section 1: Name of enterprise:** .....

**Section 2: VAT registration number, if any:** .....

**Section 3: CIDB registration number, if any:** .....

**Section 4: Particulars of sole proprietors and partners in partnerships**

| Name* | Identity number* | Personal income tax number* |
|-------|------------------|-----------------------------|
|       |                  |                             |
|       |                  |                             |
|       |                  |                             |

\* Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

**Section 5: Particulars of companies and close corporations**

Company registration number .....

Close corporation number .....

Tax reference number .....

**Section 6: Record of service of the state**

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:

- |  |   |
|--|---|
| <input type="checkbox"/> a member of any municipal council                                     | <input type="checkbox"/> an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999) |
| <input type="checkbox"/> a member of any provincial legislature                                |   |
| <input type="checkbox"/> a member of the National Assembly or the National Council of Province | <input type="checkbox"/> a member of an accounting authority of any national or provincial public entity  |
| <input type="checkbox"/> a member of the board of directors of any municipal entity            | <input type="checkbox"/> an employee of Parliament or a provincial legislature  |
| <input type="checkbox"/> an official of any municipality or municipal entity                   |   |

**If any of the above boxes are marked, disclose the following:** (insert separate page if necessary)

| Name of sole proprietor, partner, director, manager, principal shareholder or stakeholder | Name of institution, public office, board or organ of state and position held | Status of service (tick appropriate column) |                       |
|---|---|---|-----------------------|
|   |   | current                                     | Within last 12 months |
|   |   |   |                       |
|   |   |   |                       |

\* Insert separate page if necessary

**Section 7: Record of spouses, children and parents in the service of the state**

Indicate by marking the relevant boxes with a cross, if any spouse, child or parent of a sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months been in the service of any of the following:

- |  |   |
|--|---|
| <input type="checkbox"/> a member of any municipal council                                     | <input type="checkbox"/> an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999) |
| <input type="checkbox"/> a member of any provincial legislature                                |   |
| <input type="checkbox"/> a member of the National Assembly or the National Council of Province | <input type="checkbox"/> a member of an accounting authority of any national or provincial public entity  |
| <input type="checkbox"/> a member of the board of directors of any municipal entity            | <input type="checkbox"/> an employee of Parliament or a provincial legislature  |
| <input type="checkbox"/> an official of any municipality or municipal entity                   |   |

| Name of spouse, child or parent | Name of institution, public office, board or organ of state and position held | Status of service<br>(tick appropriate column) |                       |
|---------------------------------|---|--|-----------------------|
|                                 |   | current  | Within last 12 months |
|                                 |   |  |                       |
|                                 |   |  |                       |
|                                 |   |  |                       |
|                                 |   |  |                       |

\* Insert separate page if necessary

The undersigned, who warrants that he/she is duly authorised to do so on behalf of the enterprise:

- i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;
- ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;
- iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;
- iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest;
- v) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed \_\_\_\_\_ Date \_\_\_\_\_

Name \_\_\_\_\_ Position \_\_\_\_\_

Enterprise name \_\_\_\_\_

\* The schedule should be used where tenders are subject to the local Government: Municipal Finance Management Act

EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

**SCHEDULE 1B: AUTHORITY OF SIGNATORY**

Indicate the status of the tenderer by ticking the appropriate box hereunder. The tenderer must complete the certificate set out below for the relevant category.

|              |                  |                    |                      |                        |
|--------------|------------------|--------------------|----------------------|------------------------|
| A<br>Company | B<br>Partnership | C<br>Joint Venture | D<br>Sole Proprietor | E<br>Close Corporation |
|              |                  |                    |                      |                        |

**A. Certificate for Company**

I, ....., chairperson of the board of directors of  
.....  
hereby confirm that by resolution of the board (**copy attached**) taken on ..... 20.....,  
Mr/Ms .....  
acting in the capacity of ....., was authorized to sign all documents  
in connection with this tender for contract ..... and any contract resulting  
from it on behalf of the company.

**As witnesses :**

1 ..... Chairman :  
.....  
2 ..... Date :  
.....

Tenderers must attach a copy of the Resolution of the Board.

**B. Certificate for Partnership**

We, the undersigned, being the key partners in the business trading as .....  
.....  
hereby authorize Mr/Ms .....  
acting in the capacity of .....to sign all documents in connection  
with the tender for Contract .. and any contract resulting from it on  
our behalf.

| NAME | ADDRESS | SIGNATURE | DATE |
|------|---------|-----------|------|
|      |         |           |      |
|      |         |           |      |

**NOTE :** This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Partnership as a whole.

**C. Certificate for Joint Venture**

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr/Ms ..... , authorised signatory of the company ..... , acting in the capacity of lead partner, to sign all documents in connection with the tender offer for Contract .....and any contract resulting from it on our behalf.

This authorization is evidenced by the attached power of attorney signed by legally authorized signatories of all the partners to the Joint Venture.

| NAME OF FIRM | ADDRESS | AUTHORISING SIGNATURE, NAME & CAPACITY |
|--------------|---------|--|
| Lead partner |         |  |
|              |         |  |
|              |         |  |
|              |         |  |

**D. Certificate for Sole Proprietor**

I, ..... hereby confirm that I am the sole owner of the business trading as .....

**As witnesses:**

1 .....  
.  
2 .....  
.  
.....

Signature: Sole owner :

Date : .....  
.....  
.....

**E. Certificate for Close Corporation**

We, the undersigned, being the key members in the business trading as .....  
.....  
hereby authorize Mr/Ms .....  
acting in the capacity of ....., to sign all documents in connection with the tender for Contract ..... and any contract resulting from it on our behalf.

| NAME | ADDRESS | SIGNATURE | DATE |
|------|---------|-----------|------|
|      |         |           |      |
|      |         |           |      |
|      |         |           |      |
|      |         |           |      |

**NOTE:** This certificate is to be completed and signed by all of the key-partners upon who rests the direction of the affairs of the Partnership as a whole.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 1C: CERTIFICATE OF AUTHORITY FOR JOINT VENTURES (if applicable)**

This returnable schedule is to be completed by joint ventures.

We, the undersigned, are submitting this tender offer in joint venture and hereby authorize

Mr/Ms .....,

authorised signatory of the company, close corporation or partnership.....

....., acting in the capacity of lead partner, to sign all documents in  
connection with the tender offer and any contract resulting from it on our behalf.

| NAME OF FIRM | ADDRESS | DULY AUTHORISED SIGNATORY                          |
|--------------|---------|--|
| Lead partner |         | Signature .....<br>Name .....<br>Designation ..... |
|              |         | Signature .....<br>Name .....<br>Designation ..... |
|              |         | Signature .....<br>Name .....<br>Designation ..... |

**NOTE:** A copy of the Joint Venture Agreement showing clearly the **percentage contribution of each partner** to the Joint Venture shall be appended to this schedule.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 1D: RECORD OF ADDENDA TO TENDER DOCUMENTS**

We confirm that the following communications received from the Employer before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer:

| No. | Date | Title or Details |
|-----|------|------------------|
| 1.  |      |                  |
| 2.  |      |                  |
| 3.  |      |                  |
| 4.  |      |                  |
| 5.  |      |                  |
| 6.  |      |                  |
| 7.  |      |                  |
| 8.  |      |                  |
| 9.  |      |                  |
| 10. |      |                  |

Attach additional pages if more space is required.

Signed .....

Date .....

Name .....

Position .....

Tenderer .....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 1E: COMPANY'S RELEVANT EXPERIENCE IN SOUTH AFRICA**

|   | PROJECT NAME | PROJECT<br>VALUE (ZAR) | CLIENT/EMPLOYER | COMPLETION<br>DATE | COMPLETION<br>CERTIFICATE/LETTER<br>(Y/N) |
|---|--------------|------------------------|-----------------|--------------------|---|
| 1 |              |                        |                 |                    |   |
| 2 |              |                        |                 |                    |   |
| 3 |              |                        |                 |                    |   |
| 4 |              |                        |                 |                    |   |
| 5 |              |                        |                 |                    |   |

\* To be filled in by Tenderer

Signed .....

Date .....

Name .....

Position .....

Tenderer .....



**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 1F: PERSONNEL SCHEDULE**

| <b>Job Description</b>                 | <b>Qualification</b> | <b>Years of Experience</b> | <b>No. HV OHL projects completed</b> |
|--|----------------------|----------------------------|--------------------------------------|
| Contract Manager                       |                      |                            |                                      |
| Site Agent / Project Manager           |                      |                            |                                      |
| Health and Safety Manager              |                      |                            |                                      |
| Surveyors                              |                      |                            |                                      |
| Construction Manager / General Foreman |                      |                            |                                      |
| Site Engineer                          |                      |                            |                                      |
| Safety Officer                         |                      |                            |                                      |
| Foremen 1                              |                      |                            |                                      |
| Foremen 2                              |                      |                            |                                      |
| Foremen 2                              |                      |                            |                                      |
| *                                      |                      |                            |                                      |
| *                                      |                      |                            |                                      |
| *                                      |                      |                            |                                      |
| *                                      |                      |                            |                                      |
| *                                      |                      |                            |                                      |
| *                                      |                      |                            |                                      |

\* To be filled in by Tenderer

Signed .....

Date .....

Name .....

Position .....

Tenderer .....

## FORMAT OF THE CURRICULUM VITAE

EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

**SCHEDULE 1G: SCHEDULE OF PLANT AND EQUIPMENT AVAILABLE FOR THE  
CONTRACT**

The following are lists of major items of relevant equipment that I/we **presently** own or lease and will have available for this contract or will acquire or hire for this contract if my/our tender is accepted.

(a) Details of major equipment that is owned by and immediately available for this contract.

| Quantity | Description, Size, Capacity, etc |
|----------|----------------------------------|
|          |                                  |

Attach additional pages if more space is required.

(b) Details of major equipment that will be hired, or acquired for this contract if my/our tender is acceptable.

| Quantity | Description, Size, Capacity, etc |
|----------|----------------------------------|
|          |                                  |

Attach additional pages if more space is required.

Signed .....

Date .....

Name .....

Position .....

Tenderer .....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 1H: SCHEDULE OF GENERIC METHOD STATEMENT FOR CONSTRUCTION OF  
HIGH VOLTAGE (88 kV OR HIGHER) OVERHEAD LINES**

Provide a generic method statement to describe the typically steps, methods, practices, and techniques followed in the construction of High Voltage (88 kV or higher) Overhead Lines based on the contractors experience and knowledge, including the critical quality check points. please include the preliminary concrete mix design and formwork system.

Signed .....

Date .....

Name .....

Position .....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 11: SCHEDULE OF PROPOSED SUBCONTRACTORS**

We notify you that it is our intention to employ the following Subcontractors to work on this contract.  
If we are awarded the contract, we agree that this notification does not change the requirement for us to submit the names of proposed Subcontractors in accordance with requirements in the contract for such appointments. If there are no such requirements in the contract, then your written acceptance of this list shall be binding between us

| No. | Name and Address of Proposed Subcontractor | Nature and Extent of Work | Previous Experience with Subcontractor |
|-----|--|---------------------------|--|
| 1.  |  |                           |  |
| 2.  |  |                           |  |
| 3.  |  |                           |  |
| 4.  |  |                           |  |
| 5.  |  |                           |  |
| 6.  |  |                           |  |
| 7.  |  |                           |  |

Signed .....

Date .....

Name .....

Position .....

Tenderer .....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|  |
|--|
| <b>SCHEDULE 1J: CERTIFICATE OF ATTENDANCE AT VIRTUAL CLARIFICATION MEETING</b> |
|--|

This is to certify that I, \_\_\_\_\_ representing  
\_\_\_\_\_  
in the company of \_\_\_\_\_ attended  
the virtual clarification meeting on: \_\_\_\_\_.

I have made myself familiar with all local conditions likely to influence the work and the cost thereof.  
I further certify that I am satisfied with the description of the work and explanations given at  
clarification meeting and that I understand perfectly the work to be done, as specified and implied, in  
the execution of this contract.

|                  |           |      |
|------------------|-----------|------|
|                  |           |      |
| Name of Tenderer | Signature | Date |

Attendance of the above person(s) at the meeting is confirmed by the Employer's representative, namely:

|          |       |             |       |
|----------|-------|-------------|-------|
| Name     | ..... | Signature   | ..... |
| Capacity | ..... | Date & Time | ..... |

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 1K: PROPOSED AMENDMENTS AND QUALIFICATIONS**

The Tenderer should record any deviations or qualifications he may wish to make to the tender documents in this Returnable Schedule. Alternatively, a tenderer may state such deviations and qualifications in a covering letter to his tender and reference such letter in this schedule.

The Tenderer's attention is drawn to clause F.3.8 of the Standard Conditions of Tender referenced in the Tender Data regarding the employer's handling of material deviations and qualifications.

| Page | Clause or Item | Proposal |
|------|----------------|----------|
|      |                |          |

Signed .....

Date .....

Name .....

Position .....

Tenderer .....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|   |
|---|
| <b>SCHEDULE 1L: WORKMENS' COMPENSATION REGISTRATION</b> |
|---|

**L. COPY OF WORKMENS' COMPENSATION REGISTRATION CERTIFICATE (OR PROOF OF PAYMENT  
OF CONTRIBUTIONS IN TERMS OF THE COMPENSATION FOR OCCUPATIONAL INJURIES AND  
DISEASES ACT NO. 130 OF 1993)**

*[Certified Copy of the Certificate or Proof of Payment thereof obtained from the Workmen's  
Compensation Commissioner to be inserted here]*



**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**SCHEDULE 1M: FUNCTIONALITY POINTS CLAIMED**

|          | <b>CRITERIA</b>   | <b>MAXIMUM<br/>POINTS</b> | <b>BIDDER SELF<br/>SCORE</b> | <b>EVALUATOR<br/>SCORE</b> |
|----------|---|---------------------------|------------------------------|----------------------------|
| <b>1</b> | <b>COMPANY'S RELEVANT<br/>EXPERIENCE</b>  | <b>20</b>                 |                              |                            |
| <b>2</b> | <b>RELEVANT KEY PERSONNEL</b>   | <b>20</b>                 |                              |                            |
| <b>3</b> | <b>GENERIC METHOD STATEMENT<br/>FOR THE SUCCESSFUL<br/>CONSTRUCTION OF A HIGH<br/>VOLTAGE OVERHEAD LINE</b> | <b>25</b>                 |                              |                            |
| <b>4</b> | <b>OWNERSHIP OF PLANT AND<br/>EQUIPMENT TO USE FOR THIS<br/>PROJECT.</b>                                    | <b>10</b>                 |                              |                            |
| <b>5</b> | <b>SOCIAL DEVELOPMENT PLAN</b>  | <b>5</b>                  |                              |                            |
| <b>6</b> | <b>HEALTH AND SAFETY PLAN</b>   | <b>5</b>                  |                              |                            |
| <b>7</b> | <b>QUALITY CONTROL PLAN</b>   | <b>5</b>                  |                              |                            |
| <b>8</b> | <b>BANK RATING AND 3-YEAR<br/>FINANCIAL STATEMENTS</b>  | <b>10</b>                 |                              |                            |
|          | <b>TOTAL</b>  | <b>100</b>                |                              |                            |

Signed .....

Date .....

Name .....

Position .....

Tenderer .....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|   |
|---|
| <b>SCHEDULE 2A: CERTIFICATE OF CONTRACTOR REGISTRATION<br/>ISSUED BY THE CIDB</b> |
|---|

*[Proof of contractor CIDB grading to be inserted here]*

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|  |
|--|
| <b>SCHEDULE 2B: AUDITED FINANCIAL STATEMENTS</b> |
|--|

*[Audited financial statements for the past 3 years must be attached]*

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|   |
|---|
| <b>SCHEDULE 2C: PROOF OF AUTHORITY OF SIGNATORY</b> |
|---|

*[Letter of authority to sign the tender document must be inserted here]*

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|                                |
|--------------------------------|
| <b>SCHEDULE 2D: CSD REPORT</b> |
|--------------------------------|

The Tenderer must attach to this page an CSD report in respect of his/her company, close corporation or partnership. In the case of a joint venture between two or more firms, the tenderer shall attach each attached their respective reports.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|  |
|--|
| <b>SCHEDULE 2E: JOINT VENTURE AGREEMENT (Only if applicable)</b> |
|--|

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|  |
|--|
| <b>SCHEDULE 2F: MUNICIPAL LEVY PAYMENT</b> |
|--|

The tenderer must attach to this page proof of each company director's registration with the Municipalities (local and/or district) as a payer of municipal rates and taxes.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

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|---|
| <p><b>SCHEDULE 2G: A CERTIFICATE CERTIFYING THAT THE ENTERPRISE<br/>HAS NO UNDISPUTED COMMITMENTS</b></p> |
|---|



EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

SCHEDULE 2H: FORM OF INTENT TO PROVIDE PERFORMANCE GUARANTEE

*[The Tenderer must attach hereto a letter from the bank or institution with whom he has made the necessary arrangements, to the effect that the said bank or institution will be prepared to provide the required performance guarantee when asked to do so]. A Proforma is attached for the tenderers to use.*

PRO-FORMA FOR A PERFORMANCE GUARANTEE

WITH REFERENCE TO THE CONTRACT ENTERED INTO BETWEEN EMALAHLENI LOCAL  
MUNICIPALITY (the "EMPLOYER")

and ..... (the "CONTRACTOR")

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 km, 132 kV  
OVERHEAD LINE.

Contract No: ELM 20/2021 (RE-ADVERT)

We, the undersigned .....

Of.....

and.....

of.....

do hereby bind ourselves as sureties **in solidum** for the due and proper fulfilment by the Contractor for the said Contract, with terms of which we acknowledge ourselves to be fully acquainted, provided that under no circumstances the sum to be recovered from us shall exceed.

R..... (Rand .....)  
being 10 % of the Contract Sum.

We hereby specially renounce the benefit of the exceptions **ORDINIS SEU EXCUSSIONIS ET DIVISIONIS** with the meaning and effect of which exceptions we acknowledge ourselves to be fully acquainted.

The said sum or portion thereof, is payable at any time whilst we are bound as Sureties upon our receiving a written demand from the Engineer that such sum or portion thereof, is due and payable in terms of our Surety. When called upon and certified by the Engineer, the amount claimed shall be paid to the Employer within 30 days.

The claim for payment and certification of the amount payable shall be addressed

to:.....

Contact Details and address: .....

The Surety is neither negotiable nor transferable, and shall hold good until the works or parts thereof have been taken over in terms of Clause 29 of the Contract, hereafter this Suretyship shall be returned to the Contractor.

NOTE: Payment shall be executed within 30 days of receiving instruction from the Engineer.

Instruction to be addressed to the following person's attention:

Name : .....

Telephone : .....

E-mail : .....

The address for submission of the Engineer's instruction to call upon the bond for payment:

Name : .....

Telephone : .....

E-mail : .....

Address : .....

**FOR AND ON BEHALF OF THE SURETIES:**

At .....on this .....day of .....20.....

SIGNATURE: .....

SIGNATURE: .....

AS WITNESSES: 1. .... 2. ....

ADDRESS: ..... ADDRESS: .....

.....

.....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

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|--|
| <b>SCHEDULE 2I: RISK MANAGEMENT PLAN</b> |
|--|

*[The Tenderer must attach hereto a Risk Management Plan which outlines how the Tenderer will identify and put plans in place to control project risks. The Tenderer is also expected to generate a risk register with potential risks that the Tenderer is currently foreseeing, including the control measures/proposals required to mitigate or limit the project exposure]*

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|   |
|---|
| <b>SCHEDULE 3A: EXECUTION PROGRAMME</b> |
|---|

The Tenderer shall attach a preliminary programme reflecting the proposed sequence and tempo of execution of the various activities comprising the work for this Contract. The programme shall be in accordance with the information supplied in the Contract, requirements of the Project Specifications and with all other aspects of his Tender. The preliminary programme should at least be a level 3 programme, also called a Publication Schedule. It includes all major milestones, major elements of design, engineering, procurement, construction, testing, commissioning and/or start-up.

The Execution Programme must be based on the completion time as specified in the Contract Data.

**PLEASE NOTE:** the cash flow projections from the contractor (to be submitted before commencement of the execution of the contract) must be in accordance with this execution plan in order to ensure proper cash flow management and to minimise delayed payments.

SIGNATURE: .....  
(of person authorised to sign on behalf of the Tenderer)

DATE: .....

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### SCHEDULE 3B: CONTRACTOR'S HEALTH AND SAFETY DECLARATION

In terms of Clause 4(4) of the OHSA 1993 Construction Regulations 2003 (referred to as "the Regulations" hereafter), a Contractor may only be appointed to perform construction work if the Employer is satisfied that the Contractor has the necessary competencies and resources to carry out the work safely in accordance with the Occupational Health and Safety Act No 85 of 1993 and the OHSA 1993 Construction Regulations 2003. To that effect a person duly authorised by the tenderer must complete and sign the declaration hereafter in detail.

#### Declaration by Tenderer

1. I the undersigned hereby declare and confirm that I am fully conversant with the Occupational Health and Safety Act No 85 of 1993 (as amended by the Occupational Health and Safety Amendment Act No 181 of 1993), and the OHSA 1993 Construction Regulations 2003.
2. I hereby declare that my company has the competence and the necessary resources to safely carry out the construction work under this contract in compliance with the Construction Regulations and the Employer's Health and Safety Specifications.
3. I propose to achieve compliance with the Regulations by one of the following:
  - (a) From my own competent resources as detailed in 4(a) hereafter: ..... \*Yes / No
  - (b) From my own resources still to be appointed or trained until competency is achieved, as detailed in 4(b) hereafter: ..... \*Yes / No
  - (c) From outside sources by appointment of competent specialist subcontractors as detailed in 4(c) hereafter: ..... \*Yes / No(\* = delete whatever is not applicable)
4. Details of resources I propose:

*(Note: Competent resources shall include safety personnel such as a construction supervisor and construction safety officer as defined in Regulation 6, and competent persons as defined in Regulations 7, 8, 10, 11, 12, 14, 15, 18, 21(1), 22, 26 and 27, as applicable to this contract)*

- (a) Details of the competent and qualified key persons from my company's own resources, who will form part of the contract team:

| NAMES OF COMPETENT PERSONS | POSITIONS TO BE FILLED BY COMPETENT PERSONS |
|----------------------------|---|
|                            |   |
|                            |   |
|                            |   |
|                            |   |

(a) Details of training of persons from my company's own resources (or to be hired) who still have to be trained to achieve the necessary competency:

(i) By whom will training be provided? .....

(ii) When will training be undertaken? .....

(iii) List the positions to be filled by persons to be trained or hired: .....

.....

.....

.....

(c) Details of competent resources to be appointed as subcontractors if competent persons cannot be supplied from own company:

Name of proposed subcontractor: .....

Qualifications or details of competency of the subcontractor: .....

.....

.....

.....

5. I hereby undertake, if my tender is accepted, to provide, before commencement of the works under the contract, a suitable and sufficiently documented Health and Safety Plan in accordance with Regulation 5(1) of the Construction Regulations, which plan shall be subject to approval by the Employer.

6. I confirm that copies of my company's approved Health and Safety Plan, the Employer's Safety Specifications as well as the OHSA 1993 Construction Regulations 2003 will be provided on site and will at all times be available for inspection by the Contractor's personnel, the Employer's personnel, the Engineer, visitors, and officials and inspectors of the Department of Labour.

7. I hereby confirm that adequate provision has been made in my tendered rates and prices in the schedule of quantities to cover the cost of all resources, actions, training and all health and safety measures envisaged in the OHSA 1993 Construction Regulations 2003, and that I will be liable for any penalties that may be applied by the Employer in terms of the said Regulations (Regulation 30) for failure on the Contractor's part to comply with the provisions of the Act and the Regulations.

8. I agree that my failure to complete and execute this declaration to the satisfaction of the Employer will mean that I am unable to comply with the requirements of the OHSA 1993 Construction Regulations 2003, and accept that my tender will be prejudiced and may be rejected at the discretion of the Employer.

SIGNATURE: .....  
(of person authorised to sign on behalf of the Tenderer)

DATE:.....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))**

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|--|
| <b>SCHEDULE 3C: CONTRACTOR'S SAFETY PLAN</b> |
|--|

*The Tenderer shall submit the Contractor's Health and Safety Plan as required in terms of Regulation 5 of the Occupational Health and Safety Act 1993 Construction Regulations 2003, and referred to in T2.1]*

EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

**SCHEDULE 3D: PRO FORMA NOTIFICATION FORM IN TERMS OF THE OCCUPATIONAL  
HEALTH AND SAFETY ACT 1993, CONSTRUCTION REGULATIONS 2003**

*[This form must be completed and forwarded, prior to commencement of work on site, by all Contractors that qualify in terms of Regulation 3 of the Construction Regulations 2003, to the office of the Department of Labour]*

1. (a) Name and postal address of Contractor:.....  
.....  
(b) Name of Contractor's contact person: .....  
Telephone number: .....
2. Contractor's workman's compensation registration number: .....
3. (a) Name and postal address of client: .....  
.....  
(b) Name of client's contact person or agent:.....  
Telephone number .....
4. (a) Name and postal address of designer(s) for the project: .....  
.....  
(b) Name of designer's contact person: .....  
Telephone number .....
5. Name of Contractor's construction supervisor on site appointed in terms of  
Regulation 6(1): ..... Telephone number: .....
6. Name/s of Contractor's sub-ordinate supervisors on site appointed in terms of regulation 6(2).  
.....
7. Exact physical address of the construction site or site office: .....  
.....
8. Nature of the construction work: .....  
.....
9. Expected commencement date: .....
10. Expected completion date: .....
11. Estimated maximum number of persons on the construction site: .....
12. Planned number of subcontractors on the construction site accountable to Contractor: .....
13. Name(s) of subcontractors already chosen: .....  
.....

SIGNED BY:

CONTRACTOR: ..... DATE: .....

CLIENT: ..... DATE: .....



**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|  |
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| <b>SCHEDULE 3E: QUALITY CONTROL PLAN</b> |
|--|

*[The Tenderer must attach hereto their Quality Control Plan which outlines how the Tenderer will manage the quality of the work performed. A maximum of 5 points will be awarded for this section, based on how detailed and well developed the Social Development Plan is.]*

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|   |
|---|
| <b>SCHEDULE 3F: SOCIAL DEVELOPMENT PLAN</b> |
|---|

*[The Tenderer must attach hereto their Social Development Plan which outlines how the Tenderer will address the critical challenges of poverty, unemployment and inequality, over the short and medium term, with a focus on deepening social assistance and extending the scope of social security; reforming the social welfare sector and its services to deliver better results and strengthening community development. A maximum of 5 points will be awarded for this section, based on how detailed and well developed the Social Development Plan is.]*

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|  |
|--|
| <b>PART C1 : AGREEMENT AND CONTRACT DATA</b> |
|--|

- C1.1 Form of Offer and Acceptance**
- C1.2 Contract Data (Part 1)**
- C1.2 Contract Data (Part 2)**
- C1.3 Form of Guarantee**
- C1.4 Adjudicator's Agreement (if applicable)**
- C1.5 Safety Agreement**

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### C1.1 : FORM OF OFFER AND ACCEPTANCE

##### 1. OFFER

The employer, identified in the acceptance signature block, has solicited offers to enter into a contract for the procurement of:

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

The tenderer, identified in the offer signature block, has examined the documents listed in the tender data and addenda thereto as listed in the tender schedules, and by submitting this offer has accepted the conditions of tender.

By the representative of the tenderer, deemed to be duly authorized, signing this part of this form of offer and acceptance, the tenderer offers to perform all of the obligations and liabilities of the Contractor under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

**The offered total of the prices inclusive of Value-Added Tax is:**

.....

..... Rand (in words); R..... (in figures)

This offer may be accepted by the employer by signing the acceptance part of this form of offer and acceptance and returning one copy of this document to the tenderer before the end of the period of validity stated in the tender data, whereupon the tenderer becomes the party named as the contractor in terms of the conditions of contract identified in the contract data.

Signature(s) ..... ..

Name(s) ..... ..

Capacity ..... ..

for the **Tenderer** .....  
(Name and address of organization)

Name and signature  
of witness

.....

Date .....

.....

## 2. ACCEPTANCE

By signing this part of this form of offer and acceptance, the employer identified below accepts the tenderer's offer. In consideration thereof, the employer shall pay the contractor the amount due in accordance with the conditions of contract identified in the contract data. Acceptance of the tenderer's offer shall form an agreement between the employer and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement. The terms of the contract are contained in

Part C1 : Agreements and contract data (which includes this agreement)

Part C2 : Pricing data

Part C3 : Scope of work

Part C4 : Site Information

and drawings and documents or parts thereof, which may be incorporated by reference into Parts C1 to C4 above.

Deviations from and amendments to the documents listed in the tender data and any addenda thereto, as listed in the tender schedules as well as any changes to the terms of the offer agreed by the tenderer and the employer during this process of offer and acceptance, are contained in the schedule of deviations attached to and forming part of this agreement. No amendments to or deviations from said documents are valid unless contained in this schedule.

The tenderer shall, within two weeks after receiving a completed copy of this agreement including the schedule of deviation (if any), contact the employer's agent (whose details are given in the contract data) to arrange the delivery of any bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the conditions of contract identified in the contract data. Failure to fulfil any of the obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the schedule of deviations (if any). Unless the tenderer (now contractor), within five (5) working days of the date of such receipt, notifies the employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the parties.<sup>1</sup>

Signature(s) .....

Name(s) .....

Capacity .....

for the **Employer** .....  
(Name and address of organization)

Name and signature  
of witness

.....

Date .....

.....

---

<sup>1</sup> As an alternative the following wording may be used :

*Notwithstanding anything contained herein, this agreement comes into effect two (2) working days after the submission by the Employer of one fully completed original copy of this document, including the schedule of deviations (if any), to a courier-to-counter delivery / counter-to-counter delivery / door-to-counter delivery / door-to-door delivery / courier service (delete that which is not applicable), provided that the Employer notifies the Tenderer of the tracking number within 24 hours of such submission. Unless the tenderer (now contractor) within seven (7) working days of the date of such submission notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the parties.*

### 3. SCHEDULE OF DEVIATIONS

#### Notes:

1. The extent of deviations from the tender documents issued by the employer before the tender closing date is limited to those permitted in terms of the conditions of tender.
2. A tenderer's covering letter shall not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid, be the subject of agreements reached during the process of offer and acceptance, the outcome of such agreement shall be recorded here.
3. Any other matter arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents, and which it is agreed by the Parties becomes an obligation of the contract, shall also be recorded here.
4. Any change or addition to the tender documents arising from the above agreements and recorded here, shall also be incorporated into the final draft of the contract.

1. Subject .....  
Details .....
2. Subject .....  
Details .....
3. Subject .....  
Details .....
4. Subject .....  
Details .....
5. Subject .....  
Details .....

By the duly authorized representatives signing this schedule of deviations, the employer and the tenderer agree to and accept the foregoing schedule of deviations as the only deviations from and amendments to the documents listed in the tender data and addenda thereto as listed in the tender schedules, as well as any confirmation, clarification or changes to the terms of the offer agreed by the tenderer and the employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this agreement.

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## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C1.2: GENERAL CONDITIONS OF CONTRACT (PART 1)

##### CONDITIONS OF CONTRACT IN ACCORDANCE WITH THE FIDIC CONDITIONS OF CONTRACT FOR CONSTRUCTION FOR BUILDING AND ENGINEERING WORKS DESIGNED BY THE EMPLOYER

##### FIDIC ® SECOND EDITION 2017

The Conditions of Contract comprises of two parts of which Part 1 is the General Conditions of Contract and Part 2 the Particular Conditions of Contract. Furthermore, the Particular Conditions comprise of the Particular Conditions Part A – Contract Data and the Particular Conditions Part B – Special Provisions.

Under the usual arrangement of this Contract, the Contractor is responsible for the construction, in accordance with the design of the Employer, of building and/or engineering works. These Conditions allow that the Contractor may be required to design a proportion or element of the Permanent Works.

The Conditions of Contract comprise of:

##### “GENERAL CONDITIONS”

Which form part of the:

##### “CONDITIONS OF CONTRACT FOR CONSTRUCTION FOR BUILDING AND ENGINEERING WORKS DESIGNED BY THE EMPLOYER”

*[Second Edition 2017, as published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC)(ISBN 978-2-88432-084-9)]*

*(Copy obtainable at cost from CESA)*

SIGNATURE: .....

SIGNED BY: .....  
(for and on behalf of the Contractor)

DATE: .....

#### C1.2.1 PARTICULAR CONDITIONS OF CONTRACT (PART 2)

The Conditions of Contract further comprise of the following “Particular Conditions of Contract” (PCC), the General Conditions of Contract shall be amended by the Particular Conditions of Contract as detailed herein.

These “Particular Conditions of Contract” forms an integral part of the Contract and they supersede conditions contained elsewhere in the documents.

The Particular Conditions of Contract comprise of two sub-parts viz.

## PART 2 A: CONTRACT DATA

## PART 2 B: SPECIAL PROVISIONS

### C1.3 PARTICULAR CONDITIONS (PART 2 A) – CONTRACT DATA

The following Contract Data lays down specific information required by certain Sub-Clauses in the General Condition of Contract. Tenderers shall not amend the Contract data as provided unless instruction is given to populate data i.e. *“Tenderer to complete”*.

| SUB-<br>CLAUSE | DATA TO BE GIVEN   | DATA   |
|----------------|--|--|
| 1.1.19         | Where the Contract allows for Cost Plus Profit, percentage profit to be added to the Cost: | 5 %  |
| 1.1.27         | Defects Notification Period (DNP)  | 365 days<br>(From the date of issuing the Taking-Over Certificate)   |
| 1.1.31         | Employer's name and address  | <b>EMALAHLENI LOCAL MUNICIPALITY</b><br>Civic Centre<br>29 Mandela Street<br>eMalahleni<br>1039  |
| 1.1.35         | Engineer's name and address  | <b>LYON AND PARTNERS (PTY) LTD.</b><br>Proliba Building, Suite 2,<br>24 Hertz Boulevard,<br>Vanderbijlpark<br>1911   |
| 1.1.85         | Time for Completion<br>(Tenderer to Complete)  | .....  |
| 1.3(a)(ii)     | Agreed methods of electronic transmission  | e-mail   |
| 1.3(d)         | Address of Employer for communications   | Mr. Colin Brentjies<br><a href="mailto:s502059@emalahleni.gov.za">s502059@emalahleni.gov.za</a><br>Civic Centre<br>29 Mandela Street<br>eMalahleni<br>1039       |
| 1.3(d)         | Address of Engineer for communications   | Mr. Christo de Beer<br><a href="mailto:christo@lyon.co.za">christo@lyon.co.za</a><br>Proliba Building, Suite 2,<br>24 Hertz Boulevard,<br>Vanderbijlpark<br>1911 |
| 1.3(d)         | Address of Contractor for communications<br>(Tenderer to Complete)                         | .....<br>.....<br>.....  |



| SUB-<br>CLAUSE | DATA TO BE GIVEN  | DATA  |
|----------------|---|---|
| 1.4            | Contract shall be governed by the law of:   | The contract shall be governed, construed and interpreted in accordance with the Laws of the Republic of South Africa.  |
| 1.4            | Ruling language   | English   |
| 1.4            | Language for communications   | English   |
| 1.8            | Number of additional paper copies of Contractor's Documents   | - One paper original to the Employer.<br>- One electronic copy to the Employer.   |
| 2.1            | After receiving the Letter of Acceptance, the Contractor shall be given right of access to all or part of the Site within | 28 days   |
| 2.4            | Employer's financial arrangements   | Phase over two financial years.   |
| 2.6            | List of Employer-Supplied Material and / or Employer's Equipment  | Not Applicable  |
| 4.2            | Performance Security (as percentages of the Accepted Contract Amount in Currencies):                                      |   |
|                | - Percent   | 10 %  |
|                | - Currency  | ZAR   |
| 4.3            | Name of the Contractor's Representative during performance of the Contract<br>( <i>Tenderer to Complete</i> )             | .....   |
| 4.7.2          | Period for notification by the Contractor of errors in the items of reference   | 28 days   |
| 4.19           | Period of payment by the Contractor for temporary utilities   | Monthly   |
| 5.1(a)         | Maximum allowable accumulated value of work subcontracted (as a percentage of the Accepted Contract Amount)               | 30 %  |
| 5.1(b)         | Parts of the Works for which subcontracting is not permitted  | <ul style="list-style-type: none"> <li>Erection of equipment and stringing</li> </ul>   |
| 6.5            | Normal working hours on the Site  | <ul style="list-style-type: none"> <li>Monday to Friday from 07:00 to 17:00</li> <li>Saturday from 07h00 to 13h00</li> <li>No Sundays</li> <li>No public holidays</li> </ul> (Note: work outside normal working hours required for power outages) |
| 7.7            | Payment shall be certified as a percentage of the material rate for material delivered to site.                           | 80%<br>( <i>Refer to the special provisions for conditions to be met</i> )  |

| <b>SUB-<br/>CLAUSE</b> | <b>DATA TO BE GIVEN</b>   | <b>DATA</b>   |
|------------------------|---|---|
| 8.1                    | Commencement Date   | Date of the Letter of Acceptance or as stated in the Letter of Acceptance, which shall be within 28 days after the Contractor received the Letter of Acceptance.  |
| 8.8                    | Delay Damages payable for each day of delay                                       | 0.5% of the Contract amount per calendar day.   |
| 8.8                    | Maximum amount of Delay Damages   | 10% of final contract sum.  |
| 12.2                   | Method of measurement   | Net actual quantities measured in accordance with the Bill of Quantities  |
| 12.3                   | Percentage profit   | As stated under 1.1.19 above  |
| 13.4(b)(ii)            | Percentage rate to be applied to Provisional Sums for overhead charges and profit | 0 % if the Employer enters into a direct payment agreement with a subcontractor or nominated subcontractor, otherwise 5 %.  |
| 13.7                   | Adjustments for Changes in Cost:  | Not applicable (fixed amount contract)  |
| 14.2                   | Total amount of Advance Payment (as a percentage of Accepted Contract Amount)     | Not applicable  |
| 14.2                   | Currency or currencies of Advance Payment   | Not applicable  |
| 14.2.3                 | Percentage deductions for the repayment of the advance Payment                    | Not applicable  |
| 14.3                   | Period of payment   | Monthly<br>The procedure for payment to be addresses with the project kick-off.   |
| 14.3(iii)              | Percentage of retention   | Retention shall be withheld for payments due by the Employer to the Contractor: <ul style="list-style-type: none"> <li>- 10% of each Statement value certified for interim payment, until 5% of the Contract value is accumulated as retention, for the duration of the executions of the works;</li> <li>- 50% of the 5% accumulated retention amount is released on issuing of the Taking-Over Certificate;</li> <li>- The remaining 50% of the 5% previously accumulated retention is released on issue of the Final Completion Certificate (Performance Certificate as per sub-clause 11.9);</li> </ul> <p style="text-align: center;">or</p> In lieu of the above the Contractor may submit a retention guarantee for the duration of the defects notification period if approved by the Employer. |
| 14.3(iii)              | Limit of Retention Money (as a percentage of Accepted Contract Amount)            | As stipulated in 14.3 (iii) of the Contract Data.   |

| SUB-<br>CLAUSE | DATA TO BE GIVEN  | DATA  |
|----------------|---|---|
| 14.5(b)(i)     | Plant and Materials for payment when shipped  | Not applicable  |
| 14.5(c)(i)     | Plant and Materials for payment when delivered to the site  | Not applicable  |
| 14.6.2         | Minimum amount of Interim Payment Certificate (IPC)   | R 200 000.00  |
| 14.7(a)        | Period for payment of Advance Payment to the Contractor   | Not applicable  |
| 14.7(b)(i)     | Period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 ( <i>Interim Payment</i> )  | As per the General Conditions:<br>30 days after the Engineer receives the Contractor's approved statement |
| 14.7(b)(ii)    | Period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 ( <i>Final Interim Payment</i> )  | As per the General Conditions:<br>30 days after the Employer receives the approved FPC                    |
| 14.7(c)        | Period for the Employer to make final payment to the Contractor ( <i>Final Payment</i> )  | As per the General Conditions:<br>30 days after the Employer receives the approved FPC                    |
| 14.8           | Financing charges for delayed payment (percentage points above the average bank short-term lending rate as referred to under sub-paragraph (a))   | As per the General Conditions:<br>ABSA Prime Rate plus 3%   |
| 14.15          | Currencies for payment of Contract Price  | ZAR   |
| 14.15(a)(i)    | Proportions or amounts of Local and Foreign Currencies are:<br><br>- Local<br>( <i>Contractor to complete</i> )<br><br>- Foreign<br>( <i>Contractor to complete</i> )   | .....<br><br>.....  |
| 14.15(c)       | Currencies and proportions for payment of Delay Damages   | ZAR   |
| 14.15(f)       | Rates of exchange   | Not applicable  |
| 17.2(d)        | Forces of nature, the risks of which are allocated to the Contractor  | Abnormal weather.<br>Refer to the Annexure to PCC - Rainfall  |
| 19.1           | Permitted deductible limits:<br><br>- Insurance required for the Works and Goods<br><br>- Insurance required for liability for breach of professional duty<br><br>- Insurance required against liability for fitness for purpose (if any is required) | <br><br>R 20 000.00<br><br>R 20 000.00<br><br>R 20 000.00   |

| SUB-<br>CLAUSE | DATA TO BE GIVEN   | DATA  |
|----------------|--|---|
|                | - Insurance required for injury to persons and damage to property                            | R 20 000.00   |
|                | - Insurance required for injury to employees   | R 20 000.00   |
|                | - Other insurances required by Laws and by Local Practice                                    | .....<br>.....  |
| 19.2(1)(b)     | Additional amount to be insured in the joint name of the Contractor and the Employer         | As per the General Conditions: 15%                                    |
| 19.2(1)(iv)    | List of Exceptional Risks which shall not be excluded from the insurance cover for the Works | Force majeure, community unrest, riot, political                      |
| 19.2.2         | Extent of insurance required for Goods   | Full replacement value plus delivery to site                          |
| 19.2.3(a)      | Amount of insurance required for liability for breach of professional duty                   | R 5 000 000.00  |
| 19.2.3(b)      | Insurance required against liability for fitness for purpose                                 | Yes   |
| 19.2.3         | Period of insurance required for liability for breach of professional duty                   | From the commencement date to the date of the Performance Certificate |
| 19.2.4         | Amount of insurance required for injury to persons and damage to property                    | Minimum amount of R 5 000 000,00 insurance for third party liability  |
| 19.2.6         | Other insurances required by Laws and by local practice<br>( <i>Tenderer to complete</i> )   | .....   |
| 21.1           | Time for appointment of DAAB   | 28 Days after dispute is declared                                     |
| 21.1           | The DAAB shall comprise  | One (1) Member  |
| 21.1           | List of proposed members of DAAB   | Coenraad Snyman<br>(Coen Snyman International)                        |
|                | - Proposed by Employer   |   |
|                | - Proposed by Contractor   | 1. ....   |
| 21.2           | Appointing entity (official) for DAAB members  | The President of FIDIC or a person appointed by the President         |

SIGNATURE: .....

SIGNED BY: .....  
(for and on behalf of the Contractor)

DATE: .....

## C1.4 PARTICULAR CONDITIONS (PART 2 B) – SPECIAL PROVISIONS

The Conditions of Contract further comprise of the following Special Provisions as part of the Particular Conditions of Contract, the General Conditions of Contract shall be amended by the Special Provisions as detailed herein.

These Special Provisions forms an integral part of the Particular Conditions of Contract and the Contract, and supersedes overrides any other provisions contained elsewhere in the documents.

The following clauses of the “Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer” Second Edition 2017, published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC) (ISBN 978-2-88432-084-9) shall be amended as follows:

### **1. GENERAL PROVISIONS**

| Clause Description             | Clause No | Amendment   |
|--------------------------------|-----------|---|
| <b>DEFINITIONS</b>             | 1.1.31    | “Employer” also means the Company, Subsidiary or Succession in Title or stated in the Contract Data.  |
|                                | 1.1.35    | “Engineer” means an Engineer duly authorised by the Company, Subsidiary or Succession in Title stated in the Contract Data.   |
|                                | 1.1.7     | Add to this sub-clause:<br>The <b>Commencement Date</b> shall be defined under Sub-Clause 8.1 and shall be notified in the Contract Data or the Letter of Acceptance. Access to the site shall be granted on the Commencement Date. |
| <b>LIMITATION OF LIABILITY</b> | 1.15      | Notwithstanding the provisions of this Clause, the Contractors Limit of Liability in terms of defects shall be 5 years.   |

### **2. THE EMPLOYER**

|   |     |  |
|---|-----|--|
| <b>EMPLOYER’S FINANCIAL ARRANGEMENTS</b>                    | 2.4 | The Employer shall only be obliged to provide reasonable evidence that financial arrangements have been made and are being made, if there is a dispute arising from non-payment of a certificate or of any amounts payable to the Contractor or if the Employer intends to make material changes notwithstanding the provisions of this sub-clause. In all other cases, the Employer shall not be bound to provide the requested information.              |
| <b>EMPLOYER-SUPPLIED MATERIALS AND EMPLOYER’S EQUIPMENT</b> | 2.6 | Add to this sub-clause:<br>After this visual inspection, the Employer-Supplied / free-issue materials shall come under the care, custody and control of the Contractor at which point, except where otherwise stated in the Contract, all risk in such free-issue materials shall also pass to the Contractor and shall remain with the Contractor unless and until the said free-issue materials are returned to the custody and control of the Employer. |

### **3. THE ENGINEER**

| <b>Clause Description</b>              | <b>Clause No</b> | <b>Amendment</b>  |
|--|------------------|---|
| <b>ENGINEER'S DUTIES AND AUTHORITY</b> | 3.2              | Add to this sub-clause:<br>The Engineer shall require approval from the Employer on any matter, which affects extension of time or variation to the Contract Price. Variations of the project scope that is covered by contingency amounts requires only the Engineers approval. If the Contractor receives any instructions from the Engineer that fall outside of these conditions, he shall obtain written confirmation from the Employer before proceeding. |
| <b>DELEGATION BY THE ENGINEER</b>      | 3.4              | Add to the end of this sub-clause:<br>No oral representation shall be made by the Contractor to the Engineer through the Engineers Representative.<br>The authority to delegate expressly excludes the delegation of powers to vary the Works in terms of Sub-Clause 13.1 [Right to Vary].  |
| <b>ENGINEERS INSTRUCTIONS</b>          | 3.5              | Add to this sub-clause:<br>No oral instructions may be accepted from the Engineer unless these are recorded in writing by the Contractor who then obtains confirmation from the Engineer by means of a signature or confirmation in minutes within 7 days of the instruction being issued, or prior to commencing work on the item in question.   |
| <b>REPLACEMENT OF THE ENGINEER</b>     | 3.6              | Add to this sub-clause:<br>In the unforeseen situation where the Engineer or Engineers representative is not available to complete the Works, the Employer will advise the Contractor immediately upon knowledge of such an event and will give notice to the Contractor within 7 days of the details of the proposed replacement.  |

### **4. THE CONTRACTOR**

|                             |     |  |
|-----------------------------|-----|--|
| <b>PERFORMANCE SECURITY</b> | 4.2 | <p>Add to this sub-clause:<br/>With the Employers consent, the Engineer will hold the original Performance Security for safekeeping.</p> <p>The following is added at the end of this Sub-Clause:</p> <p>"Should the Contractor fail to provide the said security within the specified time the Employer, in his sole discretion, may either: -</p> <ul style="list-style-type: none"> <li>(a) Withhold payment from the Contractor until the amount withheld is equal the Performance Security Amount stipulated in the Contract Data (as percentages of the Accepted Contract Amount) over and above the normal retention, or</li> <li>(b) Proceed to issue notice in terms of Clause 15 [Termination by Employer]"</li> </ul> |
|-----------------------------|-----|--|

| Clause Description                                 | Clause No | Amendment  |
|--|-----------|--|
| <b>CONTRACTORS REPRESENTATIVE</b>                  | 4.3       | <p>Add to this sub-clause:<br/>           "Without derogating from the generality of the foregoing, the Contractor's Representative shall, at the Contractor's cost, implement forthwith any additional safety precautions which the Engineer may consider necessary for the proper protection of the Contractor's employees engaged in the Works.</p> <p>Work to which such additional precautions will apply shall be suspended pending the implementation of such precautions."</p>   |
| <b>QUALITY ASSURANCE</b>                           | 4.9       | <p>Add to this sub-clause under 4.9.3 General provisions:</p> <p>Testing frequency of all materials shall be in accordance with the relevant clause of the Specifications or as specified on the construction drawings.</p> <p>The Engineer will have the right to visit the manufacturing location for the purpose of audit, surveillance or inspection during the manufacturing of the Materials/Plant to verify the Contractor's quality management.</p> <p>In the event of the Material/Plant being rejected due to non-compliance with the specification, workmanship and/or other valid reasons, then the cost of rectification as well as the Engineer's time based cost and re-inspection cost shall be for the account of the Contractor.</p> |
| <b>SUFFICIENCY OF THE ACCEPTED CONTRACT AMOUNT</b> | 4.11      | <p>The following is added at the end of this Sub-Clause:</p> <p>Without derogating from the generality of the foregoing, no claim by the Contractor for additional payment will be entertained which is consequent upon any misunderstanding or the allegation, or fact that it was supplied with incorrect information by any person, or its failure to obtain correct information as to any matter affecting its accepted tender or the execution of the Works to be provided, nor will any such misunderstanding, or the obtaining of incorrect information, or the failure to obtain correct information, relieve it from any risk or responsibility for the due fulfilment of its obligations in terms of the Contract.</p>                       |
| <b>PROGRESS REPORTS</b>                            | 4.20      | <p>Add to this sub-clause:<br/>           Progress reports shall include updating of drawings issued by the Engineer to as-built drawings as the work progresses.</p>  |
| <b>WAIVER OF CONTRACTOR'S LIEN</b>                 | 4.24      | <p>The following additional Sub-Clause 4.24 is added to the end of Clause 4:</p> <p>The Contractor waives, in favour of the Employer, any lien or right of retention that is or may be held in respect of the Works to be executed on the Site. The Contractor shall ensure that it procures similar waivers from its subcontractors.</p>  |

## 5. SUBCONTRACTING

| Clause Description                  | Clause No | Amendment   |
|-------------------------------------|-----------|---|
| <b>NOMINATED<br/>SUBCONTRACTORS</b> | 5.2       | <p>The following additional Sub-Clause 5.2.5 is added to the end of Clause 5.2:</p> <p><u>5.2.5 Direct Payment with nominated sub-contractors</u></p> <p>The Employer may enter into a direct payment agreement with a nominated sub-contractor.</p> <p>The Contractors profit shall not be paid to the Contractor if:</p> <ul style="list-style-type: none"><li>i) The Contractor does not pay the subcontractor's invoice after receiving payment for work certified by the Engineer.</li><li>ii) The Employer and nominated sub-contractor enters into a direct payment agreement and the Contractor performs no managerial function related to the works by the nominated sub-contractor.</li></ul> |

## 6. STAFF AND LABOUR

|                                   |     |  |
|-----------------------------------|-----|--|
| <b>WORKING HOURS</b>              | 6.5 | <p>Add to this sub-clause:</p> <p>As stipulated in sub-clause 6.5 (c) execution of work on any day including holidays at any time will be required, without additional remuneration to the Contractor, for power outages and other unavoidable circumstances.</p>  |
| <b>HEALTH AND SAFETY</b>          | 6.7 | <p>Add to this sub-clause:</p> <p>A Health and Safety plan shall be furnished by the Contractor within 14 days after Letter of Acceptance.</p>   |
| <b>CONTRACTOR'S<br/>PERSONNEL</b> | 6.9 | <p>In addition to the items listed under headings (a) to (f), The Engineer may require the Contractor to remove any person who is in contravention of the provisions of the:</p> <ul style="list-style-type: none"><li>• Environmental Management Plan</li><li>• Client Safety Specification</li><li>• The provisions of any statutory Act, i.e. OHS.</li></ul> <p>Within seven (7) working days of signature of Letter Acceptance, the Contractor is required to furnish the Employer with a safety plan, risk assessment report and safe work procedures. Prior to commencement of site activities, the entire workforce to be located on site may be required to attend a Health and Safety Induction at the premises of the Employer.</p> <p>The Contractor shall ensure that all requirements set aside by the Occupational Health and Safety Act, and Construction Regulation are fulfilled.</p> |



## **7. PLANT, MATERIALS AND WORKMANSHIP**

| <b>Clause Description</b>               | <b>Clause No</b> | <b>Amendment</b>   |
|---|------------------|--|
| <b>MANNER OF EXECUTION</b>              | 7.1              | <p>Add the following to Clause (d):</p> <p>All work shall be completed in accordance with the Specifications and drawings to be read in conjunction with all appropriate SANS or SABS, NRS, IEC, BC, IEEE and ANSI codes or guidelines prepared by authorities representing specialised industries.</p>  |
| <b>OWNERSHIP OF PLANT AND MATERIALS</b> | 7.7              | <p>Add to this sub-clause:</p> <p>Before making any payment for Plant and Materials defined in this Clause, the Contractor is to provide the Employer with a Cession of ownership in a format to be agreed 14 days prior to the payment certificate.</p> <p>Payment thereof will be limited to materials stored where the following conditions are met:</p> <ul style="list-style-type: none"><li>• Materials have not been prematurely delivered.</li><li>• Materials are stored and protected adequately on site or an approved location.</li><li>• Proof of payment for such materials is made available by the Contractor.</li></ul> <p>After payment of the rate stipulated in the Contract Data, the ownership of material shall be ceded to the Employer.</p> |

## **8. COMMENCEMENT, DELAYS AND SUSPENSION**

|                                  |     |   |
|----------------------------------|-----|---|
| <b>COMMENCEMENT OF THE WORKS</b> | 8.1 | <p>Further to the provisions of this Clause, notwithstanding the agreed date for the commencement of the works, none of the activities related to project execution may begin until such time as the required proofs are received in respect of:</p> <ul style="list-style-type: none"><li>• Insurances</li><li>• Performance Guarantees</li><li>• Approved SHEQ file</li></ul> <p>The notice by the Engineer of the Commencement Date is recorded in the Contract Data.</p> <p>Access to the site shall be granted on the Commencement Date.</p> |
| <b>PROGRAMME</b>                 | 8.3 | <p>The first paragraph of this Clause is amended to read 14 days in place of 28 days.</p> <p>Add to this sub-clause:</p> <p>The programme shall provide for a minimum of two weeks "slack" in order to cater for unforeseen delays.</p> <p>The programme shall be submitted in the form of a Microsoft Projects Gantt Chart (version 2007 or newer)</p>   |

|  |      |  |
|--|------|--|
| <b>EXTENSION OF TIME FOR COMPLETION</b>      | 8.5  | <p>Add to this sub-clause:</p> <p>No extension of time for completion will be granted on account of normal inclement weather, but extension of time shall be determined for abnormal rainfall or wet conditions separately for each calendar month or part thereof in accordance with the Annexure to the Conditions of Contract applicable to Rainfall.</p> <p>The Contractor shall not be entitled to an extension of the Time for Completion to the extent that completion would, in the circumstances, in any event have been delayed by a cause not listed in sub-clause 8.5.</p>   |
| <b>DELAY DAMAGES (PENALTIES)</b>             | 8.8  | <p>Add to this sub-clause:</p> <p>Penalties shall be applied against Contractor according to Detailed Program submitted as per sub-clause 8.3</p>  |
| <b>9. <u>TESTS ON COMPLETION</u></b>         |      |  |
| <b>CONTRACTOR'S OBLIGATIONS</b>              | 9.1  | <p>Add to this sub-clause:</p> <p>The Contractor shall provide a complete set of As-Built drawings and documentation to the Engineer in an approved format together with all the test results as called for in the various sections of the Specifications, Schedules and Drawings.</p>   |
| <b>10. <u>EMPLOYER'S TAKING OVER</u></b>     |      |  |
| <b>TAKING OVER OF THE WORKS AND SECTIONS</b> | 10.1 | <p>Notwithstanding the various provisions of this Clause, if the Employer is a private entity it is the Contractors responsibility to ensure that all works are completed, inspected and approved to the satisfaction of the relevant authority.</p>   |
| <b>11. <u>DEFECTS AFTER TAKING OVER</u></b>  |      |  |
| <b>12. <u>MEASUREMENT AND VALUATION</u></b>  |      |  |
| <b>EVALUATION</b>                            | 12.3 | <p>This Sub-Clause is amended as follows:</p> <ul style="list-style-type: none"> <li>• The percentage in sub-paragraph (b)(i) is amended to 20%</li> <li>• The percentage in sub-paragraph (b)(ii) is amended to 1.0%</li> <li>• The percentage in sub-paragraph (b)(iii) is amended to 5.0%</li> </ul> <p>Add to this sub-clause:</p> <p>The provisions for measurement are as per the Bill of Quantities and payment shall be made according to the progress on site and for material delivered to site before 7 days prior to the Contractor's Application for Interim Payment.</p> <p>The percentage payment of the material rate for material delivered to site is indicated in the Particular Conditions of Contract sub-clause 7.7.</p> |

### **13. VARIATIONS AND ADJUSTMENTS**

| <b>Clause Description</b>              | <b>Clause No</b> | <b>Amendment</b>   |
|--|------------------|--|
| <b>RIGHT TO VARY</b>                   | 13.1             | Add to this sub-clause:<br><br>The Employer reserves the right, in terms of the Clause, to request the Contractor to undertake Variations to the Contract outside the boundaries of the site but within the property boundary of land owned by the Employer. |
| <b>VARIATIONS</b>                      | 13.3             | Add to this sub-clause:<br><br>All variations to the contract shall be priced in accordance with the rates agreed in the Contract Agreement for items where rates are available for work of similar nature.  |
| <b>ADJUSTMENTS FOR CHANGES IN COST</b> | 13.7             | This Clause is not applicable to Contracts where the Contract price is a Fixed Contract amount.  |

### **14. CONTRACT PRICE AND PAYMENT**

|   |      |   |
|---|------|---|
| <b>ADVANCE PAYMENT</b>                              | 14.2 | This advance payment sub-clause is not to apply to this contract.   |
| <b>APPLICATION FOR INTERIM PAYMENT CERTIFICATES</b> | 14.3 | <p>A single copy of the Contractor Statement in an electronic format will be deemed adequate. An original, hard copy, invoice shall be raised by the Contractor upon Certification of the Contractors Claim by the Engineer.</p> <p>Add the following at the end of this Sub-Clause:</p> <ul style="list-style-type: none"><li>• In the event that the Contractor fails to submit a Statement on time, any late submission will only be evaluated in the next period.</li></ul> |
| <b>SCHEDULE OF PAYMENTS</b>                         | 14.4 | The content of this Clause is not applicable. The Contractor shall submit together with the Programme an estimated Cash Flow based on tasks in the Programme.   |

### **15. TERMINATION BY EMPLOYER**

### **16. SUSPENSION AND TERMINATION BY CONTRACTOR**

### **17. CARE OF THE WORKS AND INDEMNITIES**

### **18. EXCEPTIONAL EVENTS**

### **19. INSURANCE**

### **20. EMPLOYER'S AND CONTRACTOR'S CLAIMS**

### **21. DISPUTES AND ARBITRATION**

### **22. ADDITIONAL GENERAL PROVISIONS**

|                                     |      |   |
|-------------------------------------|------|---|
| <b>PERIOD OF VALIDITY OF TENDER</b> | 22.1 | Add this sub-clause:<br><br>The period of the tender validity shall be 120 days, with extension by mutual agreement between the Employer, Engineer and the Contractor |
|-------------------------------------|------|---|

| Clause Description  | Clause No | Amendment  |
|---|-----------|--|
| <b>TAX INVOICES</b>   | 22.2      | <p>Add this sub-clause:</p> <p>The Contractor shall issue an invoice to the Employer for all amounts to be paid to the Contractor under the Contract. If VAT is payable on any amount certified by the Engineer for payment under the Contract, the Contractor shall ensure that the invoice complies with the requirements of a Tax Invoice under the Value Added Tax Act no. 89 of 1991 (as amended). No payment shall be made by the Employer on invoices not meeting this requirement and the Employer shall not be liable for interest for such non-payment.</p>  |
| <b>EMPLOYER'S RIGHT TO STEP-IN</b>                            | 22.3      | <p>Add this sub-clause:</p> <p>If the Contractor fails to carry out any obligation under the Contract and fails to make good the failure and remedy it despite being required to do so by the Engineer by notice under Sub-Clause 15.1 [Notice to Correct] (within the specified reasonable time), the Employer, without prejudice to its other rights, powers and remedies under the Contract or in law, shall be entitled to make good the failure and remedy it either himself or via other persons, and the reasonable costs of doing so shall be for the account of the Contractor.</p> <p>The Contractor shall co-operate with the Employer and facilitate and permit the use of all required Goods, information, materials and other matter (including Contractor's Documents and all other drawings, CAD files, technical data, models, plans, designs, diagrams, evaluations, details, specifications, schedules, reports, calculation results, manuals or other documents or recorded information (electronic or otherwise) which have been or are at any time prepared by or on behalf of the Contractor under the Contract or otherwise for and/or in connection with the Works) and shall generally do all things required by the Engineer to achieve this end.</p> |
| <b>LIMITATION OF ENTITLEMENT WHERE CONTRACTOR IS CULPABLE</b> | 22.4      | <p>Add this sub-clause:</p> <p>Notwithstanding anything to the contrary, the Contractor shall not be entitled to any extension of time or additional payment or other compensation if and to the extent:</p> <ul style="list-style-type: none"> <li>(a) The cause, event or circumstance giving rise thereto is attributable to the negligence, error or default of the Contractor or any Subcontractor;</li> <li>(b) The Contractor fails to take all reasonable steps to mitigate the effects of the cause, event or circumstance giving rise thereto.</li> </ul>  |

| Clause Description  | Clause No                 | Amendment   |
|---|---------------------------|---|
| <b>RECORD AND DATA KEEPING</b>                                  | 22.5                      | <p>Add this sub-clause:</p> <p>The Contractor shall maintain all data, records, electronic communications and documentation relating to this Contract and keep full and proper records and accounts in connection with the Works (whether contained in documents or in electronic format), during the execution of the Works and for a period of 5 (five) years after the latest of the expiry dates of the Defects Notification Periods (or the earlier termination of the Contract for any reason whatsoever, as the case may be) and shall ensure that all Subcontractors do likewise.</p> <p>The Employer's Personnel and the Employer's other authorised representatives and agents shall be entitled to examine, audit, copy and inspect all such books, records, systems, processes, procedures and documents at all reasonable times during the execution of the Works and during the said 5 (five) year period in order to verify compliance by the Contractor with its obligations, and/or to assess any entitlement or claimed entitlement of the Contractor under the Contract.</p> <p>The Contractor shall provide access to all such books, records, systems, data and documents of the Contractor and to any premises and personnel of the Contractor for this purpose and shall co-operate and render all assistance requested by the Employer's Personnel and the Employer's other authorised representatives and agents.</p> <p>All data, communications, records and accounts are to be kept in a lockable storeroom and adequately protects against loss which includes, but is not limited to, fire, theft, vermin, etc.</p> |
| <b>DAMAGES FOR THE LATE SUPPLY OF DOCUMENTATION</b>             | 22.6                      | <p>Add this sub-clause:</p> <p>If the Contractor fails to provide any of the documents listed by the dates specified in the Contract, the Contractor shall pay damages to the Employer for this default. <b>These damages shall be the same amount stated in the Contract Data under sub-clause 8.8 for delay damages, which shall be paid for each day which shall elapse between the time the document in question was to have been delivered and when it was actually delivered.</b> These damages shall not relieve the Contractor from his obligations to provide the said document, or to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.</p>   |
| <b>Clause Description<br/>RETESTING &amp;<br/>RE-INSPECTION</b> | <b>Clause No<br/>22.7</b> | <b>Amendment</b> <p>If the works or any Section fails to pass any Progress Tests, Completion Tests, Progress Inspections, Completion or Take Over Inspection, the Engineer may require such Tests and Inspections to be repeated on the same terms and conditions. All costs to which the Employer may be put due to repetition of the Tests under this sub-clause shall be deducted from the Contract price.</p> <p>The Contractor shall be liable to pay R 20 000.00 penalty to the Engineer for scheduled inspections or tests failed, per failure, for time wasted.</p>   |

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Note: The Contractor is advised to extend the liability for penalties to equipment manufacturers in order to cover the Contractor's liability if the project is delayed due to delayed manufacturing.

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#### C1.4.1 ANNEXURE TO PCC – RAINFALL

No extension of the completion time will be granted in respect of normal rainfall. Extension will only be granted in respect of abnormal rainfall or abnormally wet conditions in accordance with the formula set out hereunder:

In the event of an extension being granted in accordance with the formula, no additional payment will be granted in respect of the "time related" items scheduled in Section 6: Preliminary and General of the Schedule of Quantities nor for any other costs incurred.

$$V = (N_w - N_n) \frac{R_w}{R_n}, \text{ if } N_w > N_n \text{ and where}$$

V = Extension of time in calendar days in respect of any particular month

N<sub>w</sub> = Actual number of days during the corresponding month during which precipitation exceeds 10 mm

N<sub>n</sub> = Average number of days during the corresponding month during which precipitation exceeded 10 mm

R<sub>w</sub> = Actual rainfall during the corresponding calendar month

R<sub>n</sub> = Average rainfall recorded during the corresponding calendar month

Calculations will be done for each month.

Calculations for part of a month are carried out using pro rata figures for N<sub>n</sub> and R<sub>n</sub>.

If R<sub>w</sub> / R<sub>n</sub> is greater than 2,5, its value shall be taken as 2,5.

If any month N<sub>w</sub> is smaller than N<sub>n</sub>, no extension of time will be granted for that month.

The following values of N<sub>n</sub> and R<sub>n</sub> shall be used for this Contract. They are based on figures supplied by the Weather Bureau, for the eMalahleni area.

| MONTH     | AVERAGE NUMBER<br>RAIN DAYS | N <sub>n</sub> AVERAGE NUMBER OF DAYS<br>EXCEEDING 10 MM | R <sub>n</sub> AVERAGE RAINFALL<br>IN MM |
|-----------|-----------------------------|--|--|
| JANUARY   | 13                          | 4  | 127,3                                    |
| FEBRUARY  | 9                           | 2  | 72,5                                     |
| MARCH     | 9                           | 3  | 74,6                                     |
| APRIL     | 7                           | 2  | 54,0                                     |
| MAY       | 3                           | 0  | 16,7                                     |
| JUNE      | 1                           | 0  | 9,1                                      |
| JULY      | 1                           | 0  | 8,6                                      |
| AUGUST    | 1                           | 0  | 8,2                                      |
| SEPTEMBER | 3                           | 1  | 22,7                                     |
| OCTOBER   | 9                           | 3  | 66,5                                     |
| NOVEMBER  | 12                          | 3  | 100,3                                    |
| DECEMBER  | 11                          | 3  | 103,4                                    |

AVERAGE PER YEAR: 663,9

#### C1.4.2 ANNEXURE TO PCC – SCHEDULE OF SUB-CONTRACTORS

The Tenderer shall list below any Sub-Contractors he wishes to employ to carry out part(s) of the work.

The acceptance of this tender shall not be construed as being approval of all or any of the listed Sub-Contractors. Should any or all of the Sub-Contractors not be approved subsequent to the acceptance of the tender, it shall in no way invalidate this tender, and the tendered unit rates for the various items of work shall remain final and binding even in the event of a Sub-Contractor not listed below being approved by the Employer.

**Table 1: Schedule of Sub-contractors**

| PART OR TYPE OF WORK | PROPOSED SUB-CONTRACTOR | WORK RECENTLY EXECUTED BY SUB-CONTRACTOR |
|----------------------|-------------------------|--|
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |
|                      |                         |  |

DATE: .....

SIGNATURE OF TENDERER: .....

#### C1.5 CONTRACT PRICE ADJUSTMENT

The contract prices for the Financial Year 1 are fixed and firm. It is essential to note that the Tenderer shall allow for all escalation in his/her unit prices for all material and labour supplied in Financial Year 1 as no escalation claims will be entertained.

**Table 2: CPA Items**

| EQUIPMENT                               | FOREIGN CURRENCY | MANUFACTURING ORIGIN |
|---|------------------|----------------------|
| Financial Year 2 – Labour               |                  |                      |
| Financial Year 2 – Electrical Materials |                  |                      |
| Financial Year 2 – Steel Mono Poles     |                  |                      |
| Financial Year 2 – Civil Works          |                  |                      |

The above list of material and/or equipment will be subject to the formulae and conditions contained further herein.

For Contact Price Adjustment for long lead items, these conditions shall apply:

- (a) No CPA claims will be accepted which are submitted later than 60 days from the date of the Payment Certification of the applicable equipment.
- (b) CPA claims submitted on the basis of one or more provisional indices, shall be treated as final claims.
- (c) CPA claims shall have a fixed portion of the Contract Unit Rate Price which shall not be subject to Price adjustment, if the fixed portion is not specifically detailed the fixed portion value shall default to 15% of the applicable rate. This percentage shall be applied to the cost adjustment of each item.

The following SEIFSA price adjustment will be applicable to these items for fluctuations in cost of labour and material (excluding cables).

If the Tenderer wishes to base his tender on values of x, a and b, different to those specified above, he shall state the relevant figures separately. The effect of the figures so tendered shall be calculated on the basis of the tender amount and shall be considered when appointing a Contractor.

#### **C1.5.1 FINANCIAL YEAR 2 - FLUCTUATIONS IN COST FOR LABOUR**

Fluctuation in cost of all labour for Phase 2 & 3 shall be calculated in accordance with the following formula:

$$P = P_o \times \left[ a_1 \left( \frac{Lt1}{Lo1} \right) + a_2 \left( \frac{Lt2}{Lo2} \right) \right]$$

where

P = Contract price after adjustment.

P<sub>o</sub> = Contract price after at tender stage.

x = 10 % Fixed Portion.

a<sub>1</sub> = 80 % Table C-3: Actual Labour Cost (All Hourly Paid Employees).

Lo<sub>1</sub> = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month prior to the month of Tender.

Lt<sub>1</sub> = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month in which the work was performed.

a<sub>2</sub> = 10 % Table D-3: CPI (Consumer Price Index).

Lo<sub>2</sub> = Statistics SA Consumer Price Index for the month prior to the month of Tender.

Lt<sub>2</sub> = Statistics SA Consumer Price Index for the month in which the work was performed



### C1.5.2 FINANCIAL YEAR 2 - FLUCTUATIONS IN COST FOR ELECTRICAL MATERIAL

Fluctuation in cost of all electrical material for Phase 2 & 3 shall be calculated in accordance with the following formula:

$$P = P_o \times \left[ a1 \left( \frac{Lt1}{Lo1} \right) + b1 \left( \frac{Mt1}{Mo1} \right) \right]$$

where

P = Contract price after adjustment.

P<sub>o</sub> = Contract price after at tender stage.

x = 10 % Fixed Portion.

a1 = 20 % Table C-3: Actual Labour Cost (All Hourly Paid Employees).

Lo1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month prior to the month of Tender.

Lt1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month in which the work was performed.

b1 = 70 % Table G-1: Engineering input prices (Electrical Engineering).

Mo1 = SEIFSA Index of Engineering input price (Electrical Engineering) for the month prior to the month of Tender

Mt1 = SEIFSA Index of Engineering input price (Electrical Engineering) for the prior month to the month in which the goods are ready for dispatch.

### C1.5.3 FINANCIAL YEAR 2 - FLUCTUATIONS IN COST FOR STEEL MONO POLES

Fluctuation in cost of all steel poles for Phase 2 & 3 shall be calculated in accordance with the following formula:

$$P = P_o \times \left[ a1 \left( \frac{Lt1}{Lo1} \right) + a2 \left( \frac{Lt2}{Lo2} \right) + b1 \left( \frac{Mt1}{Mo1} \right) + b2 \left( \frac{Mt2}{Mo2} \right) - 1 \right]$$

where

P = Contract price after adjustment.

P<sub>o</sub> = Contract price after at tender stage.

x = 10 % Fixed Portion.

a1 = 35 % Table C-3: Actual Labour Cost (All Hourly Paid Employees).

Lo1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month prior to the month of Tender.

Lt1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month in which the work was performed.

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- a2 = 10 % Table D-3: CPI (Consumer Price Index).
- Lo2 = Statistics SA Consumer Price Index for the month prior to the month of Tender.
- Lt2 = Statistics SA Consumer Price Index for the month in which the work was performed.
- b1 = 40 % Table E-A: Domestic Producers Price Steel Index: (Hot Rolled).
- Mo1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled) as ruling at date of Tender.
- Mt1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled) ruling for month prior to month during which work was performed.
- b2 = 5 % Table F: Zinc.
- Mo1 = SEIFSA Index of Metal Price (Zinc) as ruling at date of Tender.
- Mt2 = SEIFSA Index of Metal Price (Zinc) ruling for month prior to month during which work was performed

#### **C1.5.4 FINANCIAL YEAR 2 - FLUCTUATIONS IN COST FOR CIVIL WORKS**

Fluctuation in cost of all steel poles for Phase 2 & 3 shall be calculated in accordance with the following formula:

$$P = P_o \times [a1(\frac{Lt1}{Lo1}) + b1(\frac{Mt1}{Mo1})]$$

where

- x = 10 % Fixed Portion.
- a1 = 20 % Table C-3: Actual Labour Cost (All Hourly Paid Employees).
- Lo1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month prior to the month of Tender.
- Lt1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) for the month in which the work was performed.
- b1 = 70 % Table G-1: Building and Construction Materials
- Mo1 = SEIFSA Index of Production Price (Building and Construction Materials) as ruling at date of Tender.
- Mt1 = SEIFSA Index of Production Price (Building and Construction Materials) as ruling for month prior to month during which work was performed.

DATE: .....

SIGNATURE OF TENDERER: .....

**C1.6 RATE OF EXCHANGE**

The Tenderer must allow for changes in the Rate of Exchange in his unit prices.

DATE: .....

SIGNATURE OF TENDERER: .....

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EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

C1.7 : SAFETY AGREEMENT

MEMORANDUM OF AGREEMENT CONCLUDED BY AND BETWEEN:

EMALAHLENI LOCAL MUNICIPALITY

(HEREINAFTER REFERRED TO AS THE MUNICIPALITY)

herein represented by .....  
in his capacity as of the Municipality, he being duly authorized thereto and

*(hereinafter referred to as the Mandatary)*

herein represented by .....

in his capacity as .....

of the Mandatary, he being duly authorized thereto

WHEREAS:

1. The Municipality and the mandatary entered into a written, alternatively oral agreement on the.....day of .....20..... in terms of which the Mandatary undertook to carry out the following work for the Municipality , viz.  
(give a short description of the type of contract work to be done as well as the address where work will be done)  
.....  
.....

*(The said contract work is hereinafter referred to as the **Work**)*

2. The Occupational Health and Safety Act, Act 85 of 1993 as amended (hereinafter referred to as **the Act**) contains amongst others certain provisions with regard to the health and safety of people at work and in connection with the usage of plant and machinery, as well as the protection of other persons than persons at work against hazards to health and safety that originates from or in connection with the activities of persons at work.
3. Section 37(2) of the Act makes provision for the exclusion by the parties, by way of a written agreement, of supposition and accompanying liability of the Municipality as stipulated in section 37(1) of the Act.
4. The parties have reached consensus with regard to the terms and conditions to which they agree in terms of the provisions of section 37(2) of the Act.

## **NOW THEREFORE THE PARTIES AGREE AS FOLLOWS**

### **1. WRITTEN AGREEMENT**

The parties herewith agree in terms of section 37(2) of the Act on the arrangements and procedures that must be followed to ensure compliance with the provisions of the Act by the Mandatary.

### **2. ACKNOWLEDGEMENT BY THE MANDATARY**

The mandatary acknowledge herewith that he is fully acquainted with the contents of the Act, as well as with all regulations and SANS codes of practice that have been made in terms of section 43 of the Act.

### **3. UNDERTAKING BY MANDATARY**

- (a) The Mandatary hereby undertakes and binds himself to the Municipality to ensure prompt and strict compliance with the provisions of the Act and the said regulations as well as with the provisions included in this Safety Agreement at all times during the execution of the Works.
- (b) It is hereby recorded that the provisions of this Safety Agreement as set out hereinafter are in no way intended to restrict the duties of the Mandatary, nor to exempt the Mandatary from his obligation in accordance with the Act and the said regulations.

### **4. PERSONAL PROTECTIVE EQUIPMENT**

- (a) It is compulsory to wear equipment for eye protection when working in an eye protection zone or where the Work requires eye protection.
- (b) It is compulsory to wear safety helmets when working in a safety helmet zone or where the Work requires safety helmets.
- (c) It is compulsory to wear hearing protection when working in a noise zone or where the Work requires hearing protection.
- (d) The wearing of other protective clothing and equipment as prescribed by the Occupational Health and Safety Officer of Nelspruit Municipality is compulsory.
- (e) The Mandatary shall ensure that the statutory requirements are complied with at all times.

### **5. FENCING AND GENERAL MACHINERY PROTECTION**

No shield or fencing may be removed from or be moved at any machinery or installation without written permission.

### **6. SCAFFOLDING, LADDERS, TOOLS, ET CETERA**

The Mandatary without the written permission of the Municipality may use no equipment or tools that belong to the Municipality.

Except where agreed before hand the Mandatary shall provide enough tools and equipment to enable him to complete the Works and the Mandatary shall provide all storerooms, offices and eating halls that he may need. The Mandatary will be responsible for all his material on site.

In special case where the Municipality may lend equipment, tools or materials to the Mandatary, the Mandatary will use such equipment, tools and/or materials at his own risk and the Mandatary herewith indemnifies the Municipality against any liability of whichever nature or from any cause whatsoever, whether direct or indirect, that may arise from such usage.

## **7. SERVICES AND WORKING METHODS**

The written permission of the Municipal Manager of the Municipality shall be obtained where any work which must be undertaken by the Mandatary is connected with a working process or machinery or any other service in connection therewith, or may possibly affect it, before he commences with such work.

Approval shall be obtained from the City Electrical Engineer of the Municipality before any equipment is connected to the electrical supply of the Municipality. All equipment shall be isolated before any equipment is connected to the electrical supply of the Municipality. It shall be isolated and be provided with earth leakage protection. Electrical machinery, portable electrical tools and portable lights must comply with the requirements of the applicable regulations.

Work permits must be issued in terms of the Occupational Health and Safety Act and Regulations when the nature of the work requires it. Permits must be issued by the relevant departmental head where necessary.

## **8. EXCAVATIONS**

Written permission for excavations shall be obtained from the City Engineer of the Municipality and the Mandatary shall make sure of the existence and position of electrical cables, discharge pipes, gas lines, water conduits, et cetera before he commences with any excavation work. All excavations and obstructions and/or any openings in platforms or floors shall be enclosed in a safe way and warning notices shall be erected to ensure absolute safety. An adequate number of red or orange caution lights shall be provided when it is dark or should bad light prevail.

The area surrounding excavations shall be kept in a safe, orderly and tidy condition. No loose material of whatever nature may be left in walkways or workplaces or be allowed to block walkways or workplaces. Nobody may enter into any restricted area in which hazardous fumes or a shortage of oxygen exists without a permit giving permission to do so, issued by the head of the relevant department of the Municipality and until it has been certified safe for entrance by the Occupational Health and Safety Officer and the Health Inspector of the Municipality.

## **9. RESTRICTION TO WORKPLACE**

Employees of the Mandatary shall be restricted to their workplaces except when they have to leave their area for work purposes or when they visit toilets.

## **10. SUBCONTRACTORS**

The Mandatary shall ensure that all subcontractors receive a copy of this safety agreement and must ensure they comply with it.

## **11. OCCUPATIONAL HEALTH AND SAFETY OFFICER AND THE REPORTING OF ALL ACCIDENTS**

The Occupational Health and Safety Officer of the Municipality is available for consultation and he will make periodical visits to the workplace of the Mandatary. Any hazardous occurrence or incident to the employees of the Mandatary that results in absence from work for a period longer than three days shall be reported in writing to the Occupational Health and Safety Officer of the Municipality within forty eight hours as well as to the Department of Labour as specified by the Act. Every user, employer, occupier, builder or excavator must, under this Act, keep record of all accidents that occur.

In the case of an accident that results in loss of life, nobody may disturb the scene of the accident or any articles involved in the accident prior to the arrival of the Occupational Health and Safety Officer and the Inspector, unless it is to prevent another accident from happening or the prevention of loss of life or to remove corpses.

The Occupational Health and Safety Officer will issue contravention notices to the Mandatary or a sub contractor when there is a non compliance and will specify the time in which it must be rectified. The Occupational Health and Safety Officer will issue work stop notices to the Mandatary or sub contractor whenever he is of the opinion that the health and safety of any person at work is threatened or that the contravention notices are not adhered to.

## **12. FIRST AID**

Where five or more persons are employed at a workplace, the Mandatary shall provide and maintain an adequately equipped first-aid box that meets the following requirements.

- (a) Every first-aid box shall contain the minimum contents as prescribed by the Occupational Health and Safety Act.
- (b) Nothing except articles and equipment required for first-aid purposes may be kept in the first-aid box.
- (c) Each first-aid box shall be kept in a place readily accessible in case of an accident.

All first-aid boxes shall be placed under control of a responsible person except where five or less persons are at work. The responsible person must be in the possession of a valid first-aid certificate issued by one of the following organisations:

- A South-African Red Cross Society
- B St. John's Ambulance Foundation
- C South-African First-Aid League

A notice indicating where the first-aid box is kept as well as the name of the person in charge, shall be affixed in a conspicuous place. The first-aid facilities of the Municipality may be used during emergencies.

## **13. FIRE PREVENTION MEASURES AND STORAGE OF FLAMMABLE MATERIAL**

The Fire department of the Municipality shall be notified before any welding, oxyacetylene welding, cutting, burning of paint or tar from floors or roofs is undertaken so that the necessary fire prevention measures can be arranged. All "NO SMOKING AND OPEN SURFACE FIRES/LIGHTS PROHIBITED" notices shall be adhered to. The Mandatary and his senior employee shall acquaint themselves and their fellow workers with the fire prevention measures of the Municipality, which will also include fire alarm notices and exits in case of fire, and they shall ensure that these rules are strictly complied with.

## **14. COMPLETION OF WORK**

Before the mandatary or his sub-contractors leaves the site they shall inform the Head of the relevant Department of the Municipality and obtain his/her written approval that the work has been completed satisfactory and that the site of the work is left in a good condition.

## **15. SALVAGED MATERIAL AND EQUIPMENT**

Any building demolished or equipment or materials that are salvaged whilst carrying out the work shall remain the property of the Municipality, unless the contract specifically provides otherwise.

## **16. BREAKING OF THESE RULES AND POOR CONDUCT**

The Mandatary is warned that no behaviour that causes danger to their own employees, to the employees of the Municipality or general public will be tolerated. The Occupational Health and Safety Officer of the Municipality reserves the right of the withdrawal of any employees of the Mandatary or Municipality from the premises in the case of any default or breach of the agreement and to order that the completion of the work be stayed, pending compliance with this agreement; alternatively to cancel the agreement referred to in par.2 in which event the Municipality will be entitled to appoint an alternative contractor to complete the work and recover the costs thereof from the mandatary, without prejudice to any alternative or additional right or action or remedy to the Municipality, to recover from the mandatary damages for the default or breach and the cancellation.

The senior employees of the Mandatary shall sign a note of acknowledgement of this safety agreement to certify that they have received the regulations as included herein and that they understand the regulations.

## **17. INTOXICATION**

Nobody that is in a state of intoxication or that is in any other condition that causes or may cause his/her incapability to control him/herself or persons under his control may and shall not be permitted on the premises of the Municipality. The Occupational Health and Safety Officer of the Municipality reserves the right to the withdrawal of any employees of the Mandatary or Municipality from the premises in the case of any transgression of this nature.

## **18. CONFIDENTIALLY**

The Mandatary shall at all times treat data and information that have been made known to him or that he requires in connection with his work from the Municipality as confidential and he may not make unauthorized use thereof. He must also ensure that such data and information are not communicated to anybody else that is not an employee of the Mandatary without obtaining prior written approval from the Municipality and he must further ensure that such persons do in fact know that the said information is confidential and that they are obliged to treat it as such.

The Mandatary shall provide for adequate physical protection for any confidential documents, sketches, et cetera that he receives from the Municipality in connection with the work as well as for any copies thereof that he makes. He shall hand back all documents sketches and copies thereof to the Municipality upon completion of the work, or earlier, if so requested by the Municipality. The Mandatary shall inform the Municipality immediately should any such documents or sketches become lost.

## **19. INDEMNIFICATION BY THE MANDATARY**

The following conditions will be applicable to the Mandatary:

- (a) The Mandatary is liable and herewith indemnifies the Municipality irrevocably and in full against any claim for loss or damage to property or arising from death or injury of any person and any associated loss or damage suffered, and against all lawsuits, claims, demands, costs, expenses, and charges that may arise when the said occurrences are caused on purpose or through the negligence, violation of legal obligations or failure by the Mandatary or its employees.
- (b) Whenever any of the employees of the Municipality is busy with work to, or with the supply of material that will be used during the execution of the work by the Mandatary, or otherwise busy with work under the instruction and supervision of the Mandatary, in as far as they may be negligent or fail to do there duty, they will be regarded as employees of the mandatary
- (c) All installations, equipment, hoisting-apparatus and other implements, scaffolding, ladders, material, et cetera that are borrowed from the Municipality by the Mandatary for usage during the execution of the work, will be used entirely at the risk of the Mandatary or employees of the Mandatary and the Mandatary herewith indemnifies the Municipality irrevocably and in full against any liability that may arise from such usage.

## **20. AMENDMENTS MUST BE IN WRITING**

The parties agree herewith that this safety agreement is the only safety agreement between them and that no amendment thereof will be valid unless it is in writing and signed by both parties.

## **21. JURISDICTION AND LEGAL COSTS**

In the event of any legal action being instituted pertaining to this agreement the party in default or breach will be liable for the other party's legal costs on the scale as between attorney and own client and the parties consent to the jurisdiction of the magistrate's court for purpose of any legal action being instituted.



## PARTICULARS OF THE MANDATARY

Name (Mandatory) .....

C.E.O. (Section 16(1)) .....

ID NO .....

Designation .....

Name of Business .....

Address of Business .....

Tel number ..... (h) ..... (w) e-mail .....

Number of employees employed .....

Registration number as allocated to the Mandatory by the Workman's Compensation Commissioner

Date allocated .....

Thus done and signed on this ..... day of .....20.....

As witnesses:

..... (Signature) .....(Name in print)

..... (Signature) ..... (Name in print)

..... (Signature) .....(Name in print)

## THE MANDATARY

Thus done and signed on this.....day of.....20.....

As witnesses:

..... (Signature) .....(Name in print)

..... (Signature) ..... (Name in print)

..... (Signature) .....(Name in print)

## THE MUNICIPALITY

Acknowledgement of receipt of the agreement:

.....  
**THE MANDATARY**

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|                               |
|-------------------------------|
| <b>PART C2 : PRICING DATA</b> |
|-------------------------------|

**C2.1      Pricing Instructions**

**C2.2      Bills of Quantities**

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C2.1: PRICING INSTRUCTIONS

- C2.1.1** This Schedule of Quantities forms part of the Contract Documents as listed in the Schedule of Documents and shall be read in conjunction with the General Conditions, the Specifications and the Drawings and must be submitted, duly completed, on the closing date of Tenders.
- C2.1.2** The short description of items in the Bill of Quantities are for identification purposes only, the work covered by the items being fully specified in the relevant clauses in the Specifications. The Tenderer must therefore allow in the unit price for ordering, obtaining, supplying, delivering to site, installation and commissioning of the relevant equipment with their accessories.
- C2.1.3** Except where Sum Amounts are required or where Provisional Amounts have been indicated, the Tenderer shall enter an applicable rate in the Rate Column of the Schedule of Quantities for each scheduled item. He shall also enter an applicable sum in the Amount Column for each scheduled item. Should the Schedule not be completed in the manner herein specified, the tender may either be rejected or the Contractor will not be paid for items against which rates or sum amounts, as applicable, have not been entered. In the event of the latter procedure items not paid for will be regarded as covered by other rates entered in the Schedule of Quantities.
- C2.1.4** Tenderers must complete the Schedule of Quantities and fill in the unit rates for material and labour as well as total amount for each item. The unit rate is for a single item only. Errors of the arithmetic calculation to calculate the total amount, as entered in the Schedule may be corrected by the Employer but rates will be binding.

An example of the calculations are as follows:

| ITEM                                    | DESCRIPTION  | UNIT           | QTY | UNIT<br>LABOUR<br>RATE | UNIT<br>MATERIAL<br>RATE | TOTAL             |
|---|--|----------------|-----|------------------------|--------------------------|-------------------|
| 1                                       | Supply and install a 9 m wood pole.                  | No             | 100 | R20,00                 | R100,00                  | R12 000,00        |
| 2                                       | Excavate pole hole.                                  | m <sup>3</sup> | 100 | R50,00                 | R0,00                    | R5 000,00         |
| 3                                       | Supply and install 10 mm <sup>2</sup> , 3-core cable | m              | 50  | R5,00                  | R20,00                   | R1 250,00         |
| 4                                       | Head office overhead cost                            | Sum            | 1   | -                      | -                        | R15 000,00        |
| <b>TOTAL CARRIED FORWARD TO SUMMARY</b> |  |                |     |                        |                          | <b>R33 250,00</b> |

- C2.1.5** Tenderers are advised to check their items extensions and total additions as too many arithmetical errors occurring in the priced Schedule of Quantities will disqualify the Tenderer. Under no circumstances shall the Tenderer be permitted to change the specified quantities in the QTY column which will result in rejecting the tender or changing the quantity to the initial value and correcting the arithmetic's. If the Tenderer disagree with the quantity he must do so by means of an accompanied letter with full description and reference to the particular item.

- C2.1.6** The quantities reflected in the Schedule of Quantities are approximate only and do not necessarily represent the actual amount of work to be done. Allowance for off-cuts and scrap shall be allowed for in the unit rates. The Contract Price for the completed Contract shall be computed from the actual quantities of authorised work done to the satisfaction of the Engineer valued at the prices tendered against the respective items in the Bill of Quantities, and shall include such authorised provisional amounts and items of extra work as have become payable in terms of the Contract Documents. Extra material shall not be paid for and shall be removed from site.
- C2.1.7** The Contractor shall submit equipment technical data sheets and measured quantities for approval prior to placing any equipment orders. This information shall be submitted by the Contractor to the Engineering within 14 days of being appointed.
- C2.1.8** Unit prices quoted in the Schedule of Quantities must include for such small installation materials as are required for the complete installation in accordance with the Specifications.
- C2.1.9** Payment based on the rates tendered in the Schedule shall cover all the services and incidentals included in the works covered by the Contract and shall be made in accordance with the General Conditions, the Specifications and the Agreement pertaining to the Contract.
- C2.1.10** Where the Contractor is required to furnish detailed drawings and designs or other information in terms of the Contract Documents, all costs shall be deemed to have been provided for and included in the unit rates and sum amounts tendered for the items scheduled in the Schedule of Quantities and separate additional payment will not be made.
- C2.1.11** Writing in the Schedule must be done in black to facilitate clear photocopying.
- C2.1.12** The Contractor shall keep record of all material delivered to site, and shall submit such record to the Engineer at every site inspection. Material not installed shall be kept in the site yard or store and the material shall be kept readily available for inspection.
- C2.1.13** Application for payment, accompanied by supporting documentation, shall be submitted to the Engineer on a predetermined date which date shall be a suitable date in each month, agreed upon by all parties concerned with the payment. Claims for additional work in a particular month, for which no written instruction has not yet been issued, if applicable, must also accompany the monthly application for payment. Late claims will not be considered.
- C2.1.14** All unit rates and sum amounts shall exclude Value Added Tax, as applicable from 1 October 1991 and in accordance with the ruling rate as laid down by the Government, and all prices shall be quoted in South African currency.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A  
11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|                                  |
|----------------------------------|
| <b>C2.2: BILLS OF QUANTITIES</b> |
|----------------------------------|

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST A: PRELIMINARY AND GENERAL

| ITEM       | DESCRIPTION  | DRG<br>NO<br>D-DT | UNIT | QTY | TENDER PRICE           |                       | TOTAL |
|------------|--|-------------------|------|-----|------------------------|-----------------------|-------|
|            |  |                   |      |     | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE |       |
| <b>1</b>   | <b>PRELIMINARY AND GENERAL</b>   |                   |      |     |                        |                       |       |
|            | <b>Amount allowed for all expenses, regarding the following:</b>   |                   |      |     |                        |                       |       |
| <b>1.1</b> | <b>CONTRACTUAL REQUIREMENTS - FIXED AMOUNT</b>   |                   |      |     |                        |                       |       |
| 1.1.1      | Nett price for the fulfilment of the Tender Requirements, Conditions of Contract, Performance Security/Security Bond, Indemnification, etc. Bond to remain valid until date of issue of the Final Completion Certificate or within 28 days after expiry of Defects Notification Period |                   | Sum  | 1   |                        |                       |       |
| 1.1.2      | Insurance of the Works in the joint names of the Employer and Contractor, Insurance of the Construction Plant to its full replacement value and Third Party Insurance  |                   | Sum  | 1   |                        |                       |       |
| 1.1.3      | Site establishment, which includes, site office, site store, laydown area, temporary housing, security fence, sanitary toilets, obtaining water, electrical connection, etc.   |                   | Sum  | 1   |                        |                       |       |
| 1.1.4      | Determining and locating of existing services as well as management of wayleaves   |                   | Sum  | 1   |                        |                       |       |
| 1.1.5      | Erecting of temporary obstructions and barricades  |                   | Sum  | 1   |                        |                       |       |
| 1.1.6      | Notice board   |                   | Sum  | 1   |                        |                       |       |
| 1.1.7      | Cleaning of the site, removal of all refuse, rubble, rock, etc. prior to handing over of every phase   |                   | Sum  | 1   |                        |                       |       |
| 1.1.8      | Obtaining permits, arranging for outages and switching with relevant Authorities   |                   | Sum  | 1   |                        |                       |       |
| 1.1.9      | Obtaining access to the Eskom Website ( <a href="http://scot.eskom.co.za">//scot.eskom.co.za</a> ) for access to the relevant Eskom Standards and compile a site manual complete with all relevant Eskom DT drawings.  |                   | Sum  | 1   |                        |                       |       |
| 1.1.10     | Tools, material and safety clothing for the local labourers to conduct their work in accordance with safety requirements   |                   | Sum  | 1   |                        |                       |       |
| 1.1.11     | Medical and induction cost   |                   | Sum  | 1   |                        |                       |       |
| 1.1.12     | As built drawings and manuals. (5 x sets). As Built drawings to include surveying of the works by a qualified surveyor, especially MV and Main LV cables where applicable. (Drawings to be issued in CAD format)   |                   | Sum  | 1   |                        |                       |       |
| <b>1.2</b> | <b>COMPLY WITH THE FOLLOWING SAFETY, HEALTH, ENVIRONMENTAL AND QUALITY (SHEQ) REQUIREMENTS- FIXED AMOUNT</b>   |                   |      |     |                        |                       |       |
| 1.2.1      | Adherence to Construction Regulations of the OHSA  |                   | Sum  | 1   |                        |                       |       |
| 1.2.2      | Compile a Health and Safety Plan (H & S Plan)  |                   | Sum  | 1   |                        |                       |       |
| 1.2.3      | Compile a Risk Assessment for activities (RA)  |                   | Sum  | 1   |                        |                       |       |

**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))****LIST A: PRELIMINARY AND GENERAL**

|            |   |                   |        |     | TENDER PRICE           |                       |       |
|------------|---|-------------------|--------|-----|------------------------|-----------------------|-------|
| ITEM       | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT   | QTY | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
| 1.2.4      | Comply with Environmental Management Plan (EMP)   |                   | Sum    | 1   |                        |                       |       |
| 1.2.5      | Submit proof of calibration of equipment eg Crimper, HV test apparatus, breaking failure test of terminations and joints of ACSR OH Lines, etc.                     |                   | Sum    | 1   |                        |                       |       |
| 1.2.6      | Compile a SHEQ File to also include all the above in distinct sections  |                   | Sum    | 1   |                        |                       |       |
| <b>1.3</b> | <b>TIME-RELATED COST - ADJUSTABLE WITH CONTRACT PERIOD</b>  |                   |        |     |                        |                       |       |
|            | <b>The running cost of the project related to the contract period which will also be used to adjust the cost if an event occurs that becomes the Employers Risk</b> |                   |        |     |                        |                       |       |
| 1.3.1      | Head office overhead cost   |                   | Months | 12  |                        |                       |       |
| 1.3.2      | Site overhead cost  |                   | Months | 12  |                        |                       |       |
| 1.3.3      | Material-store cost on site   |                   | Months | 12  |                        |                       |       |
| 1.3.4      | Material-store cost off site  |                   | Months | 12  |                        |                       |       |
| 1.3.5      | Maintenance of setting out of the works by a qualified surveyor   |                   | Months | 12  |                        |                       |       |
| 1.3.6      | Contracts Manager/ Contractor's Representative : Office and Site based  |                   | Months | 12  |                        |                       |       |
| 1.3.7      | Health, Safety and Environmental Officer  |                   | Months | 12  |                        |                       |       |
| 1.3.8      | Site Supervisor / Planner : Office and Site based   |                   | Months | 12  |                        |                       |       |
| 1.3.9      | Site Agent : Site based   |                   | Months | 12  |                        |                       |       |
| 1.3.10     | Comply with SHEQ requirements by Safety Officer e.g. regular review and update of Health and Safety File  |                   | Months | 12  |                        |                       |       |
| 1.3.11     | Site offices cost , including ablution facilities, site administration, transport, accommodation etc.   |                   | Months | 12  |                        |                       |       |
| 1.3.12     | Coordination and working together with other Contractors  |                   | Months | 12  |                        |                       |       |
| 1.3.13     | Medicals and induction costs  |                   | Months | 12  |                        |                       |       |
| 1.3.14     | Security for site camp and work on site   |                   | Months | 12  |                        |                       |       |
| 1.3.15     | Local labour management cost for :  |                   |        |     |                        |                       |       |
| 1.3.15.1   | Overhead cost to manage SMME's that will execute a portion of the contract (30% of labour portion)  |                   | Months | 12  |                        |                       |       |
| 1.3.15.2   | Community Liaison Officer   |                   | Months | 12  |                        |                       |       |
| 1.3.15.3   | Community liaison and communication   |                   | Months | 12  |                        |                       |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST A: PRELIMINARY AND GENERAL

| TENDER PRICE |  |                   |        |     |                        |                       |       |
|--------------|--|-------------------|--------|-----|------------------------|-----------------------|-------|
| ITEM         | DESCRIPTION  | DRG<br>NO<br>D-DT | UNIT   | QTY | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
| 1.3.15.4     | Labour desk and recruitment  |                   | Months | 12  |                        |                       |       |
| 1.3.15.5     | Employment of local people for the duration of the project   |                   | Months | 12  |                        |                       |       |
| 1.3.15.6     | Training of semi-skilled labourers   |                   | Months | 12  |                        |                       |       |
| 1.3.15.7     | Management of local labourers  |                   | Months | 12  |                        |                       |       |
| <b>1.4</b>   | <b>COMPLY WITH THE FOLLOWING SHEQ REQUIREMENTS- TIME RELATED</b>   |                   |        |     |                        |                       |       |
| 1.4.1        | Adherence to Construction Regulations of the OHSA  |                   | Months | 12  |                        |                       |       |
| 1.4.2        | Review and update the Health and Safety Plan (H & S Plan)  |                   | Months | 12  |                        |                       |       |
| 1.4.3        | Review and update the Risk Assessment for activities (RA)  |                   | Months | 12  |                        |                       |       |
| 1.4.4        | Review and update the Environmental Management Plan (EMP)  |                   | Months | 12  |                        |                       |       |
| 1.4.5        | Independent Environmental Compliance Officer   |                   | PC     | 1   | R 450 000.00           |                       |       |
| <b>1.5</b>   | <b>MAINTENANCE SUPPORT</b>   |                   |        |     |                        |                       |       |
|              | Provide comprehensive maintenance support for a period of 12 Months after completion certificate.  |                   |        |     |                        |                       |       |
|              | Maintenance support shall include all equipment included in the secondary plant and primary plant.   |                   | Sum    | 1   |                        |                       |       |
| <b>1.6</b>   | <b>PHASED IMPLEMENTATION</b>   |                   |        |     |                        |                       |       |
|              | <b>Allow adequately time to execute the project over the specified period which could result in withdrawal from site and re-establishment on site. (Note: Contractor to allow for all costs for de-establishing and re-establishing including costs for contractual requirements).</b> |                   |        |     |                        |                       |       |
| 1.6.1        | June 2023: Phase 1   |                   | Sum    | 1   |                        |                       |       |
| 1.6.2        | June 2024: Phase 2   |                   | Sum    | 1   |                        |                       |       |
| <b>1.7</b>   | <b>MISCELLANEOUS COSTS</b>   |                   |        |     |                        |                       |       |
| 1.7.1        | Installation and maintenance of LV Aux. construction supply to be used for entire delivery period. Contractor to submit a application to the Electricity Department of the Municipality.   |                   | Sum    | 1   |                        |                       |       |
| 1.7.2        | Removal of LV Aux. construction supply   |                   | Sum    | 1   |                        |                       |       |
| 1.7.3        | Construction lights to be provided prior to starting of electrical works for security purposes.  |                   |        |     |                        |                       |       |
|              | All equipment and labour to be provided for by the contractor, including the temporary lights, which shall be sufficient enough to light up the entire construction site. Temporary lights to be removed after completion  |                   | Sum    | 1   |                        |                       |       |
|              |  |                   |        |     |                        |                       |       |
|              |  |                   |        |     |                        |                       |       |
|              |  |                   |        |     |                        |                       |       |



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**VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))**

**LIST B: QUALITY CONTROL PROGRAM & BUSH CLEARING**

|  |   |                   |      |     |                        | TENDER PRICE          |       |
|--|---|-------------------|------|-----|------------------------|-----------------------|-------|
| ITEM   | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT | QTY | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
| 1  | <b>QUALITY CONTROL PROGRAM</b>  |                   |      |     |                        |                       |       |
| 1.1  | Compile a detailed Quality Control Program for construction activities.   |                   | Sum  | 1   |                        |                       |       |
| 1.2  | Supply all material and perform the following tests at an approved body. Should the Test Joint fail, the Contractor will retest the assembly at his own cost.   |                   |      |     |                        |                       |       |
| 1.2.1  | 1 x Chicadee joint and 2 x Chicadee dead end assembly as specified in Clause 4 of Section V.  |                   | Sum  | 1   |                        |                       |       |
| 1.2.2  | 1 x OPGW dead end assembly as specified in Clause 4 of Section V.   |                   | Sum  | 1   |                        |                       |       |
| 1.2.3  | 1 x 19 / 2,65 wire stay assembly as specified in Clause 4 of Section V.   |                   | Sum  | 1   |                        |                       |       |
| 1.3  | Before construction commences, the crimper to be used on the line shall be used to crimp the test piece as specified above by authorised person who shall perform joints on the line. This must be witnessed by Engineer and test certificates to be part of Hand Over Documentation as specified in Clause 4 of Section V. |                   | Sum  | 1   |                        |                       |       |
| 2  | <b>BUSH CLEARING</b>  |                   |      |     |                        |                       |       |
| 2.1  | Bush clearing and herbicide application (Contractor to identify extend of bush clearing)  |                   | Sum  | 1   |                        |                       |       |
| 2.2  | Install Farm Gates (for fences crossed by line and where required)  | D-FS-12051        | Each | 10  |                        |                       |       |
| 2.3  | Interaction with property owners regarding the use of access routes on farms and property as well as settling of disputes.  |                   | Sum  | 1   |                        |                       |       |
| 2.4  | Rehabilitation of grass after completion, repair all fences, gates and damage resulted from construction or use of land.  |                   | Sum  | 1   |                        |                       |       |
| 3  | <b>MAINTENANCE COMPUTERS:</b>   |                   |      |     |                        |                       |       |
| 3.1  | Maintenance Notebook as specified.  | C3.1.22           | Each | 3   |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
| <b>SUBTOTAL CARRIED TO ITEM 2 OF SUMMARY</b> |   |                   |      |     |                        |                       |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

| ITEM      | DESCRIPTION  | DRG<br>NO<br>D-DT | UNIT           | QTY       | TENDER PRICE           |                       | TOTAL |
|-----------|--|-------------------|----------------|-----------|------------------------|-----------------------|-------|
|           |  |                   |                |           | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE |       |
|           |  |                   |                |           |                        |                       |       |
|           | <b>FOUNDATIONS</b>   |                   |                |           |                        |                       |       |
|           | <b>Note</b>  |                   |                |           |                        |                       |       |
|           | Nominations of foundation types and design to be done by a registered Civil Engineer. Civil Engineer to specify which of the foundation types must be used for each structure.   |                   |                |           |                        |                       |       |
|           |  |                   |                |           |                        |                       |       |
| <b>1.</b> | <b>FOUNDATIONS FOR TYPE 3 SOIL</b>   |                   |                |           |                        |                       |       |
|           | Transport to pole position, supply and transport imported material, dispose excavated material, excavate, supply, and install complete foundation and based on a Type 3 foundation, for the following structures (Note: flange mounted foundations shall include the concrete blinding, concrete foundation, steel reinforcing including all spacers and fixtures, Top & Bottom templates, holding down bolts including all washers, nuts and torqueing, shuttering and finishing, backfill and compaction): |                   |                |           |                        |                       |       |
| 1.1       | 22 m Intermediate Steel Pole, single circuit (Int_mono_SC_22m.pol)   | 7850s4            | Each           | 5         |                        |                       |       |
| 1.2       | 24 m Intermediate Steel Pole, single circuit (Int_mono_SC_24m_FM.pol)  | Custom Design     | Each           | 1         |                        |                       |       |
| 1.2.1     | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | 20.9      |                        |                       |       |
| 1.2.2     | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | 10.7      |                        |                       |       |
| 1.2.3     | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | 0.7       |                        |                       |       |
| 1.2.4     | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | 11.8      |                        |                       |       |
| 1.2.5     | Reinforcement (Total for all foundations required)   |                   | kg             | 857       |                        |                       |       |
| 1.3       | 25.3 m Intermediate Steel Pole, single circuit (Int_mono_SC_25.3m_FM.pol)  | GEN12062-101      | Each           | 10        |                        |                       |       |
| 1.3.1     | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | 305       |                        |                       |       |
| 1.3.2     | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | 164       |                        |                       |       |
| 1.3.3     | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | 9.8       |                        |                       |       |
| 1.3.4     | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | 157       |                        |                       |       |
| 1.3.5     | Reinforcement (Total for all foundations required)   |                   | kg             | 11371     |                        |                       |       |
| 1.4       | 24 m Intermediate Steel Pole, double circuit (HV/MV) (Int_mono_DCHVdcmv_24m_FM.pol)  | Custom Design     | Each           | 11        |                        |                       |       |
| 1.4.1     | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | 229.9     |                        |                       |       |
| 1.4.2     | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | 117.7     |                        |                       |       |
| 1.4.3     | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | 7.7       |                        |                       |       |
| 1.4.4     | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | 129.8     |                        |                       |       |
| 1.4.5     | Reinforcement (Total for all foundations required)   |                   | kg             | 9427      |                        |                       |       |
| 1.5       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_in-line_20m.pol)  | 7851s4            | Each           | 1         |                        |                       |       |
| 1.6       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_20m.pol)  | 7851s4            | Each           | 1         |                        |                       |       |
| 1.7       | 23.2 m Angle Strain Steel Pole, single circuit (Str_mono_SC_23-2m_FMSS.pol)  | GEN12062-106      | Each           | Rate Only |                        |                       |       |
| 1.7.1     | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 1.7.2     | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 1.7.3     | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 1.7.4     | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 1.7.5     | Reinforcement (Total for all foundations required)   |                   | kg             | Rate Only |                        |                       |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

| ITEM      | DESCRIPTION  | DRG<br>NO<br>D-DT | UNIT           | QTY       | TENDER PRICE           |                       |       |
|-----------|--|-------------------|----------------|-----------|------------------------|-----------------------|-------|
|           |  |                   |                |           | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
| 1.8       | 24 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_24.pol)   | 7851s4            | Each           | 3         |                        |                       |       |
| 1.9       | 19 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_19mtcah+MV_FM.pol)  | CIS14033-003      | Each           | 2         |                        |                       |       |
| 1.9.1     | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | 115.6     |                        |                       |       |
| 1.9.2     | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | 61.6      |                        |                       |       |
| 1.9.3     | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | 3.4       |                        |                       |       |
| 1.9.4     | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | 57.4      |                        |                       |       |
| 1.9.5     | Reinforcement (Total for all foundations required)   |                   | kg             | 4155.8    |                        |                       |       |
| 1.10      | 23.2 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_23.2mtcah+MV_FM.pol)  | GEN12062-106      | Each           | 1         |                        |                       |       |
| 1.10.1    | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | 74.3      |                        |                       |       |
| 1.10.2    | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | 36.8      |                        |                       |       |
| 1.10.3    | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | 2.06      |                        |                       |       |
| 1.10.4    | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | 39.6      |                        |                       |       |
| 1.10.5    | Reinforcement (Total for all foundations required)   |                   | kg             | 2872.1    |                        |                       |       |
| 1.11      | 3 x 32 m Pole Strain structure (Str_3pole_in-line_32m.pol)   | CIS06024-101      | Each           | Rate Only |                        |                       |       |
| 1.12      | 4 Pole Strain structure (4x10 m Poles) (Str_4pole_in-line_10m.pol)   | 7851s4            | Each           | 1         |                        |                       |       |
| 1.13      | 4 Pole Strain structure (4x11 m Poles) (Str_4pole_in-line_11m.poll)  | 7851s4            | Each           | 1         |                        |                       |       |
| 1.14      | 4 Pole Strain structure (3x10 m & 1x11 m Poles) (Str_4pole_in-line_10m_11m.pol)  | 7851s4            | Each           | 1         |                        |                       |       |
| 1.15      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_in-line_10m_12m.pol)  | 7851s4            | Each           | Rate Only |                        |                       |       |
| 1.16      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_90deg_10m_12m.pol)  | 7851s4            | Each           | 1         |                        |                       |       |
| 1.17      | 4 Pole Strain structure (3x15 m & 1x16 m Poles) (Str_4pole_in-line_15m_16m.pol)  | 7851s4            | Each           | 1         |                        |                       |       |
| 1.18      | 4 Pole Strain structure (3x15 m & 1x17 m Poles) (Str_4pole_in-line_15m_17m.pol)  | 7851s4            | Each           | 1         |                        |                       |       |
| <b>2.</b> | <b>FOUNDATIONS FOR TYPE 1 SOIL</b>   |                   |                |           |                        |                       |       |
|           | Transport to pole position, supply and transport imported material, dispose excavated material, excavate, supply, and install complete foundation and based on a Type 1 foundation, for the following structures (Note: flange mounted foundations shall include the concrete blinding, concrete foundation, steel reinforcing including all spacers and fixtures, Top & Bottom templates, holding down bolts including all washers, nuts and torqueing, shuttering and finishing, backfill and compaction): |                   |                |           |                        |                       |       |
| 2.1       | 22 m Intermediate Steel Pole, single circuit (Int_mono_SC_22m.pol)   | 7850s2            | Each           | Rate Only |                        |                       |       |
| 2.2       | 24 m Intermediate Steel Pole, single circuit (Int_mono_SC_24m_FM.pol)  | Custom Design     | Each           | Rate Only |                        |                       |       |
| 2.2.1     | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.2.2     | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.2.3     | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.2.4     | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

| ITEM   | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT           | QTY       | TENDER PRICE           |                       |       |
|--------|---|-------------------|----------------|-----------|------------------------|-----------------------|-------|
|        |   |                   |                |           | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
| 2.2.5  | Reinforcement (Total for all foundations required)                                  |                   | kg             | Rate Only |                        |                       |       |
| 2.3    | 25.3 m Intermediate Steel Pole, single circuit (Int_mono_SC_25.3m_FM.pol)           | GEN12062-101      | Each           | Rate Only |                        |                       |       |
| 2.3.1  | Excavation (Total for all foundations required)                                     |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.3.2  | Backfill (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.3.3  | Blinding (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.3.4  | Concrete (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.3.5  | Reinforcement (Total for all foundations required)                                  |                   | kg             | Rate Only |                        |                       |       |
| 2.4    | 24 m Intermediate Steel Pole, double circuit (HV/MV) (Int_mono_DCHVdcmv_24m_FM.pol) | Custom Design     | Each           | Rate Only |                        |                       |       |
| 2.4.1  | Excavation (Total for all foundations required)                                     |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.4.2  | Backfill (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.4.3  | Blinding (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.4.4  | Concrete (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.4.5  | Reinforcement (Total for all foundations required)                                  |                   | kg             | Rate Only |                        |                       |       |
| 2.5    | 20 m Angle Strain Steel Pole, single circuit (Str_mono_in-line_20m.pol)             | 7851s2            | Each           | Rate Only |                        |                       |       |
| 2.6    | 20 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_20m.pol)         | 7851s2            | Each           | Rate Only |                        |                       |       |
| 2.7    | 23.2 m Angle Strain Steel Pole, single circuit (Str_mono_SC_23-2m_FMSS.pol)         | GEN12062-106      | Each           | Rate Only |                        |                       |       |
| 2.7.1  | Excavation (Total for all foundations required)                                     |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.7.2  | Backfill (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.7.3  | Blinding (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.7.4  | Concrete (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.7.5  | Reinforcement (Total for all foundations required)                                  |                   | kg             | Rate Only |                        |                       |       |
| 2.8    | 24 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_24.pol)          | 7851s2            | Each           | Rate Only |                        |                       |       |
| 2.9    | 19 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_19mtcah+MV_FM.pol)               | CIS14033-003      | Each           | Rate Only |                        |                       |       |
| 2.9.1  | Excavation (Total for all foundations required)                                     |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.9.2  | Backfill (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.9.3  | Blinding (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.9.4  | Concrete (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.9.5  | Reinforcement (Total for all foundations required)                                  |                   | kg             | Rate Only |                        |                       |       |
| 2.10   | 23.2 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_23.2mtcah+MV_FM.pol)           | GEN12062-106      | Each           | Rate Only |                        |                       |       |
| 2.10.1 | Excavation (Total for all foundations required)                                     |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.10.2 | Backfill (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.10.3 | Blinding (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.10.4 | Concrete (Total for all foundations required)                                       |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 2.10.5 | Reinforcement (Total for all foundations required)                                  |                   | kg             | Rate Only |                        |                       |       |
| 2.11   | 3 x 32 m Pole Strain structure (Str_3pole_in-line_32m.pol)                          | CIS06024-101      | Each           | Rate Only |                        |                       |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

|           |  |               |                |           | TENDER PRICE     |                    |       |
|-----------|--|---------------|----------------|-----------|------------------|--------------------|-------|
| ITEM      | DESCRIPTION  | DRG NO D-DT   | UNIT           | QTY       | UNIT LABOUR RATE | UNIT MATERIAL RATE | TOTAL |
| 2.12      | 4 Pole Strain structure (4x10 m Poles) (Str_4pole_in-line_10m.pol)   | 7851s2        | Each           | Rate Only |                  |                    |       |
| 2.13      | 4 Pole Strain structure (4x11 m Poles) (Str_4pole_in-line_11m.poll)  | 7851s2        | Each           | Rate Only |                  |                    |       |
| 2.14      | 4 Pole Strain structure (3x10 m & 1x11 m Poles) (Str_4pole_in-line_10m_11m.pol)  | 7851s2        | Each           | Rate Only |                  |                    |       |
| 2.15      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_in-line_10m_12m.pol)  | 7851s2        | Each           | Rate Only |                  |                    |       |
| 2.16      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_90deg_10m_12m.pol)  | 7851s2        | Each           | Rate Only |                  |                    |       |
| 2.17      | 4 Pole Strain structure (3x15 m & 1x16 m Poles) (Str_4pole_in-line_15m_16m.pol)  | 7851s2        | Each           | Rate Only |                  |                    |       |
| 2.18      | 4 Pole Strain structure (3x15 m & 1x17 m Poles) (Str_4pole_in-line_15m_17m.pol)  | 7851s2        | Each           | Rate Only |                  |                    |       |
| <b>3.</b> | <b>FOUNDATIONS FOR TYPE 2 SOIL</b>   |               |                |           |                  |                    |       |
|           | Transport to pole position, supply and transport imported material, dispose excavated material, excavate, supply, and install complete foundation and based on a Type 2 foundation, for the following structures (Note: flange mounted foundations shall include the concrete blinding, concrete foundation, steel reinforcing including all spacers and fixtures, Top & Bottom templates, holding down bolts including all washers, nuts and torqueing, shuttering and finishing, backfill and compaction): |               |                |           |                  |                    |       |
| 3.1       | 22 m Intermediate Steel Pole, single circuit (Int_mono_SC_22m.pol)   | 7850s3        | Each           | Rate Only |                  |                    |       |
| 3.2       | 24 m Intermediate Steel Pole, single circuit (Int_mono_SC_24m_FM.pol)  | Custom Design | Each           | Rate Only |                  |                    |       |
| 3.2.1     | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.2.2     | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.2.3     | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.2.4     | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.2.5     | Reinforcement (Total for all foundations required)   |               | kg             | Rate Only |                  |                    |       |
| 3.3       | 25.3 m Intermediate Steel Pole, single circuit (Int_mono_SC_25.3m_FM.pol)  | GEN12062-101  | Each           | Rate Only |                  |                    |       |
| 3.3.1     | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.3.2     | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.3.3     | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.3.4     | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.3.5     | Reinforcement (Total for all foundations required)   |               | kg             | Rate Only |                  |                    |       |
| 3.4       | 24 m Intermediate Steel Pole, double circuit (HV/MV) (Int_mono_DCHVdcmv_24m_FM.pol)  | Custom Design | Each           | Rate Only |                  |                    |       |
| 3.4.1     | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.4.2     | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.4.3     | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.4.4     | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 3.4.5     | Reinforcement (Total for all foundations required)   |               | kg             | Rate Only |                  |                    |       |
| 3.5       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_in-line_20m.pol)  | 7851s3        | Each           | Rate Only |                  |                    |       |
| 3.6       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_20m.pol)  | 7851s3        | Each           | Rate Only |                  |                    |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

| ITEM   | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT           | QTY       | TENDER PRICE           |                       |       |
|--------|---|-------------------|----------------|-----------|------------------------|-----------------------|-------|
|        |   |                   |                |           | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
| 3.7    | 23.2 m Angle Strain Steel Pole, single circuit (Str_mono_SC_23-2m_FMSS.pol)   | GEN12062-106      | Each           | Rate Only |                        |                       |       |
| 3.7.1  | Excavation (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.7.2  | Backfill (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.7.3  | Blinding (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.7.4  | Concrete (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.7.5  | Reinforcement (Total for all foundations required)  |                   | kg             | Rate Only |                        |                       |       |
| 3.8    | 24 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_24.pol)  | 7851s3            | Each           | Rate Only |                        |                       |       |
| 3.9    | 19 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_19mtcah+MV_FM.pol)   | CIS14033-003      | Each           | Rate Only |                        |                       |       |
| 3.9.1  | Excavation (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.9.2  | Backfill (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.9.3  | Blinding (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.9.4  | Concrete (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.9.5  | Reinforcement (Total for all foundations required)  |                   | kg             | Rate Only |                        |                       |       |
| 3.10   | 23.2 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_23.2mtcah+MV_FM.pol)   | GEN12062-106      | Each           | Rate Only |                        |                       |       |
| 3.10.1 | Excavation (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.10.2 | Backfill (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.10.3 | Blinding (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.10.4 | Concrete (Total for all foundations required)   |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 3.10.5 | Reinforcement (Total for all foundations required)  |                   | kg             | Rate Only |                        |                       |       |
| 3.11   | 3 x 32 m Pole Strain structure (Str_3pole_in-line_32m.pol)  | CIS06024-101      | Each           | Rate Only |                        |                       |       |
| 3.12   | 4 Pole Strain structure (4x10 m Poles) (Str_4pole_in-line_10m.pol)  | 7851s3            | Each           | Rate Only |                        |                       |       |
| 3.13   | 4 Pole Strain structure (4x11 m Poles) (Str_4pole_in-line_11m.poll)   | 7851s3            | Each           | Rate Only |                        |                       |       |
| 3.14   | 4 Pole Strain structure (3x10 m & 1x11 m Poles) (Str_4pole_in-line_10m_11m.pol)   | 7851s3            | Each           | Rate Only |                        |                       |       |
| 3.15   | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_in-line_10m_12m.pol)   | 7851s3            | Each           | Rate Only |                        |                       |       |
| 3.16   | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_90deg_10m_12m.pol)   | 7851s3            | Each           | Rate Only |                        |                       |       |
| 3.17   | 4 Pole Strain structure (3x15 m & 1x16 m Poles) (Str_4pole_in-line_15m_16m.pol)   | 7851s3            | Each           | Rate Only |                        |                       |       |
| 3.18   | 4 Pole Strain structure (3x15 m & 1x17 m Poles) (Str_4pole_in-line_15m_17m.pol)   | 7851s3            | Each           | Rate Only |                        |                       |       |
| 4.     | <b>FOUNDATIONS FOR TYPE 4 SOIL</b>  |                   |                |           |                        |                       |       |
|        | Transport to pole position, supply and transport imported material, dispose excavated material, excavate, supply, and install |                   |                |           |                        |                       |       |
|        | complete foundation and based on a Type 4 foundation, for the following structures (Note: flange mounted foundations shall    |                   |                |           |                        |                       |       |
|        | include the concrete blinding, concrete foundation, steel reinforcing including all spacers and fixtures, Top & Bottom        |                   |                |           |                        |                       |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

|       |  |               |                |           | TENDER PRICE     |                    |       |
|-------|--|---------------|----------------|-----------|------------------|--------------------|-------|
| ITEM  | DESCRIPTION  | DRG NO D-DT   | UNIT           | QTY       | UNIT LABOUR RATE | UNIT MATERIAL RATE | TOTAL |
|       | templates, holding down bolts including all washers, nuts and torqueing, shuttering and finishing, backfill and compaction): |               |                |           |                  |                    |       |
| 4.1   | 22 m Intermediate Steel Pole, single circuit (Int_mono_SC_22m.pol)   | 7850s5        | Each           | Rate Only |                  |                    |       |
| 4.2   | 24 m Intermediate Steel Pole, single circuit (Int_mono_SC_24m_FM.pol)  | Custom Design | Each           | 1         |                  |                    |       |
| 4.2.1 | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | 32.2      |                  |                    |       |
| 4.2.2 | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | 18.2      |                  |                    |       |
| 4.2.3 | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | 1.07      |                  |                    |       |
| 4.2.4 | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | 15.6      |                  |                    |       |
| 4.2.5 | Reinforcement (Total for all foundations required)   |               | kg             | 1130.3    |                  |                    |       |
| 4.3   | 25.3 m Intermediate Steel Pole, single circuit (Int_mono_SC_25.3m_FM.pol)  | GEN12062-101  | Each           | 5         |                  |                    |       |
| 4.3.1 | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | 229       |                  |                    |       |
| 4.3.2 | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | 131.5     |                  |                    |       |
| 4.3.3 | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | 7.4       |                  |                    |       |
| 4.3.4 | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | 105.5     |                  |                    |       |
| 4.3.5 | Reinforcement (Total for all foundations required)   |               | kg             | 7659.5    |                  |                    |       |
| 4.4   | 24 m Intermediate Steel Pole, double circuit (HV/MV) (Int_mono_DCHVdcmv_24m_FM.pol)  | Custom Design | Each           | 2         |                  |                    |       |
| 4.4.1 | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | 64.4      |                  |                    |       |
| 4.4.2 | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | 36.4      |                  |                    |       |
| 4.4.3 | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | 2.14      |                  |                    |       |
| 4.4.4 | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | 31.2      |                  |                    |       |
| 4.4.5 | Reinforcement (Total for all foundations required)   |               | kg             | 2260.6    |                  |                    |       |
| 4.5   | 20 m Angle Strain Steel Pole, single circuit (Str_mono_in-line_20m.pol)  | 7851s5        | Each           | Rate Only |                  |                    |       |
| 4.6   | 20 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_20m.pol)  | 7851s5        | Each           | Rate Only |                  |                    |       |
| 4.7   | 23.2 m Angle Strain Steel Pole, single circuit (Str_mono_SC_23-2m_FMSS.pol)  | Custom Design | Each           | 3         |                  |                    |       |
| 4.7.1 | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | 345       |                  |                    |       |
| 4.7.2 | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | 178.5     |                  |                    |       |
| 4.7.3 | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | 9.6       |                  |                    |       |
| 4.7.4 | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | 173.1     |                  |                    |       |
| 4.7.5 | Reinforcement (Total for all foundations required)   |               | kg             | 12557.4   |                  |                    |       |
| 4.8   | 24 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_24.pol)   | 7851s5        | Each           | Rate Only |                  |                    |       |
| 4.9   | 19 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_19mtcah+MV_FM.pol)  | CIS14033-003  | Each           | Rate Only |                  |                    |       |
| 4.9.1 | Excavation (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 4.9.2 | Backfill (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 4.9.3 | Blinding (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 4.9.4 | Concrete (Total for all foundations required)  |               | m <sup>3</sup> | Rate Only |                  |                    |       |
| 4.9.5 | Reinforcement (Total for all foundations required)   |               | kg             | Rate Only |                  |                    |       |
| 4.10  | 23.2 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_23.2mtcah+MV_FM.pol)  | GEN12062-106  | Each           | Rate Only |                  |                    |       |



## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

| ITEM   | DESCRIPTION  | DRG<br>NO<br>D-DT | UNIT           | QTY       | TENDER PRICE           |                       | TOTAL |
|--------|--|-------------------|----------------|-----------|------------------------|-----------------------|-------|
|        |  |                   |                |           | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE |       |
| 4.10.1 | Excavation (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 4.10.2 | Backfill (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 4.10.3 | Blinding (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 4.10.4 | Concrete (Total for all foundations required)  |                   | m <sup>3</sup> | Rate Only |                        |                       |       |
| 4.10.5 | Reinforcement (Total for all foundations required)   |                   | kg             | Rate Only |                        |                       |       |
| 4.11   | 3 x 32 m Pole Strain structure (Str_3pole_in-line_32m.pol)   | CIS06024-101      | Each           | 1         |                        |                       |       |
| 4.12   | 4 Pole Strain structure (4x10 m Poles) (Str_4pole_in-line_10m.pol)   | 7851s5            | Each           | Rate Only |                        |                       |       |
| 4.13   | 4 Pole Strain structure (4x11 m Poles) (Str_4pole_in-line_11m.pol)   | 7851s5            | Each           | Rate Only |                        |                       |       |
| 4.14   | 4 Pole Strain structure (3x10 m & 1x11 m Poles) (Str_4pole_in-line_10m_11m.pol)  | 7851s5            | Each           | 1         |                        |                       |       |
| 4.15   | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_in-line_10m_12m.pol)  | 7851s5            | Each           | Rate Only |                        |                       |       |
| 4.16   | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_90deg_10m_12m.pol)  | 7851s5            | Each           | 1         |                        |                       |       |
| 4.17   | 4 Pole Strain structure (3x15 m & 1x16 m Poles) (Str_4pole_in-line_15m_16m.pol)  | 7851s5            | Each           | Rate Only |                        |                       |       |
| 4.18   | 4 Pole Strain structure (3x15 m & 1x17 m Poles) (Str_4pole_in-line_15m_17m.pol)  | 7851s5            | Each           | Rate Only |                        |                       |       |
| 5.     | <b>FOUNDATIONS FOR ROCK</b>  |                   |                |           |                        |                       |       |
|        | Transport to pole position, supply and transport imported material, dispose excavated material, excavate, supply, and install complete foundation and based on a Rock foundation, for the following structures (Note: flange mounted foundations shall include the concrete blinding, concrete foundation, steel reinforcing including all spacers and fixtures, Top & Bottom templates, holding down bolts including all washers, nuts and torqueing, shuttering and finishing, backfill and compaction): |                   |                |           |                        |                       |       |
| 5.1    | 22 m Intermediate Steel Pole, single circuit (Int_mono_SC_22m.pol)   | 7850s1            | Each           | Rate Only |                        |                       |       |
| 5.2    | 24 m Intermediate Steel Pole, single circuit (Int_mono_SC_24m_FM.pol)  | Custom Design     | Each           | Rate Only |                        |                       |       |
| 5.3    | 25.3 m Intermediate Steel Pole, single circuit (Int_mono_SC_25.3m_FM.pol)  | GEN12062-101      | Each           | Rate Only |                        |                       |       |
| 5.4    | 24 m Intermediate Steel Pole, double circuit (HV/MV) (Int_mono_DCHVdcmv_24m_FM.pol)  | Custom Design     | Each           | Rate Only |                        |                       |       |
| 5.5    | 20 m Angle Strain Steel Pole, single circuit (Str_mono_in-line_20m.pol)  | 7851s1            | Each           | Rate Only |                        |                       |       |
| 5.6    | 20 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_20m.pol)  | 7851s1            | Each           | Rate Only |                        |                       |       |
| 5.7    | 23.2 m Angle Strain Steel Pole, single circuit (Str_mono_SC_23-2m_FMSS.pol)  | GEN12062-106      | Each           | Rate Only |                        |                       |       |
| 5.8    | 24 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_24.pol)   | 7851s1            | Each           | Rate Only |                        |                       |       |
| 5.9    | 19 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_19mtcah+MV_FM.pol)  | CIS14033-003      | Each           | Rate Only |                        |                       |       |

**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))****LIST C: LINE CONSTRUCTION**

|           |   |              |      |           |                  | TENDER PRICE       |       |  |
|-----------|---|--------------|------|-----------|------------------|--------------------|-------|--|
| ITEM      | DESCRIPTION   | DRG NO D-DT  | UNIT | QTY       | UNIT LABOUR RATE | UNIT MATERIAL RATE | TOTAL |  |
| 5.10      | 23.2 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_23.2mtcah+MV_FM.pol)   | GEN12062-106 | Each | Rate Only |                  |                    |       |  |
| 5.11      | 3 x 32 m Pole Strain structure (Str_3pole_in-line_32m.pol)  | CIS06024-101 | Each | Rate Only |                  |                    |       |  |
| 5.12      | 4 Pole Strain structure (4x10 m Poles) (Str_4pole_in-line_10m.pol)  | 7851s1       | Each | Rate Only |                  |                    |       |  |
| 5.13      | 4 Pole Strain structure (4x11 m Poles) (Str_4pole_in-line_11m.poll)   | 7851s1       | Each | Rate Only |                  |                    |       |  |
| 5.14      | 4 Pole Strain structure (3x10 m & 1x11 m Poles) (Str_4pole_in-line_10m_11m.pol)   | 7851s1       | Each | Rate Only |                  |                    |       |  |
| 5.15      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_in-line_10m_12m.pol)   | 7851s1       | Each | Rate Only |                  |                    |       |  |
| 5.16      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_90deg_10m_12m.pol)   | 7851s1       | Each | Rate Only |                  |                    |       |  |
| 5.17      | 4 Pole Strain structure (3x15 m & 1x16 m Poles) (Str_4pole_in-line_15m_16m.pol)   | 7851s1       | Each | Rate Only |                  |                    |       |  |
| 5.18      | 4 Pole Strain structure (3x15 m & 1x17 m Poles) (Str_4pole_in-line_15m_17m.pol)   | 7851s1       | Each | Rate Only |                  |                    |       |  |
| <b>6</b>  | <b>Extra-over items for foundation excavations:</b>   |              |      |           |                  |                    |       |  |
| 6.1       | Intermediate material excavation  |              | m³   | 100       |                  |                    |       |  |
| 6.2       | Hard Rock excavation  |              | m³   | 100       |                  |                    |       |  |
| 6.3       | Boulder excavation  |              | m³   | 100       |                  |                    |       |  |
| 6.4       | In close proximity to a Livened Line  |              | Sum  | 1         |                  |                    |       |  |
| <b>7.</b> | <b>STAY ROD ASSEMBLIES</b>  |              |      |           |                  |                    |       |  |
|           | Excavate and transport imported material, barricade and dispose of excavated material and install complete permanent 19/2.65mm stay rod assembly for the following soil conditions. |              |      |           |                  |                    |       |  |
| 7.1       | Type 3 soil.  |              | Each | 105       |                  |                    |       |  |
| 7.2       | Type 1 soil.  |              | Each | Rate Only |                  |                    |       |  |
| 7.3       | Type 2 soil.  |              | Each | Rate Only |                  |                    |       |  |
| 7.4       | Type 4 soil.  |              | Each | Rate Only |                  |                    |       |  |
| 7.5       | Rock  |              | Each | Rate Only |                  |                    |       |  |
| <b>8.</b> | <b>CONCRETE TEST CERTIFICATES</b>   |              |      |           |                  |                    |       |  |
|           | Take concrete test samples and obtain test certificates for the following:  |              |      |           |                  |                    |       |  |
| 8.1       | 7, 14 and 28 concrete test cubes for Flange Mounted 25 m Monolithic Pole foundation (3 test cubes per concrete delivery).   |              | Sum  | 1         |                  |                    |       |  |
| 8.2       | 7, 14 and 28 concrete test cubes for foundation blindings and pole caps (Note: 3 test cubes per concrete delivery).   |              | Sum  | 1         |                  |                    |       |  |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST C: LINE CONSTRUCTION

| ITEM       | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT           | QTY | TENDER PRICE           |                       | TOTAL |
|------------|---|-------------------|----------------|-----|------------------------|-----------------------|-------|
|            |   |                   |                |     | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE |       |
| <b>9.</b>  | <b>EARTHING</b>   |                   |                |     |                        |                       |       |
|            | Excavate, supply, install and bond tower earthing for the following structures:   |                   |                |     |                        |                       |       |
| 9.1        | Bond 2 x terminal towers to individual substation's earthmats using 2x 70 mm <sup>2</sup> copper equivalent CCS buried 1m deep                  |                   |                |     |                        |                       |       |
| 9.1.1      | Vulcan MTS  | 6045              | m              | 60  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 9.1.       | Siyanqoba Substation  | 6045              | m              | 60  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 9.2        | Excavate, supply and install complete 3 point star earth electrode (incl. rocky terrain)  | 0640              | Each           | 55  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 9.3        | Testing of tower footing resistance   |                   | Each           | 55  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 9.4        | <u>Extra-over items earthing: (Rates are only for excavation of the earth electrode trenches)</u>   |                   |                |     |                        |                       |       |
| 9.4.1      | Intermediate material excavation  |                   | m <sup>3</sup> | 50  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 9.4.2      | Hard Rock excavation  |                   | m <sup>3</sup> | 20  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 9.4.3      | Boulder excavation  |                   | m <sup>3</sup> | 20  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| <b>10.</b> | <b>DISPOSAL OF EXCAVATED MATERIAL</b>   |                   |                |     |                        |                       |       |
|            | Any additional disposal that might be required. (5km radius from the pole/tower position will be regarded as a free haul).                      |                   |                |     |                        |                       |       |
| 10.1       | Limited haul (The first 5 km beyond the end of the free haul distance by the shortest practical route)  |                   | m <sup>3</sup> | 50  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 10.2       | Long haul (Remainder of distance beyond the limited haul by the shortest practical route)   |                   | m <sup>3</sup> | 50  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| <b>11.</b> | <b>IMPORTING SOIL</b>   |                   |                |     |                        |                       |       |
|            | Any additional disposal that might be required. (5km radius from the pole/tower position will be regarded as a free haul).                      |                   |                |     |                        |                       |       |
| 11.1       | Limited haul (The first 5 km beyond the end of the free haul distance by the shortest practical route)  |                   | m <sup>3</sup> | 50  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 11.2       | Long haul (Remainder of distance beyond the limited haul by the shortest practical route)   |                   | m <sup>3</sup> | 50  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| <b>12.</b> | <b>ERECTING OF STRUCTURES</b>   |                   |                |     |                        |                       |       |
|            | Supply, transport to pole position, install and erect the steel pole for the following structures at specified positions, including backfilling |                   |                |     |                        |                       |       |
| 12.1       | 22 m Intermediate Steel Pole, single circuit (Int_mono_SC_22m.pol)  | 7611              | Each           | 4   |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 12.2       | 24 m Intermediate Steel Pole, single circuit (Int_mono_SC_24m_FM.pol)   | Custom Design     | Each           | 2   |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 12.3       | 25.3 m Intermediate Steel Pole, single circuit (Int_mono_SC_25.3m_FM.pol) (44 kN)   | Item 7 - 1        | Each           | 15  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 12.4       | 24 m Intermediate Steel Pole, double circuit (HV/MV) (Int_mono_DCHVdcmv_24m_FM.pol)   | Custom Design     | Each           | 13  |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 12.5       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_in-line_20m.pol)   | 7615              | Each           | 2   |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |
| 12.6       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_20m.pol)   | 7615              | Each           | 1   |                        |                       |       |
|            |   |                   |                |     |                        |                       |       |

**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))****LIST C: LINE CONSTRUCTION**

| ITEM       | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT | QTY | TENDER PRICE           |                       | TOTAL |
|------------|---|-------------------|------|-----|------------------------|-----------------------|-------|
|            |   |                   |      |     | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE |       |
| 12.7       | 23.2 m Angle Strain Steel Pole, single circuit (Str_mono_SC_23-2m_FMSS.pol)   | Item 5 - 1        | Each | 3   |                        |                       |       |
| 12.8       | 24 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_24.pol)  | 7615              | Each | 3   |                        |                       |       |
| 12.9       | 19 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_19mtcah+MV_FM.pol) (256 kN)  | CIS 156kN S/C     | Each | 1   |                        |                       |       |
| 13.10      | 23.2 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_23.2mtcah+MV_FM.pol) (156 kN)  | Item 5 - 1        | Each | 2   |                        |                       |       |
| 13.11      | 3 x 32 m Pole Strain structure (Str_3pole_in-line_32m.pol)  | CIS06024-201      | Each | 1   |                        |                       |       |
| 13.12      | 4 Pole Strain structure (4x10 m Poles) (Str_4pole_in-line_10m.pol)  | 7618              | Each | 1   |                        |                       |       |
| 13.13      | 4 Pole Strain structure (4x11 m Poles) (Str_4pole_in-line_11m.pol)  | 7618              | Each | 1   |                        |                       |       |
| 13.14      | 4 Pole Strain structure (3x10 m & 1x11 m Poles) (Str_4pole_in-line_10m_11m.pol)   | 7618              | Each | 1   |                        |                       |       |
| 13.15      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_in-line_10m_12m.pol)   | 7618              | Each | 1   |                        |                       |       |
| 13.16      | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_90deg_10m_12m.pol)   | 7618              | Each | 2   |                        |                       |       |
| 13.17      | 4 Pole Strain structure (3x15 m & 1x16 m Poles) (Str_4pole_in-line_15m_16m.pol)   | 7618              | Each | 1   |                        |                       |       |
| 13.18      | 4 Pole Strain structure (3x15 m & 1x17 m Poles) (Str_4pole_in-line_15m_17m.pol)   | 7618              | Each | 1   |                        |                       |       |
| 13.18      | Extra-over items for 7: (Rates are only for the erection of the structures)   |                   |      |     |                        |                       |       |
| 13.18.1    | In close proximity to a Livened Line  |                   | Sum  | 1   |                        |                       |       |
| <b>14.</b> | <b>STAY ROD ASSEMBLIES</b>  |                   |      |     |                        |                       |       |
| 14.1       | Supply & install complete stay rod assembly.  | 7325              | Each | 119 |                        |                       |       |
| 14.2       | Erecting of construction stays  | 7325              | Sum  | 1   |                        |                       |       |
| <b>15.</b> | <b>STRUCTURE DRESSING</b>   |                   |      |     |                        |                       |       |
|            | Supply, transport to specific pole position and install complete hardware (including supply of all insulators) for the following structures (Strains > 60° need no post insulators) : |                   |      |     |                        |                       |       |
| 15.1       | 22 m Intermediate Steel Pole, single circuit (Int_mono_SC_22m.pol)  |                   | Each | 4   |                        |                       |       |
| 15.2       | 24 m Intermediate Steel Pole, single circuit (Int_mono_SC_24m_FM.pol)   |                   | Each | 2   |                        |                       |       |
| 15.3       | 25.3 m Intermediate Steel Pole, single circuit (Int_mono_SC_25.3m_FM.pol)   |                   | Each | 15  |                        |                       |       |
| 15.4       | 24 m Intermediate Steel Pole, double circuit (HV/MV) (Int_mono_DCHVdcmv_24m_FM.pol)   |                   | Each | 13  |                        |                       |       |
| 15.5       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_in-line_20m.pol)   |                   | Each | 2   |                        |                       |       |
| 15.6       | 20 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_20m.pol)   |                   | Each | 1   |                        |                       |       |

|  |   |                   |      |     | TENDER PRICE           |                       |       |
|--|---|-------------------|------|-----|------------------------|-----------------------|-------|
| ITEM   | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT | QTY | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
| 15.7   | 23.2 m Angle Strain Steel Pole, single circuit (Str_mono_SC_23-2m_FMSS.pol)                           |                   | Each | 3   |                        |                       |       |
| 15.8   | 24 m Angle Strain Steel Pole, single circuit (Str_mono_SC_7615d_r2_24.pol)                            |                   | Each | 3   |                        |                       |       |
| 15.9   | 19 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_19mtcah+MV_FM.pol)                                 |                   | Each | 1   |                        |                       |       |
| 15.10  | 23.2 m Angle Strain Steel Pole HV/MV (Str_2pole_2xSC_23.2mtcah+MV_FM.pol)                             |                   | Each | 2   |                        |                       |       |
| 15.11  | 3 x 32 m Pole Strain structure (Str_3pole_in-line_32m.pol)  |                   | Each | 1   |                        |                       |       |
| 15.12  | 4 Pole Strain structure (4x10 m Poles) (Str_4pole_in-line_10m.pol)                                    |                   | Each | 1   |                        |                       |       |
| 15.13  | 4 Pole Strain structure (4x11 m Poles) (Str_4pole_in-line_11m.poll)                                   |                   | Each | 1   |                        |                       |       |
| 15.14  | 4 Pole Strain structure (3x10 m & 1x11 m Poles) (Str_4pole_in-line_10m_11m.pol)                       |                   | Each | 1   |                        |                       |       |
| 15.15  | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_in-line_10m_12m.pol)                       |                   | Each | 1   |                        |                       |       |
| 15.16  | 4 Pole Strain structure (3x10 m & 1x12 m Poles) (Str_4pole_90deg_10m_12m.pol)                         |                   | Each | 2   |                        |                       |       |
| 15.17  | 4 Pole Strain structure (3x15 m & 1x16 m Poles) (Str_4pole_in-line_15m_16m.pol)                       |                   | Each | 1   |                        |                       |       |
| 15.18  | 4 Pole Strain structure (3x15 m & 1x17 m Poles) (Str_4pole_in-line_15m_17m.pol)                       |                   | Each | 1   |                        |                       |       |
| 15.19  | <u>Extra-over items for 7: (Rates are only for dressing)</u>  |                   |      |     |                        |                       |       |
| 15.19.1                                      | In close proximity to a Livened Line  |                   | Sum  | 1   |                        |                       |       |
| <b>16.1</b>                                  | <b>TRANSPORTATION</b>   |                   |      |     |                        |                       |       |
|  | Transporting all material and equipment to pole/tower position not covered elsewhere                  |                   |      |     |                        |                       |       |
| 16.1   | Limited haul (The first 5km beyond the end of the free haul distance by the shortest practical route) |                   | Sum  | 1   |                        |                       |       |
| 16.2   | Long haul (Remainder of distance beyond the limited haul by the shortest practical route)             |                   | Sum  | 1   |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
|  |   |                   |      |     |                        |                       |       |
| <b>SUBTOTAL CARRIED TO ITEM 3 OF SUMMARY</b> |   |                   |      |     |                        |                       |       |

**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))****LIST D: STRINGING AND REGULATION**

| ITEM      | DESCRIPTION   | DRG<br>NO<br>D-DT | UNIT | QTY       | TENDER PRICE           |                       | TOTAL |
|-----------|---|-------------------|------|-----------|------------------------|-----------------------|-------|
|           |   |                   |      |           | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE |       |
|           | <b>STRINGING AND REGULATION</b>   |                   |      |           |                        |                       |       |
| <b>1.</b> | <b>STRINGING</b>  |                   |      |           |                        |                       |       |
|           | Supply, transport to site and string the following (Length is for all three phases):  |                   |      |           |                        |                       |       |
| 1.1       | Phase conductor - Single Chickadee  | 3136s3            | m    | 37000     |                        |                       |       |
| 1.2       | Earth wire (Single 7/3.35)  | 3124              | m    | Rate Only |                        |                       |       |
| <b>2.</b> | <b>JOINTS AND TERMINATIONS</b>  |                   |      |           |                        |                       |       |
|           | Supply and install the following compression joints:  |                   |      |           |                        |                       |       |
| 2.1       | Midspan joint - Kingbird  | 7001s3            | Each | 24        |                        |                       |       |
| 2.2       | Dead end termination - Chickadee  | 7000s3            | Each | 126       |                        |                       |       |
| 2.3       | Dead end termination - Earth wire (Single 7/3.35)   | 7035s1            | Each | Rate Only |                        |                       |       |
| <b>3.</b> | <b>DAMAGE REPAIR</b>  |                   |      |           |                        |                       |       |
|           | Supply and install repair sleeves for damaged conductors:   |                   |      |           |                        |                       |       |
| 3.1       | Midspan repair sleeve (Kingbird)  | 7020s3            | Each | 1         |                        |                       |       |
| <b>4.</b> | <b>MAKING OFF AND REGULATION</b>  |                   |      |           |                        |                       |       |
|           | (Strain to Strain Section)  |                   |      |           |                        |                       |       |
| 4.1       | Phase conductor - Single Chickadee  |                   | Each | 66        |                        |                       |       |
| 4.2       | Earth wire (Single 7/3.35)  |                   | Each | Rate Only |                        |                       |       |
| <b>5.</b> | <b>CLAMPING-IN</b>  |                   |      |           |                        |                       |       |
| 5.1       | Clamping-in phase conductor (Chickadee)   |                   | Each | 189       |                        |                       |       |
| <b>6.</b> | <b>VIBRATION DAMPERS</b>  |                   |      |           |                        |                       |       |
|           | Supply and install the following vibration dampers:   |                   |      |           |                        |                       |       |
| 6.1       | Install Multi-frequency dampers for Chickadee conductor   | 7005s3            | Each | 390       |                        |                       |       |
| 6.2       | Install Spiral dampers for Earth wire (Single 7/3.35)   | 3176              | Each | Rate Only |                        |                       |       |
| <b>7.</b> | <b>PERCHING BRACKET</b>   |                   |      |           |                        |                       |       |
|           | Supply and install a perching bracket   | 7447              | Each | 55        |                        |                       |       |
| <b>8.</b> | <b>AIRCRAFT WARNING SPHERES</b>   |                   |      |           |                        |                       |       |
|           | Supply, transport to specific spans and install complete hardware on specified spans  | 7028              | Each | 50        |                        |                       |       |
| <b>9.</b> | <b>NATIONAL AND PROVINCIAL ROAD CROSSING</b>  |                   |      |           |                        |                       |       |
|           | Prepare structures, erecting of temporary structures for road crossing, provision of all required road signs at point of crossing. Notify Route Manager, Regional Manager and provincial Traffic Officials at least 30 days prior |                   |      |           |                        |                       |       |

**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))****LIST D: STRINGING AND REGULATION****TENDER PRICE**

| ITEM       | DESCRIPTION  | DRG<br>NO<br>D-DT | UNIT | QTY       | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE | TOTAL |
|------------|--|-------------------|------|-----------|------------------------|-----------------------|-------|
|            | to commencement of stringing. Arrange notification of road closure by means of news media and radio stations.          |                   |      |           |                        |                       |       |
| 9.1        | National Road crossing including all signage and traffic control.  |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 9.2        | Cost to advertise road closure and arrange closure with Provincial Traffic Department.                                 |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| <b>10.</b> | <b>MUNICIPAL MAIN ROAD CROSSING</b>  |                   |      |           |                        |                       |       |
|            | Prepare structures, erecting of temporary obstructions and barricades, provision of road signs. Notify manager Roads   |                   |      |           |                        |                       |       |
|            | Department and municipal traffic officials at least 30 days prior commencement of stringing.                           |                   |      |           |                        |                       |       |
| 10.1       | Municipal Main Road crossing including all signage and traffic control.  |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 10.2       | Cost to advertise road closure and arrange closure with Municipal Traffic Department.                                  |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| <b>11.</b> | <b>RAILWAY CROSSINGS.</b>  |                   |      |           |                        |                       |       |
|            | Prepare structures, erecting of temporary structures for railway crossing. Notify Transnet Manager 30 days prior to    |                   |      |           |                        |                       |       |
|            | commencement of stringing across railway.  |                   |      |           |                        |                       |       |
| 11.1       | Railway crossing.  |                   | Sum  | Rate Only |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 11.2       | Transnet Supervision Cost  |                   | Sum  | Rate Only |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 11.3       | Railway live line crossing   |                   | Sum  | Rate Only |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| <b>12.</b> | <b>PIPELINE CROSSINGS</b>  |                   |      |           |                        |                       |       |
|            | Prepare structures, erecting of temporary structures for waterboard crossing. Notify District Superintendent 30 days   |                   |      |           |                        |                       |       |
|            | prior to commencement of stringing across waterpipe line.  |                   |      |           |                        |                       |       |
| 12.1       | Gaspipe Line crossing.   |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| <b>13.</b> | <b>Miscellaneous overhead crossings</b>  |                   |      |           |                        |                       |       |
|            | Prepare structures, erecting of temporary obstructions and barricades, provision of relevant signs. Notify relevant    |                   |      |           |                        |                       |       |
|            | stakeholders at least 30 days prior commencement of stringing and obtain permits for the following crossing:           |                   |      |           |                        |                       |       |
| 13.1       | Gravel Roads   |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 13.2       | River and/or stream crossing   |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 13.3       | Telephone Line   |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 13.4       | Houses and/or structures   |                   | Sum  | Rate Only |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| <b>14.</b> | <b>Miscellaneous Electrical Lines overhead crossings</b>   |                   |      |           |                        |                       |       |
|            | Prepare structures, erecting of temporary obstructions and barricades, provision of relevant signs. Notify relevant    |                   |      |           |                        |                       |       |
|            | stakeholders at least 30 days prior commencement of stringing and obtain permits for the following overhead crossings: |                   |      |           |                        |                       |       |
| 14.1       | LV Power Line  |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |
| 14.2       | 11 & 22 kV Power Line  |                   | Sum  | 1         |                        |                       |       |
|            |  |                   |      |           |                        |                       |       |

**VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))**

## LIST D: STRINGING AND REGULATION

[illegible]



**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))****LIST E: FIBRE OPTIC WORK**

| ITEM      | DESCRIPTION  | DRG<br>NO<br>D-DT | UNIT | QTY   | TENDER PRICE           |                       | TOTAL |
|-----------|--|-------------------|------|-------|------------------------|-----------------------|-------|
|           |  |                   |      |       | UNIT<br>LABOUR<br>RATE | UNIT MATERIAL<br>RATE |       |
|           | <b>FIBRE OPTIC</b>   |                   |      |       |                        |                       |       |
| <b>1.</b> | <b>STRINGING</b>   |                   |      |       |                        |                       |       |
|           | Supply and string the following:   |                   |      |       |                        |                       |       |
| 1.1       | 48 Fibre 10/125 single mode OPGW cable   |                   | m    | 12100 |                        |                       |       |
| 1.2       | 48 Fibre 10/125 single mode non-metallic duct fibre cable (ADSS)   |                   | m    | 200   |                        |                       |       |
| 1.3       | 6 Fibre 10/125 single mode underground cable (armoured)  |                   | m    | 50    |                        |                       |       |
| <b>2.</b> | <b>FIBRE OPTIC CONTROL CABLES</b>  |                   |      |       |                        |                       |       |
|           | Supply and install the following:  |                   |      |       |                        |                       |       |
| 2.1       | Patch leads Duplex ST to ST 3m   |                   | Each | 2     |                        |                       |       |
| <b>3.</b> | <b>FIBRE OPTIC CONTROL PANELS</b>  |                   |      |       |                        |                       |       |
|           | Supply and install the following:  |                   |      |       |                        |                       |       |
| 3.1       | 19" Patch panel, 48 way (Complete with ST ceramic mid couplers, ST pigtails unruggedised)  |                   | Each | 1     |                        |                       |       |
| 3.2       | 19" Patch panel, 6 way (Complete with ST ceramic mid couplers, ST pigtails unruggedised)   |                   | Each | 2     |                        |                       |       |
| 3.3       | 19" Swing-frame BME cabinet  |                   | Each | 1     |                        |                       |       |
| <b>4.</b> | <b>JOINTS AND TERMINATIONS</b>   |                   |      |       |                        |                       |       |
|           | Supply and install the following :   |                   |      |       |                        |                       |       |
| 4.1       | Outdoor Splice enclosure (2 way)   |                   | Each | 8     |                        |                       |       |
| 4.2       | Dead end termination - OPGW  |                   | Each | 44    |                        |                       |       |
| <b>5.</b> | <b>OPTIC FIBRE HARDWARE</b>  |                   |      |       |                        |                       |       |
|           | Supply and install the following:  |                   |      |       |                        |                       |       |
| 5.1       | HDPE Tubing (grade 6 or better) or Optex   |                   | m    | 200   |                        |                       |       |
| 5.2       | Galvanised pipe (25mm) / Channeling  |                   | m    | 50    |                        |                       |       |
| <b>6.</b> | <b>MAKING OFF AND REGULATION</b>   |                   |      |       |                        |                       |       |
|           | (Strain to Strain Section)   |                   |      |       |                        |                       |       |
| 6.1       | OPGW   |                   | Each | 22    |                        |                       |       |
| <b>7.</b> | <b>CLAMPING-IN</b>   |                   |      |       |                        |                       |       |
| 7.1       | Clamping-in OPGW   |                   | Each | 34    |                        |                       |       |
| <b>8.</b> | <b>DRESSING</b>  |                   |      |       |                        |                       |       |
|           | Supply, transport to specific pole position and install complete OPGW hardware for the following structures according to Eskom standard TRMASACB2: |                   |      |       |                        |                       |       |

[illegible]

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST F: SUBSTATION

| ITEM | DESCRIPTION   | DRG NO | UNIT | QTY | TENDER PRICE     |                    | TOTAL |
|------|---|--------|------|-----|------------------|--------------------|-------|
|      |   |        |      |     | UNIT LABOUR RATE | UNIT MATERIAL RATE |       |
| 1.   | <b>EARTHING</b>   |        |      |     |                  |                    |       |
| 1.1  | Transformer earthing, 80 mm x 6 mm galvanised steel earth strap (to be measured and bent on site) | 5232   | m    | 50  |                  |                    |       |
| 2.   | <b>INSTALLATION OF EQUIPMENT</b>  |        |      |     |                  |                    |       |
|      | Supply, Installation and Commissioning of the following equipment:                                |        |      |     |                  |                    |       |
| 2.1  | 20 MVA 132 / 11 kV YNd1 OLTC transformer to be installed and commissioned by OEM                  | 6126s1 | Each | 1   |                  |                    |       |
| 2.2  | 132 kV Surge Arrestor S/CL MCOV 56kV 31mm/kV (Trfr mounted).                                      | 6211   | Each | 3   |                  |                    |       |
| 2.3  | 66 kV Surge Arrestor S/CL MCOV 48kV 31mm/kV (Trfr mounted) Neutral Bushing.                       | 6212   | Each | 1   |                  |                    |       |
| 2.4  | 11 kV Surge Arrestor S/CL MCOV 12kV 31mm/kV (Trfr mounted).                                       | 6216   | Each | 3   |                  |                    |       |
| 2.5  | 11 kV NEC / NER / AUX Transformer 360A-10sec 31mm/kV.   | 6140s1 | Each | 1   |                  |                    |       |
| 2.6  | 66 kV Post Insulators.  | 6232s1 | Each | 6   |                  |                    |       |
| 2.7  | Insulated Long Rod 132 kV 120kN B/S 31C   | 7014s2 | Each | 18  |                  |                    |       |
| 3.   | <b>CLAMP ASSEMBLIES, STRINGING, STRANDED CONDUCTOR &amp; TUBULAR CONDUCTOR</b>                    |        |      |     |                  |                    |       |
|      | Supply and install the following which must be capable of carrying 2 300 A.                       |        |      |     |                  |                    |       |
| 3.1  | CLAMP B/COMP 26.5mm - 26mm EXC-A 0 DEG (McWade : KC-1)  | 6006s2 | Each | 3   |                  |                    |       |
| 3.2  | CLAMP B/COMP 38.3mm - 38mm EXC-C 0DEG (Mcwade : KC-3)   | 6006s2 | Each | 3   |                  |                    |       |
| 3.3  | CLAMP T/COMP RUN-23.5mm TAP-26.5mm ETC-A (McWade : TC-1)  | 6010s2 | Each | 6   |                  |                    |       |
| 3.4  | CLAMP PISTOL 4B 20mm-30mm   | 6042s1 | Each | 6   |                  |                    |       |
| 3.5  | CLAMP TUBE TAP-OFF ETP-TE-IL1-F0 (McWade : TBCT120/C1-38 0 DEG)                                   | 6090s3 | Each | 3   |                  |                    |       |
| 3.6  | CLAMP, SLIDE TUBE ECC-PI-S-F (McWade : TBSC120-127)   | 6086s4 | Each | 3   |                  |                    |       |
| 3.7  | CLAMP, FIXED TUBE ECC-PI-F-F (McWade : TBFC120-127)   | 6086s1 | Each | 3   |                  |                    |       |
| 3.8  | CLAMP TUB BUS/PALM T/OFF TBPT120  | 6117s1 | Each | 6   |                  |                    |       |
| 3.9  | BOLT U GALV M16 x 89 x 102mm  | 6098s1 | Each | 18  |                  |                    |       |
| 3.10 | CLEVIS BALL 16mm IEC 120kN  | 6059s1 | Each | 18  |                  |                    |       |
| 3.11 | SOCK TONGUE 16mm IEC 120kN  | 6061s1 | Each | 18  |                  |                    |       |

**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))****LIST F: SUBSTATION**

| ITEM       | DESCRIPTION  | DRG NO | UNIT | QTY  | TENDER PRICE     |                    | TOTAL |
|------------|--|--------|------|------|------------------|--------------------|-------|
|            |  |        |      |      | UNIT LABOUR RATE | UNIT MATERIAL RATE |       |
| 3.12       | 11 kV Busbar - Aluminium Tubes, 120 x 4 mm thick x 12 m lengths inclusive of vibration damping   | 6000s1 | Each | 1    |                  |                    |       |
| 3.13       | Stringers and droppers - Centipede   | 3136s7 | m    | 200  |                  |                    |       |
| 3.14       | Stringers and droppers - Bull insulated  | 3136s8 | m    | 50   |                  |                    |       |
| <b>4.</b>  | <b>EQUIPMENT LABELLING</b>   |        |      |      |                  |                    |       |
| 4.1        | Supply and install outdoor equipment labels (chromadek c/w bolts, brackets etc).   | 5047   | Each | 3    |                  |                    |       |
| 4.2        | Supply and install phase identification disks (Blue/Red/White).  | 6114   | Each | 9    |                  |                    |       |
| <b>5.</b>  | <b>FACTORY ACCEPTANCE TEST (FAT)</b>   |        |      |      |                  |                    |       |
|            | Provision for three (3) Engineers and three (3) Employer Representatives and one (1) contractor representative to witness FAT at manufacturer as specified in Clause C3.1.19.10 for the following equipment: |        |      |      |                  |                    |       |
| 5.1        | 20 MVA 132/11 kV Transformer   |        | Sum  | 1    |                  |                    |       |
| 5.2        | 11kV NEC / NER / AUX Transformer   |        | Sum  | 1    |                  |                    |       |
| <b>6.</b>  | <b>SITE ACCEPTANCE TEST (FAT)</b>  |        |      |      |                  |                    |       |
| 6.1        | 20 MVA 132/11 kV Transformer   |        | Sum  | 1    |                  |                    |       |
| 6.2        | 11kV NEC / NER / AUX Transformer   |        | Sum  | 1    |                  |                    |       |
| <b>7.</b>  | <b>CONTROL CABLE WORK</b>  |        |      |      |                  |                    |       |
|            | Supply, installation and commissioning of the following control cables:  |        |      |      |                  |                    |       |
| <b>7.1</b> | <b>CABLE LAYING</b>  |        |      |      |                  |                    |       |
| 7.1.1      | Cable 1 kV 19c 2,5 mm <sup>2</sup> Armoured (No 3)   |        | m    | 950  |                  |                    |       |
| 7.1.2      | Cable 1 kV 12c 2,5 mm <sup>2</sup> Armoured (No 3)   |        | m    | 2460 |                  |                    |       |
| 7.1.3      | Cable 1 kV 7c 2,5 mm <sup>2</sup> Armoured (No 3)  |        | m    | 500  |                  |                    |       |
| 7.1.4      | Cable 1 kV 4c 2.5 mm <sup>2</sup> Armoured (No 1)  |        | m    | 500  |                  |                    |       |
| 7.1.5      | Cable 1 kV 4c 4 mm <sup>2</sup> Armoured (No 1)  |        | m    | 2150 |                  |                    |       |
| 7.1.6      | Cable 1 kV 4c 16 mm <sup>2</sup> Armoured (No 2)   |        | m    | 100  |                  |                    |       |
| 7.1.7      | Cable 1 kV 4c 25 mm <sup>2</sup> Armoured (No 3)   |        | m    | 100  |                  |                    |       |
| 7.1.8      | Cable 10 Pair 0,6 mm <sup>2</sup> Armoured (No 1)  |        | m    | 30   |                  |                    |       |
| 7.1.9      | Cable 25 Pair 0,6 mm <sup>2</sup> Armoured (No 3)  |        | m    | 30   |                  |                    |       |

## BILL OF QUANTITIES

VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))

## LIST F: SUBSTATION

|            |   |        |      |     | TENDER PRICE     |                    |       |
|------------|---|--------|------|-----|------------------|--------------------|-------|
| ITEM       | DESCRIPTION   | DRG NO | UNIT | QTY | UNIT LABOUR RATE | UNIT MATERIAL RATE | TOTAL |
| 7.1.10     | Cable 50 Pair 0,6 mm <sup>2</sup> Armoured (No 2)   |        | m    | 30  |                  |                    |       |
| 7.1.11     | All HV external and internal SCADA cabling, wiring, termination, glanding etc. requirements (MV SCADA cabling and wiring measured with MV switchgear)   |        | Sum  | 1   |                  |                    |       |
| <b>7.2</b> | <b>CABLE MAKE OFF</b>   |        |      |     |                  |                    |       |
|            | <b>Supply, making off and commissioning of cable ends.</b>  |        |      |     |                  |                    |       |
| 7.2.1      | Cable 1 kV 19c 2,5 mm <sup>2</sup> Armoured (No 3)  |        | Each | 36  |                  |                    |       |
| 7.2.2      | Cable 1 kV 12c 2,5 mm <sup>2</sup> Armoured (No 3)  |        | Each | 114 |                  |                    |       |
| 7.2.3      | Cable 1 kV 7c 2,5 mm <sup>2</sup> Armoured (No 3)   |        | Each | 9   |                  |                    |       |
| 7.2.4      | Cable 1 kV 4c 2,5 mm <sup>2</sup> Armoured (No 1)   |        | Each | 9   |                  |                    |       |
| 7.2.5      | Cable 1 kV 4c 4 mm <sup>2</sup> Armoured (No 1)   |        | Each | 197 |                  |                    |       |
| 7.2.6      | Cable 1 kV 4c 16 mm <sup>2</sup> Armoured (No 2)  |        | Each | 6   |                  |                    |       |
| 7.2.7      | Cable 1 kV 4c 25 mm <sup>2</sup> Armoured (No 3)  |        | Each | 6   |                  |                    |       |
| 7.2.8      | Cable 10 Pair 0,6 mm <sup>2</sup> Armoured (No 1)   |        | Each | 24  |                  |                    |       |
| 7.2.9      | Cable 25 Pair 0,6 mm <sup>2</sup> Armoured (No 3)   |        | Each | 6   |                  |                    |       |
| 7.2.10     | Cable 50 Pair 0,6 mm <sup>2</sup> Armoured (No 2)   |        | Each | 6   |                  |                    |       |
| <b>8.</b>  | <b>TESTING AND COMMISSIONING</b>  |        |      |     |                  |                    |       |
|            | Megger testing of all LV cables before energising and confirming their destination  |        | Sum  | 1   |                  |                    |       |
| <b>9.</b>  | <b>CONTROL PANELS (INDOOR SWING FRAME)</b>  |        |      |     |                  |                    |       |
|            | <b>Design, supply, install and commission panels as follows. (Protection panels to include 1 x painted mimic c/w 19" rack-mounted frame, semaphores for all equipment and lamp test)</b>                                |        |      |     |                  |                    |       |
| 9.1        | Transformer Protection Panel and Tap Change Panel   |        | Each | 1   |                  |                    |       |
| 9.2        | 132 kV Feeder Protection Panel  |        | Each | 1   |                  |                    |       |
| <b>10.</b> | <b>FACTORY ACCEPTANCE TEST (FAT)</b>  |        |      |     |                  |                    |       |
|            | <b>Provision for three (3) Engineers and three (3) Employer Representatives and one (1) contractor representative to witness FAT at the manufacturer as specified in Clause C3.1.19.10 for the following equipment:</b> |        |      |     |                  |                    |       |
| 10.1       | Transformer Protection and Tap Change Panel & Feeder Protection Panel   |        | Sum  | 1   |                  |                    |       |

|      |   |         |      |     | TENDER PRICE     |                    |       |
|------|---|---------|------|-----|------------------|--------------------|-------|
| ITEM | DESCRIPTION   | DRG NO  | UNIT | QTY | UNIT LABOUR RATE | UNIT MATERIAL RATE | TOTAL |
| 11.  | <b>TESTING AND COMMISSIONING BY OEM ON SITE</b>   |         |      |     |                  |                    |       |
|      | Test of protection panels to be done with Omicron Testing Equipment.  |         | Sum  | 1   |                  |                    |       |
| 12.  | <b>FOUNDATIONS / PLINTHS</b>  | 1200LC  |      |     |                  |                    |       |
|      | Excavate, dispose of burden within free haul distance of 5km, backfill, compaction, supply and cast complete concrete foundations with holding down bolts, fdn, with holding down bolts, fdn, internal earthing and earth connections detailed in the drawings, rates for concrete to include taking concrete samples and obtaining test certificates for 9,14 & 28 days. General rules applicable to casting of concrete: cast below 35°C; use steel shuttering as far as possible, use slow curing concrete; use low shrinkage concrete. Concrete maximum shrinkage, stress and modules of elasticity obtainable from the specification. Only steel shuttering may be used and steel templates for the holding down bolts - to be approved prior to foundation construction |         |      |     |                  |                    |       |
| 12.1 | 132kV Column Lattice Steel Foundation   | 5252s1A | Each | 6   |                  |                    |       |
| 12.2 | MV cable end support foundation   | 5213s1A | Each | 1   |                  |                    |       |
| 13.  | <b>ERECTION OF STEELWORK</b>  |         |      |     |                  |                    |       |
|      | Equipment Support - Manufacture, supply and install equipment support for the following:  |         |      |     |                  |                    |       |
| 13.1 | 132kV Column Lattice Steel  | 5252s2A | Each | 8   |                  |                    |       |
| 13.2 | 132/50/1 Beam Lattice Steel   | 5252s2B | Each | 6   |                  |                    |       |
| 13.3 | 132/40/1 Beam Lattice Steel   | 5252s2D | Each | 4   |                  |                    |       |
| 13.4 | 132/EW Earthwire Support Lattice Steel  | 5252s2E | Each | 8   |                  |                    |       |
| 13.5 | 132kV Column Anti-Climbing Device   | 5252s2F | Each | 8   |                  |                    |       |
| 13.6 | MV Cable Sealing End support  | 5213s3  | Each | 1   |                  |                    |       |
| 14   | <b>MISCELLANEOUS</b>  |         |      |     |                  |                    |       |
|      | The tenderer to provide the following as par to fo the contract.  |         |      |     |                  |                    |       |
| 14.1 | 12 Month maintenance support  |         | Sum  | 1   |                  |                    |       |
| 14.2 | As-built manuals and drawings, hard and software copy.  |         | Each | 5   |                  |                    |       |
| 15   | <b>CABLE TRENCH</b>   | PSE 07  |      |     |                  |                    |       |
|      | Excavation, bedding, danger tape, backfilling and consolidation of cable trenches.  |         | m    | 200 |                  |                    |       |
|      |   |         |      |     |                  |                    |       |
|      |   |         |      |     |                  |                    |       |
|      |   |         |      |     |                  |                    |       |
|      | <b>SUBTOTAL CARRIED TO ITEM 7 OF SUMMARY</b>  |         |      |     |                  |                    |       |

**BILL OF QUANTITIES****VULCAN MTS TO SIYANQOBA SUBSTATION 132 kV CIRCUIT OVERHEAD LINE (CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT))  
SUMMARY**

| ITEM NO | DESCRIPTION OF THE ITEM                                    | LIST   | PAGE | PRICE |
|---------|--|--------|------|-------|
|         | <b>Overhead Line</b>                                       |        |      |       |
| 1       | A - Preliminaries and General                              | List A |      |       |
| 2       | B - Quality Control Program and Bush Clearing              | List B |      |       |
| 3       | C - Line Construction                                      | List C |      |       |
| 4       | D - Stringing and Regulation                               | List D |      |       |
| 5       | E - Fibre Optic Work                                       | List E |      |       |
| 6       | F - Substation   | List F |      |       |
|         | <b>SUBTOTAL A</b>  |        |      |       |
|         | Plus: Amount allowed for contingencies (10 % x Subtotal A) |        |      |       |
|         | Plus: Amount allowed for escalation (5 % x Subtotal A)     |        |      |       |
|         | <b>SUBTOTAL B</b>  |        |      |       |
|         | Plus: 15 % VAT   |        |      |       |
|         | <b>TOTAL TENDER PRICES (Incl VAT)</b>                      |        |      |       |

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF  
A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**



## **THE CONTRACT**

### **PART C3. SCOPE OF THE WORKS**



**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF  
A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**THE CONTRACT PART 3: SCOPE OF THE WORKS**

**TABLE OF CONTENTS**

|  |  |            |
|--|--|------------|
| <b>C3</b>                                      | <b>SCOPE OF WORKS</b>                              | <b>142</b> |
| <b>GENERAL</b>                                 |  | <b>142</b> |
| <b>DESCRIPTION OF THE WORKS</b>                |  | <b>142</b> |
| <b>HIGH LEVEL SCOPE OF WORKS</b>               |  | <b>143</b> |
| <b>CONSTRAINTS WITH EXECUTION OF THE WORKS</b> |  | <b>144</b> |
| <b>C3.1. PROJECT SPECIFICATIONS</b>            |  | <b>147</b> |
| C3.1.1.  | DEFINITIONS  | 147        |
| C3.1.2.  | SITE ESTABLISHMENT                                 | 149        |
| C3.1.3.  | SITE INSTRUCTION BOOK                              | 150        |
| C3.1.4.  | SECURITY   | 150        |
| C3.1.5.  | DRAWINGS   | 150        |
| C3.1.6.  | REQUIREMENTS FOR THE PROGRAMME                     | 150        |
| C3.1.7.  | TIME FOR COMPLETION                                | 152        |
| C3.1.8.  | SURVEY   | 152        |
| C3.1.9.  | MEASUREMENTS                                       | 153        |
| C3.1.10.                                       | FINAL INSPECTION                                   | 153        |
| C3.1.11.                                       | QUALIFIED PERSONNEL                                | 153        |
| C3.1.12.                                       | CONTRACTOR'S RESPONSIBILITY                        | 153        |
| C3.1.13.                                       | PAYMENTS   | 163        |
| C3.1.14.                                       | PROJECT SPECIFICATION                              | 164        |
| C3.1.15.                                       | EQUIPMENT SPECIFICATION                            | 166        |
| C3.1.16.                                       | SUBTRANSMISSION OVERHEAD LINE (PSE 11)             | 167        |
| C3.1.17.                                       | POWER TRANSFORMERS (PSE 18)                        | 200        |
| C3.1.18.                                       | NECRT (PSE 20)                                     | 201        |
| C3.1.19.                                       | SURGE ARRESTORS (PSE 56)                           | 203        |
| C3.1.20.                                       | SUBSTATION TECHNICAL SPECIFICATION – CONTROL PLANT | 203        |
| C3.1.21.                                       | USING OF OWN MANPOWER (PSE 100)                    | 211        |

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|  |            |
|--|------------|
| <b>C3.2. TECHNICAL SCHEDULES .....</b>                   | <b>216</b> |
| C3.2.1. TSE11 – SUBTRANSMISSION OVERHEAD LINE .....      | 216        |
| C3.2.2. TSE18 - POWER TRANSFORMERS .....                 | 216        |
| C3.2.3. TSE20 – NECRT’s .....                            | 216        |
| C3.2.4. TSE48 - OPGW .....                               | 216        |
| C3.2.5. TSE56 - SURGE ARRESTORS .....                    | 216        |
| <b>C3.3. GENERAL SPECIFICATIONS .....</b>                | <b>219</b> |
| C3.3.1. PREAMBLE .....                                   | 219        |
| C3.3.2. LAW - NATIONAL AND INTERNATIONAL STANDARDS ..... | 220        |
| C3.3.3. ESKOM SPECIFICATIONS / STANDARDS .....           | 220        |
| C3.3.4. SANS/IECSPECIFICATIONS .....                     | 222        |
| <b>C4. SITE INFORMATION .....</b>                        | <b>225</b> |

#### LIST OF TABLES

|  |     |
|--|-----|
| Table 1: High level primary plant scope of work .....  | 143 |
| Table 2: High level control plant scope of work .....  | 143 |
| Table 3: Standard Equipment Schedule .....             | 166 |
| Table 4: Structure Coordinates .....                   | 175 |
| Table 5: Tube Details .....                            | 177 |
| Table 6: Tube Details .....                            | 179 |
| Table 7: Method Statement .....                        | 182 |
| Table 8: SEL487 Transformer Protection Functions ..... | 208 |
| Table 9: CT Ratio's .....                              | 210 |
| Table 10: Tap Change Current Input .....               | 211 |
| Table 11: Eskom Specifications/Standards .....         | 220 |
| Table 12: Site information .....                       | 226 |

#### LIST OF FIGURES

|  |     |
|--|-----|
| Figure 1: Optical Fibre Cable Routing in 19" Fixed frame Cabinet .....     | 173 |
| Figure 2: Faceplate labelling .....  | 174 |
| Figure 3: Rx vs Tx port labelling .....                                    | 174 |
| Figure 4: Typical Tiled Mimic Layout .....                                 | 207 |
| Figure 5: 20MVA 132/11kV Transformer Single Line Diagram .....             | 209 |
| Figure 6: 20MVA 132/11KV Transformer and Tap Changer Cabling Diagram ..... | 210 |
| Figure 7: Locality .....   | 225 |

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3 SCOPE OF WORKS**

This scope of work institutes information that specifies and describes the goods, services, or engineering and construction works which are to be provided and any other requirements and constraints relating to the manner in which the contract work is to be performed;

The Scope of Works includes three distinct sub-sections namely:

- C3.1 – Project Specifications
- C3.2 – Technical Schedules
- C3.3 – General Specifications

The Contractor must allow in his tender price, for the supply, delivery of material on site, installation and commissioning of the works as specified in this document. The onus is on the Contractor to ensure that he received a complete document as indicated in the Index.

#### **GENERAL**

This specification deals with the technical installation aspects relating to this project. Any discrepancy between the Particular Specification, Bill of Quantities and Drawings must be reported to the Engineer who will clarify such contradiction before closing of tender.

If any discrepancies exist between parts of this document, the following order of preference will take place:

- Drawings
- Bill of Quantities
- Project Specifications
- General specifications

Regarding the conditions of the contract, the order of priority is as follows:

- Special Conditions of Contract and Appendix to Tender
- General Conditions of Contract
- Tender requirements
- Common Law

#### **DESCRIPTION OF THE WORKS**

The scope of the contract is for the fabrication, erection and commissioning of a 11,5 km, 132 kV Chickadee overhead line from Eskom's Vulcan Main Transmission Substation (MTS) to the Siyanqoba Substation in order to provide a bulk electrical supply to the Siyanqoba Township. The Chickadee conductor will be strung on 20 to 24 m, steel monopoles in a single circuit configuration and will after completion be handed over to Emalahleni Local Municipality to commercially operate and maintain. A portion of this project will entail the installation of a new 20 MVA, 132/11 kV power transformer in the existing Siyanqoba Substation.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

The project will be funded by the Department of Mineral Resources and Energy (DoE) and it is envisaged that the project will be completed over a period of two (2) municipal financial years as funds become available. The tenderer must therefore allow to construct the HV overhead line over a two (2) year period as funds become available.

The tenderer must take note that the funds from DMRE is not guaranteed and the construction of the overhead line will be subject to availability of funds.

All the material shall be supplied by the tenderer which includes the manufacturing, according to Eskom Specification, transporting to site, offload, installation and commissioning will all be undertaken by the successful tenderer.

Prior to energizing, commissioning certificates must be submitted by the OEM for the power transformer. Prior to the energising of the 20 MVA transformers an oil sample must be taken and the oil sample shall not be older than 30 days at the time of energising.

#### HIGH LEVEL SCOPE OF WORKS

The scope of works is outlined below.

**Table 1: High level primary plant scope of work**

|     |   |
|-----|---|
| 1.  | Pegging and setting out of the line route, pole and stay positions.   |
| 2.  | Excavation of pole and stay holes as well as soil nominations.        |
| 3.  | Dressing of poles.  |
| 4.  | Planting of poles.  |
| 5.  | Planting of stays and temporary construction stays.                   |
| 6.  | Stringing and Regulation of CHICKADEE.                                |
| 7.  | Stringing and Regulation of OPGW.                                     |
| 8.  | Installation of 20 MVA, 132/11 kV Power Transformer.                  |
| 9.  | Commission and energise the overhead line                             |
| 10. | Submit 5 sets of as-built drawings and manuals of the new substation. |

**Table 2: High level control plant scope of work**

|    |   |
|----|---|
| 1. | Install all fibre optic cable work.                 |
| 2. | Commissioning of 1 x Transformer Protection Schemes |
| 3. | Commissioning of 1 x Feeder Protection Schemes      |
| 4. | Testing, commissioning and handing over             |

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **CONSTRAINTS WITH EXECUTION OF THE WORKS**

- a) Any variation or modification with a cost implication must be approved by the Project Manager before work can commence. No late claim will be entertained.
- b) All relevant procedures pertaining to the project will be detailed on the first site handover meeting. The Contractor should however take note of the standard 42 page Construction Regulations & Checklist document which must be adhered to and signed off pertaining to all tasks successfully completed. The handing over document must be signed and handover must take place 7 days prior to the official energising of the project. The handing over document must be accompanied by commissioning certificates of the OEM as follows (Hard & soft copy):
  - 132/11 kV Transformers
  - Protection Schemes
- c) The Contractor must adhere to Safety Requirements.  
A document must be compiled stating the following:
  - A method statement
  - Safe working procedure
  - Risk analysis

Further safety requirements are as follows:

- Only harnesses and no safety belts must be used in alleviated positions.
  - No labourers will be allowed to stay on site. A night watch shall be appointed to guard the site at night.
  - No short pants will be allowed on site.
  - Safety clothes suitable for the specific task must be worn at all times.
  - Toilet facilities are available on site; no temporary toilets will be allowed.
  - Day visitors will be able to enter with a visitor's card.
  - Hard hats and safety boots are compulsory on the construction site.
  - All operators must be trained and competent.
  - All equipment must be in a good working order.
  - The Contractor must have a first-aid kit on site and all injuries must be reported.
  - The Contractor must keep complete record of all man hours.
- d) The tenderer shall provide three complete sets of all special tools for the equipment supplied. The tenderer shall further provide a list of spare parts which it is recommended and should be kept by the Employer. Spares, which the employer decides to order, shall be delivered simultaneously with the rest of the equipment and shall be separately packed and appropriately marked.

The spares specified herein must be handed over to the Client before the issuing of the Taking Over Certificate and may not be used by the Contractor for maintenance or for

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF  
A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

replacement of components which have to be replaced due to defects during the Defects Liability Period or for the replacement of any item which is still under guarantee.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**



**THE CONTRACT PART 3: SCOPE OF THE WORKS**

**C3.1: PROJECT SPECIFICATIONS**

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C3.1. PROJECT SPECIFICATIONS

This specification deals with the technical installation aspects relating to this project.

Any discrepancy between the Particular Specification, Bill of Quantities and Drawings must be reported to the Engineer who will clarify such contradiction before closing of tender.

If any discrepancies exist between parts of this document, the following order of preference will take place:

- a) The Contract Agreement (if any)
- b) The Letter of Acceptance
- c) The Letter of Tender
- d) The Particular Conditions
- e) These General Conditions
- f) The Specifications
- g) The Drawings, and
- h) The Schedules and any other documents forming part of the Contract

##### C3.1.1. DEFINITIONS

For the purposes of this document, terms used herein or in accompanying documents shall have the following meaning:

**“Agreement”** shall mean the agreement entered into between the Employer and the Contractor for the execution of the accepted Tender Price or accepted quotation. Under this contract this means the FIDIC Condition of Contract and other contract documents;

**“Bills of Quantities”** or **“Schedule of Quantities”** or **“Pricing Schedules”** shall mean the document attached to a Tender Document or Quotation in which the quantities of work, labour, materials and articles required for the execution of the contract will be entered, together with the rates or prices for such items;

**“Calendar Days”** means twenty-four (24) hour days commencing at midnight (00:00) which include working and non-working days.

**“Certificate of Final Completion”** means a certificate issued by the Engineer to the Contractor stating the date on which final completion of the works was achieved.

**“Certificate of Practical Completion”** means a certificate issued by the Engineer to the Contractor stating the date on which practical completion of the works was achieved.

**“Certificate of Works Completion”** means a certificate issued by the Engineer to the Contractor stating the date on which works completion of the works was achieved

**“Contractor”** shall mean the Employer has accepted the person or persons, partnership, firm or company, whose tender for the work referred to in the Contract or who has or have signed the contract and shall include his or their heirs, executors, administrators, judicial managers, trustees, successors in title and duly appointed representatives.



**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**“Contract”** or **“Contract Documents”** shall mean and include the Conditions of Tender, General Conditions of Contract, Special Conditions of Contract, Project Specifications, Schedules of Quantities or Pricing Schedules or Bills of Quantities, Schedule of Prices for Variations, Drawings, Form of Tender, Letter of Acceptance and the Agreement to follow thereon and shall include such printed matter or explanatory memorandum submitted by a Tenderer with his tender as may be acceptable to the Employer;

**“Contract Price”** or **“Contract Sum”** shall mean the amount entered in the Form of Tender for the whole of the Works done or materials supplied for the Works, subject to additions or deductions as may be made in terms of the Contract;

**“Construction Equipment”** shall mean all the materials, machinery, implements, tackle, vehicles, barrows, tools, etc. provided by the Contractor, for the due performance of the Contract, but not essentially forming part of the Contract.

**“Drawings”** shall mean the drawings, sketches, diagrams, maps, plans, sections and other delineations which accompany or are referred to in the Contract Documents, and which have been signed by the Engineer and such further drawings as may be issued or approved by the Engineer relating to the works, whether such further drawings indicate variations of the Works, whether by way of addition, alteration or omission, or merely elaborate the signed Drawings in greater detail.

**“Employer”** or the **“Client”** shall mean the Owner of the completed Works or the official body who acts as the representative of the Owner and shall include their duly appointed representatives.

**“Engineer”** shall mean the Engineer duly appointed by the Employer to act on his behalf for the purpose of a Contract. Under this contract the Engineer might act as the Principle Agent

**“In writing”** shall mean type written script or printed communication matter transmitted via land mail or via e-mail, or delivered by hand, to the Engineer.

**“OEM”** shall mean the Original Equipment Manufacturer for any product or equipment required as part of this project.

**“Order in Writing”** shall mean any printed, typewritten or written document or letter signed by the Engineer and addressed to the Contractor for the purpose of his guidance and directions.

**“Plant”, “Work” or “Works”** shall mean all equipment, plant, materials, articles, matters and items comprised by, described in, or referred to in the Contract Documents and which are to be manufactured and/or delivered, constructed, erected and completed. These shall include all those details which are not particularly mentioned in the aforesaid Documents, nor shown upon the Drawings, but which are requisite for the perfect completion of each and every one of the several parts, and all additional Works that may be ordered to be executed according to the true intent and meaning of the Contract plus the maintenance for the prescribed period;

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

**“Schedule of Prices for Variations”** shall mean the schedules attached to a Contract Document or Quotation in which the amounts to be added to, or deducted from the Contract Amounts are entered according to whether the items mentioned in the said schedule are extra to or omitted from the Contract as may be provided for in the General Conditions of Contract;

**“Site”** shall mean the land and/or place to which Works is to be delivered or where work is to be executed or carried out under a Contract and any other land and/or place acquired or used by the Contractor in connection therewith, and includes any place wherever anything is manufactured, excavated or stored for the purpose of carrying out a Contract, together with so much of the area surroundings the said place or places as the Contractor shall with the consent of the Engineer actually use in connection with the Works otherwise than merely for the purpose of access to the said place or places.

**“Specification”** shall mean the section in the Contract document in which the detail method and standard of executing the Work and the nature of the materials to be used or supplied are described;

**“Standard Practice”** shall mean the methods and means of working normally as employed by the Employer;

**“Sub-Contractor”** shall mean the person or persons, partnership, firm or company named in the Contract for any part of the Work or to whom any part of the Contract has been sublet with the consent in writing of the Engineer and the legal representatives, successors and assigns of such person or persons, partnership, firm or company and all specialists, merchants, tradesmen or others executing any Work or supplying any goods for which prime cost prices or provisional sums are included in the Specification or Bill of Quantities and Prices who may at any time be nominated, selected or approved by the Engineer;

**“Tests on Completion”** shall mean such tests as are prescribed by the Specification to be made by the Contractor before the Works is taken over by the Employer;

Words imparting the singular only shall also include the plural and vice versa where the context so requires. The headings or notes in these General Requirements shall not be deemed to be part thereof, or be taken into consideration in the interpretation or construction thereof or of the Contract.

#### **C3.1.2. SITE ESTABLISHMENT**

The specific Contractor shall supply, transport and off-load his own facilities such as sheds, water, electricity, lighting, etc. on the site. The Contractor shall also be responsible for removing all facilities established on site after his work is completed.

It shall be expected from the Electrical Contractor to erect a site office with surrounding fence. The surrounding fence to be 1,8 m high, with Y shape frame on top and equipped with barbed wired. Lockable gates must form part of the surrounding fence. This site yard must therefore provide adequate security to all material stored, even if it means that the Contractor must provide for a trench alongside the fence. The site office must be equipped with furniture for meeting purposes and the Contractor must make arrangements to have a full time security

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

guard, keeping close watch over all material stored in this yard. Pin boards shall be provided in site facilities to accommodate all project and construction drawings.

The Contractor must also provide for all the necessary sanitary toilets, water, rain gauge etc.

The Contractor shall cater for his own water, electricity and sanitation requirements.

The Contractor must also erect a name board, with a size of 2 800 mm x 3 222 mm, at a suitable place to be pointed out by the Engineer. For further details, refer to the drawing of the name board which forms part of this project specification.

The Engineer will indicate the preferred site; the onus is on the contractor to verify if the proposed site is suitable. The Contractor shall submit a Site Establishment application to the Building and Land Use Department on the prescribed application form of the Municipality which can be obtained from the Building and Land Use Department.

#### **C3.1.3. SITE INSTRUCTION BOOK**

The Contractor shall make provision for a site instruction book (triplicate pages) which shall be kept in the site office at all times. All instructions and variations shall be written in this site instruction book by the Engineer while attending the site. The onus will be on the Contractor to confirm such instructions and variations in writing, if the Engineer neglects to do so within 14 days after the issuing of this instruction, especially if it has a cost implication.

#### **C3.1.4. SECURITY**

The Contractor shall make provision for a site instruction book (triplicate pages) which shall be kept in the site office at all times. All instructions and variations shall be written in this site instruction book by the Engineer while attending the site. The onus will be on the Contractor to confirm such instructions and variations in writing, if the Engineer neglects to do so within 14 days after the issuing of this instruction, especially if it has a cost implication.

#### **C3.1.5. DRAWINGS**

The tenderer shall ensure that accurate as-built records are kept of all infrastructure installed or relocated during the contract. A marked-up set of drawings shall also be kept and updated by the tenderer. This information shall be supplied to the Engineer's Representative on a regular basis. All information in possession of the tenderer required by the Engineer and/or the Engineer's Representative to complete the as-built/record drawings, shall be submitted to the Engineer's Representative before a Certificate of Completion will be issued.

#### **C3.1.6. REQUIREMENTS FOR THE PROGRAMME**

This tender must be accompanied by a detailed programme based on prior experience and accounting for site conditions. The programme must also make provision for delivery dates of material as quoted by their suppliers. The Contractor must take cognisance of the fact that

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

he/she will be responsible for late delivery of material, except if the supplier can prove that late delivery was beyond their control. The Engineer and the Employer reserves the right to alter the programme to meet the priorities of the Client. These amendments will be such, that the Contractor will still be able to complete the works within the tendered construction time.

Based on the above, the tender must be accompanied by a cash flow report. This information is required for adjudication of the tender and to determine the escalation on the project when applicable. This will also assist the Contractor in putting his/her tender together and finalizing his/her tender price.

When compiling the project programme attention shall be given to the Health and Safety file which may require a permit application before the construction can initiate. Adequate allowance for this process shall be included in the programme if needed.

The Engineer, Project Manager and his Clerk of Works (if applicable) will have full access to the site and the Clerk of Works (if applicable) is expected to visit the site once a week. A formal site meeting or site inspection will be conducted every second week on a rotational basis.

**It shall be expected from the Contractor to forward a weekly progress report to the Project Manager which must be emailed to his office every Friday.**

The Contractor must submit a progress report at each monthly, scheduled site meeting based on this original program. The actual and scheduled progress must be clearly indicated in the report. The Contractor must also indicate his/her labour force and equipment on site in this report.

The programme must be, based on the following anticipated dates:

|                                 |  |
|---------------------------------|--|
| <b>Tender award</b>             | - 1 August 2021                              |
| <b>Commencement date</b>        | - 15 August 2022                             |
| <b>Completion date, Phase 1</b> | - 30 June 2023 (132 kV Overhead Line)        |
| <b>Completion date, Phase 2</b> | - 30 June 2024 (132/11 kV Power Transformer) |

The programme must also indicate the following:

- a) Time for site establishment.
- b) Material Procurement.
- c) Manufacture of equipment.
- d) Survey and pegging of line.
- e) Excavation of pole holes and stay holes.
- f) Planting and dressing poles and stays.
- g) Stringing.
- h) Tension and Regulation.
- i) Finishing.
- j) Closing span.
- k) Factory Acceptance Testing of 20 MVA, 132/11 kV Power Transformer.
- l) Delivery to site and Installation of 20 MVA, 132/11 kV Power Transformer.
- m) Site Acceptance Testing of 20 MVA, 132/11 kV Power Transformer.
- n) Testing and Commissioning.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

- o) Handover.
- p) "Float" for unforeseen delays

The Contractor must take cognisance that time is of the essence must also allow for normal rainfall during this period in his programme.

Expected delivery date of long lead material must be recorded in the section of this document containing forms to be completed.

#### **C3.1.7. TIME FOR COMPLETION**

The Contractor must allow sufficient time in his/her contract working period for delays due to climate and weather according to the average rainfall for this area, as indicated in the special conditions of contract.

Extensions of time will only be granted if evidence can be provided that the delays were caused by abnormal weather conditions. Claims for rework will not be considered, and is an issue for insurance. The Contractor shall however allow slack in the construction programme to cater for any unforeseen circumstances.

The penalty for late completion of the works is indicated in the contract conditions and it is emphasized that time is of the essence. Commencement of the contract will be as indicated in the acceptance letter.

**The Taking Over Certificate will not be signed prior to receipt of all as-built information as detailed in this specification. This may result in penalties.**

#### **C3.1.8. SURVEY**

The Contractor will be required to appoint a qualified Land Surveyor to peg the line according to the issued Construction Staking Table. Frans Brugman was responsible for the design survey and can be contacted at cell number 082 852 4309 for pegging of pole and stay positions.

Prior to commencement of any phase of the project as indicated on the drawings, the Contractor must do a thorough survey to ensure that all pegs applicable to this project are installed. Missing pegs must be report in writing to the Engineer. The Contractor will be responsible for re-installing of all missing pegs, not reported, at own expense on the day of handover of a particular phase.

Any stand pegs, where applicable, which are removed accidentally or intentionally by the Contractor in the course of his/her activities, shall immediately be reported to the Engineer. The Employer's land surveyor shall re-install such pegs at the expense of the Contractor. The Contractor must issue a certificate obtained from a professional land surveyor to verify that all pegs are installed along the line route.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

The Contractor shall after completion of the contract employ a land surveyor acceptable to the Engineer and Employer to certify the correctness of the constructed overhead line. This certificate must be submitted to the Engineer.

#### **C3.1.9. MEASUREMENTS**

Before ordering of equipment and conductor, the measurements must be finalised on site and must be confirmed with the Engineer. The accuracy or inaccuracy of the Bill of Quantities will not influence the validity of the tender. The quantities in the Bill are measured from a drawing and serve only as an indication to obtain a unit rate. At the end of the Contract period a final re-measurement, based on actual quantities, will be done.

#### **C3.1.10. FINAL INSPECTION**

After completion of each section of the project, the Tenderer must perform an internal, thorough inspection on all the work done, to satisfy himself that the work complies with the specifications, and then apply in writing to the Engineer for a final inspection. The Tenderer will be liable to pay the Engineer according to the newest gazetted ECSA rates for re-inspections. The application for the final inspection must be accompanied by the as-built drawings. The installation will not be approved before submission of the as-built drawings.

#### **C3.1.11. QUALIFIED PERSONNEL**

The Tenderer must submit a list of the staff allocated to this project with proof of their qualifications and experience in the construction and erection of HV overhead lines.

The Tenderer shall also submit a certificate issued by the Inspector of Occupational Health and Safety, indicating that he is fully competent performing electrical construction work and will therefore be fully responsible for the construction of the works. No work will be allowed before submission of these documents.

The Tenderer shall provide the Employer and Engineer with the names of the supervisory personnel on site before commencement of the contract works.

**If the Contractor, during any stage of the contract and for whatever reason, desires to change the supervisory personnel on site, he will do so in writing to the Employer and Engineer. Failure to do this will result in the Engineer halting the contract works until such time the necessary documentation is provided. Any such delays will not be considered by the Engineer for late completion of the contract.**

#### **C3.1.12. CONTRACTOR'S RESPONSIBILITY**

##### **C3.1.12.1. GENERAL**

Until the Contract Works have been completed or deemed to have been completed, the Contractor shall be responsible (subject to the Memorandum of Agreement and the Conditions of Contract) for the Contract Works, whether under construction, during tests, or in use for service.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

The handling and storage of materials and equipment near the erection site prior to installation shall be done in a tidy and safe manner. The Contractor shall at his own expense, keep the site area allocated to him, and the erection area of the Contract Works, reasonably clean and shall remove all waste material as it accumulates, and as directed by the Engineer from time to time. There shall be no Safety, Health, Environmental or Quality impact due to the installations carried out and the Contractor shall take full responsibility for all construction methodologies.

Storage of materials shall not be permitted without prior approval, and the Contractor shall take all necessary steps to protect any materials stored on the site.

When the work is completed, the Contractor shall remove all rubbish and debris, unused materials, temporary erections and plant and shall leave the site of the work clear. The Contractor shall also make good at his own expense, any damage caused to buildings, plant or property belonging to the owner of the works.

#### **C3.1.12.2. ORDERING OF MATERIAL AND EQUIPMENT**

All the material shall be supplied by the tenderer, which includes fabrication, according to the relevant standards and specification, transporting to site, off-loading on site, installation and commissioning which will all be undertaken by the successful tenderer unless otherwise specified.

The offloading and safekeeping of material off-site is the responsibility of the Contractor.

The successful Tenderer shall attend meetings at venues and at times, as may be arranged by the Engineer, after having been advised that his/her Tender has been accepted, for the purpose of coordinating the technical requirements and the time frame of the project, so that orders can be placed for the correct materials.

Contractors must note that materials and equipment on long delivery shall be ordered well in advance as late deliveries will be the Contractors sole responsibility. Any applicable escalation on equipment or materials ordered late will be calculated using indices as specified by the Employer. If, for some reason, late deliveries are found to be to the advantage of the Employer, the Contractor will be instructed in writing regarding the delay in ordering of such materials.

Unless otherwise indicated or stated, all units of measurement indicated in the Pricing Schedules, Schedule of Quantities or Bills of Quantities are metric units.

The linear quantities of wire, conduit, trunking, cables, switchgear, fittings etc. as given in the Pricing Schedules, Schedule of Quantities or Bills of Quantities are measured from drawings for Contract document compiling purposes. Contractors can thus not accept that such quantities are accurate when materials are ordered. Before ordering any equipment, materials and cables, the measurements must be finalised on site and must be confirmed with the Engineer. The accuracy or inaccuracy of the Bill of Quantities will not influence the validity of the tender.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

**At the end of the Contract period a final re-measurement, based on actual quantities, will be done. Any excess cable or material will be for the account of the contractor and payment for excess cable or material will not be considered.**

If such measurements cannot be taken at the onset of the Contract, the Contractor shall obtain approval from the Engineer to order the required materials that may cause delays or additional cost due to escalation before ordering such materials as allowed for in the Pricing Schedules, Schedule of Quantities or Bills of Quantities.

#### **C3.1.12.3. WORKSHOP ASSEMBLY**

To avoid problems with the erection and installation activities on site, components, equipment and sub-assemblies must be pre-assembled in the place of manufacture to ensure proper fitting and operation on site.

Such pre-assemblies which are to be tested in the place of manufacture, shall be set up in a simulated mode, using the specified peripheral equipment as far as possible in a temporary connected condition to simulate site conditions as accurately as possible. This requirement is, in particular, applicable to field equipment for electrical and electronic installations.

The purpose of such preliminary testing, shall further be done to check whether the equipment complies with predetermined set values and shall produce certain predetermined set results, as set out in the various parts of the document.

Measurements of equipment shall be taken into consideration to ensure that such equipment and materials can be handled on site and can be placed into the specified positions.

Additional costs or delays resulting from failure on the part of the Contractor to check access conditions, positions, openings, etc., will be for the Contractors account.

Individual units of equipment shall be clearly marked by employing an identification code in such a manner that actual re-assembly, erection and installation on site can be done in the minimum of time with a minimum of fitting and adjusting on site.

Equipment should be delivered to site in the largest sub-assemblies that are practical.

Equipment of the same type shall all be obtained from one manufacturer and sub-components shall be changeable. Prior to manufacture, the Contractor shall ascertain the critical dimensions of points of entry to the building.

The Engineer may, upon request by the Contractor, inspect existing installations of prototype assemblies in the factory to determine whether the extent and workmanship of such units are of the required standard for the particular Contract. This may be done to obviate the possibility of having to replace unacceptable equipment already installed.

#### **C3.1.12.4. DELIVERY OF EQUIPMENT**

The Contractor shall make the necessary arrangements to get all equipment delivered to site in accordance with the Programme of the Works and in an undamaged condition.



## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

The Contractor shall pack equipment and material for transport and delivery in soundly constructed crates or other packages fitted with removable lids or openings for inspection.

All parts of the equipment prior to packaging, shall have been thoroughly protected to preclude damage during transport and storage.

Any damage that may occur in transit or storage must be repaired, corrected or replaced by the Contractor before such materials or equipment is installed. Any parts of items found to be defective after installation on site, shall be replaced or repaired at the Contractor's expense, to the Engineer's approval

The Contractor shall be responsible for the acquisition of any insurance cover that may be required for equipment in transit and temporary storage on and off site.

All the lifting and erection equipment required by the Contractor to off-load, install or erect equipment on site is deemed to have been allowed for by the Contractor in the Contract price, as no assistance in this regard will be provided by the Employer or other Contractors.

If no item has been measured in the Pricing Schedules, Schedule of Quantities or Bills of Quantities for such handling equipment, the rate of the item to be handled shall include such handling costs.

Materials stored off-site must be repacked or protected, after inspection, to provide the necessary protection thereof for transport to site.

#### **C3.1.12.5. MATERIAL MANAGEMENT**

The Contractor will be responsible for the transporting of all materials and equipment to the off-site storage facility or on-site and will provide the off-loading, rigging, lifting, handling and placement thereof into the permanent position as planned for the equipment. The Employer will not provide any assistance or equipment for the placing of equipment into position or materials

The Contractor shall administer this material according to store bookkeeping system by means of computer aid. A stock taking report shall be submitted to the Project Manager on a two-weekly basis.

It will at all times be assumed that the Contractor has ensured upon issue of material that no visible damage has occurred to it. In the case of damaged material, acceptance will be refused. If a dispute arises, the Executive Director: Public Work of Emfuleni Local Municipality shall be called in for a decision. Damage material found on site will be replaced at the cost of the Contractor and no extension of the contract time will be granted for the extra delivery time.

All material must comply with the requirements of the latest revised SANS Standards.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

In the event that offered material do not comply or fails the specified tests, the contractor shall at his cost replace the material or equipment that do not comply or has failed the specified tests. All replacement equipment or material shall comply with the relevant specifications.

#### **C3.1.12.6. OFF-SITE HANDLING OF MATERIALS AND SAFETY**

Equipment and materials stored off-site shall be stored in a safe, dry and clean environment and shall be protected against damage, from the elements and theft. Electrical and electronic equipment shall not be assembled, stored or tested in areas where grinding, welding or painting work takes place. Damaged equipment and materials, stored in factories or stores of the Contractor, will be rejected upon inspection.

Areas in stores or places of manufacture for testing or inspections of equipment and materials by the Engineer shall be clean and safe for the purpose of testing or inspections. Floors must be free of loose materials, dirt and debris.

Equipment and materials will not be inspected in noisy or dirty environments and also not in areas where welding, grinding, and painting or any other manufacturing processes are underway. Testing or inspections will not be undertaken in hazardous or explosive atmospheres.

Materials stored in the stores of the Contractor or in alternate storage space, and which is acceptable to the Engineer for off-site certification for payment, shall only be certified for payment under the conditions as laid down in this document.

#### **C3.1.12.7. ON-SITE HANDLING OF MATERIALS AND SAFETY**

Equipment and materials stored on site shall be stored in a safe, dry and clean environment and shall be protected against damage, from the elements and theft.

Heavy materials shall be stored in a manner as not to create a danger to other Contractors or to the Employer or the Engineer.

Small materials shall not be left lying around on site. Expensive, small items such as instrumentation or electronic components shall be kept under lock and key until the installation thereof.

Store rooms used by the Contractor shall be kept locked to prevent unnecessary loss of materials.

Redundant material, which is the property of the Employer, shall be removed from site and either be reused elsewhere or returned to the Employer through the relevant processes. If clear directions are not available in this regard, the Contractor shall obtain instructions for the removal of the equipment from the Engineer. No redundant material shall become the property of the Contractor or any other party and shall remain the property of the Employer unless decided otherwise by the Employer.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.12.8. RE-LABELLING**

The Contractor shall be responsible to attend to all labelling requirements that arise with any system installation. All labelling requirements shall be allowed for in the unit rates of the Contractors priced bill of quantities. A schedule of labels shall be compiled by the Contractor and submitted to the Engineer for approval.

#### **C3.1.12.9. CONSTRUCTION METHODS**

Before initiating any construction, the Contractor shall compile a list of all defects per sectional area and verify such defects alongside a duly authorized representative. The repair of any damage not listed shall be the full responsibility of the Contractor, the Employer shall under no circumstances be held responsible for payment of damages done by the Contractor or damages not listed prior to initiating construction.

Where the Contractor will perform trench work, it shall be the Contractor's responsibility to request that the employer scans the trench for any existing services, especially cables at substations. The Contractor shall mark the trench positions clearly by means of chalking.

The Contractor shall ensure that all wayleaves are approved prior to commencement of any work and shall be responsible for maintaining any pre-approved wayleaves.

#### **C3.1.12.10. SITE SAFETY**

NOTE: Tenderer's and Contractors must ensure that they have read and understood the requirements of this document.

The requirements of the Occupational Health and Safety Act, Act 85 of 1993 and the requirements of SANS 10142-1 (or the latest edition thereof) shall be complied with as far as site safety is concerned.

Excavations shall be barricaded, backfilled and compacted as soon as possible after excavating to allow safe passage for persons and traffic on site.

Contractors shall not allow any workers to work in excavations deeper than 1m, unless the sides of the excavations are properly shored and supported, especially in sandy or wet soil conditions.

Open manholes shall be barricaded.

Deep waterlogged excavations shall be pumped empty as soon as possible after flooding or shall be solidly barricaded until pumped dry.

Open, live or unsafe power connections shall not be left unguarded or unprotected.

The construction site shall be kept clean and tidy on a daily basis.

Off-cuts and rubbish shall be removed from the site and deposited in the designated dumping place on a daily basis.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

The Contractor shall adhere to all safety rules and regulations as may be in existence on a site or as may be required by the Employer or the Engineer. The Contractor shall also ensure that their workforce on site adhere to safety rules.

Contractor shall not drive or allow a vehicle or machine to be driven close to excavations.

Contractor shall keep all power connections and/or live equipment with voltages above 50V, temporary or permanent, in a good and safe condition and shall keep all doors, shutters and covers closed on such equipment, during construction, testing and commissioning and shall take all steps to prevent accidental contact of live equipment by any person.

The Contractor shall take control over any power cable or power circuit connected from equipment installed by him, or under his control and which operates at a voltage higher than 50V. The Contractor shall not energise such a cable or circuit and shall not grant permission to any other person on the site to energise such a cable or circuit without first having made sure that such action does not create a dangerous situation.

The Contractor shall not connect any portion of an installation to the point of supply of a Supply Authority without first having complied with the requirements and regulations of such an Authority as far as tests, certification or clearance from the Authority is concerned and also not until permission is obtained from the Engineer in this regard.

Any damage to equipment of other contractors or the Employer due to equipment being supplied by such an unauthorized power connection shall be for the account of the Contractor for this Contract.

The Contractor shall not energise any portion of an installation until the earth points of power equipment in such installation have been properly bonded and earthed to a known good earth point with a value of 5 ohm or less, referred to zero, as tested with a null balance megger.

#### **C3.1.12.11. EXISTING SERVICES**

The tenderer should take note of the existing cables and other services. The services may be buried and cannot be accurately pinpointed. Therefore, all excavations must be done with care.

The tenderer shall acquaint himself with the position of all the existing services such as storm water pipes, water mains, sewer mains, gas pipes, telephone cables, etc. before any excavations are commenced. For this purpose, he shall approach the Engineer's representative, the local municipal authority and any other authority, which may be involved, in writing.

The Electrical Contractor shall accept full responsibility for any damage caused by excavation work, whether caused directly or indirectly and whether written permission has been granted for machine excavation or blasting, or not.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

Repair of damaged services undertaken by the Electrical Contractor shall be to the satisfaction of the owner of the service. The cost of repair work undertaken by the owners of the service as well as consequential losses due to the damaging of the service will be recovered from payments due to the Electrical Contractor without notice, unless proof of direct payment to the owners can be produced.

The Contractor shall report any damaging of existing services immediately to the Engineer as well as the owner of the service, irrespective of whether the damage is considered a minor damage or not. Apart from reporting damage, an entry shall be made in the site diary, indicating the time of occurrence, extent of the damage, time reported and names of the persons reported to at the Consulting Engineers as well as Owners of the service.

Penalties shall be levied for damage caused to existing services caused under the following circumstances:

- Damage due to machine excavation or blasting without the written permission of the Engineer.
- Damage which the Contractor failed to report to the Engineer as well as the owners of the service, or which the Contractor failed to enter comprehensively in the site diary.
- The penalties referred to above, shall be 100 % of the cost of repair work carried out by the owner of the service as well as 100 % of the value of consequential losses as calculated by the owners of the service. Any such penalties shall be recovered from any payments due to the Contractor

#### **C3.1.12.12. DESIGN RESPONSIBILITY**

Preparation of all details designs, manufacturing drawings and documentations for approval specified throughout the enquiry document shall initiate once the successful tenderer has received a Letter of Acceptance.

The tenderer shall be responsible for furnishing all equipment detailed designs as well as the protection schemes based on the specification. The tenderer shall submit the initial design drawings to the Engineer for a design review and the allowed duration for the design review by the Engineer shall be 10 working days. The design freeze will be only granted after approval by the Engineer. The tenderer shall submit all outline drawings and design details including requested supporting documents within a reasonable time frame and prior to the commencement of the equipment manufacturing.

It is envisaged that detail design and certification of the following but not limited to will be required:

- a) All 132 kV overhead line steel structures and foundations.
- b) 20 MVA 132 / 11 kV power transformer.

The following documentation and drawings shall be submitted for approval:

- a) All primary plant equipment drawings.

Note: all drawings shall be submitted in hard and soft copy – soft copies shall be in editable dxf / dgn format.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

Five sets of the following information are required on completion of the works:

- a) Operation and Maintenance manuals.
- b) Commissioning Reports.
- c) Design Drawings.
- d) Factory Acceptance Testing Reports.
- e) Commissioning Reports.
- f) As-built drawings.
- g) Soft copy of all documentation

All detail designs shall be submitted to the Engineer for approval prior to the manufacturing of the equipment.

#### **C3.1.12.13. FACTORY TESTS AND INSPECTIONS**

The tenderer will also be responsible for arranging Factory Acceptance Tests (FAT) at the OEM, which will be attended by the Maintenance Personnel of the Employer and the Engineers Representative.

The Contractor shall inform the Engineer of equipment tests or any part of an installation in the place of manufacture or on site is ready for inspections or tests. The Engineer shall be given sufficient notice in advance of inspections or tests and final dates and times of such inspection will then be confirmed with the Contractor by the Engineer. The inspection or testing of manufactured equipment in a factory by the Contractor or by any other test facility in the presence of the Engineer must not be regarded as acceptance of responsibility by the Engineer for the correct performance of such equipment on site.

The OEM shall issue a list of all proposed tests to be conducted during the FAT to the Engineer for approval. The manufacturer shall issue a list of all proposed tests to be conducted during the FAT to the Engineer for approval 12 weeks prior to the scheduled FAT.

The Contractor shall provide a clean and safe testing area in the place of manufacture of any equipment to be tested and inspected by the Engineer. The area shall be open and accessible and tests or inspection will not be carried out in cramped or dangerous areas. No tests or inspections will be carried out in areas where overhead cranes or hoists are in operation.

All live equipment shall either be screened off or enclosed so that inspecting persons are not endangered during such tests or inspections. Inspections or tests will not be carried out near paint areas, paint booths, ovens, grinding or polishing areas or on equipment which are still under construction.

Tests will not be done by the Engineer in areas where a normal conversation cannot take place due to background noise. Test equipment, test leads, clean writing top space and all other facilities shall be provided for the Engineer during such tests. The Engineer reserves the right to instruct the Contractor to carry out the re-testing of any equipment which does not pass the first inspection or test.

The time and travelling cost of the Engineer for the purpose of any re-testing of equipment which failed to pass the first or a previous test will be for the account of the Contractor. Any

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

delays in Contract time caused by failures of inspections or tests will also be for the account of the Contractor

The factory tests shall be done as far as possible with full control conditions as may be experienced on site. All remote controls of equipment must be simulated during these tests by using temporary connected toggle switches to replace remote field devices such as sensors, switches, contacts, etc. Temporary simulated signals for the future field instrumentation or signals for future controls and field instrumentation must be available during the factory tests and must be fully operative and all field signals must be simulated during these tests by using appropriate signal generators or signal sources.

The following equipment shall be subjected to Factory Acceptance Testing:

- a) 20 MVA, 88/11 kV Transformer

If any of the equipment specified is manufactured and/or assembled outside the Mpumalanga Province or South Africa, the tenderer shall make all the necessary arrangements for three (3) Engineer representatives and three (3) Employer representatives and one (1) Contractor representative to witness the FAT at the manufacturer. The cost thereof shall be for the account of the tenderer. The tenderer shall include into his unit rates of the FAT for flights to and from the manufacturer, accommodation in a four (4) star hotel or guest house, breakfast, lunch and dinner as well as local transport to and from the manufacturer to the accommodation. It will further be a requirement that separate rooms are booked for the representatives that will be attending the FAT.

#### **C3.1.12.14. TRAINING OF PERSONNEL**

The training of personnel of the Employer or User of the Works shall only be applicable to the Contract.

Training provided by the Contractor and OEM shall be directly applicable to the actual equipment to be used at the installation. Training shall be carried out on site and at the OEM's works. The priced unit rates in the bill of quantities shall allow for all travel, accommodation and living expenses.

All of the training shall be presented by the OEM and allowed for by the contractor in the bill of quantity's unit rates.

Operators of the installed equipment shall be trained by The Contractor to safely and successfully operate the equipment and controls.

This training course shall include the training of technical personnel of the Employer during the installation period and commissioning stages of equipment on site to make the technical staff and or skilled operators completely conversant with the installed equipment and the use thereof.

The Employer thus reserves the right to appoint certain staff to the Contractor's team during the installation and commissioning phase of the work for training as described in the previous paragraph. The Employer will bear the cost of salaries, accommodation and other allowances

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

and traveling expenses of its personnel, but all other expenses to allow the personnel to attend the said training on site shall be borne by the Contractor.

The Employer may also decide to request the Contractor to make use of the ability of the staff of the Employer to assist with physical installation and commissioning work, and in such instance the Engineer will instruct the Contractor accordingly.

The Contractor shall provide all course material including manuals and training data in this case, and shall present well prepared lectures of the courses in locations which suite the Employer.

Advanced training courses shall proceed within one month after date of first hand-over of the particular section of the Works.

The Contractor shall price the items allowed for training in the Bill of Quantities of the tender document.

At conclusion of any training period, either for the operation and maintenance of equipment, or for advanced software and programming, the Contractor shall issue the necessary certificates at the end of the course and/or a signed statement to the effect that these training sessions were adequate.

The tenderer shall also be responsible for arranging formal training by the agency, distributor or accredited supplier for all specified equipment offsite as well as on site, which will be attended by the Maintenance Personnel of the Employer and the Engineers Representatives. The offsite training shall be held at a premise of the supplier. The number of delegates will be as specified in the BoQ.

Training shall be provided in a class room environment, the OEM shall provide relays or equipment for each delegate attending the training session which will allow for practical interaction with various control, monitoring and measuring equipment. Training material shall include the necessary equipment manuals and software.

Training content shall be approved by the original equipment supplier if the supplier is not the original equipment manufacturer.

Training shall as a minimum have the following objectives.

- a) Enable the trainee to operate the equipment with confidence.
- b) Ensure that equipment shall be correctly maintained.

#### **C3.1.13. PAYMENTS**

Payment application will be assessed once a month and the claim must be agreed to and approved by the Engineer. The claim must reach the Engineer's office 7 calendar days prior to the agreed invoice submission date.

The Engineer will not issue any certificate for interim payment of any equipment and material that is stored on or off site in such a way as to hinder inspection thereof.



## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

The Employer reserves the right to be under no obligation to pay for material delivered to or off site, and shall take preference for payment to the Contractor after commissioning of the works. The Contractor shall price the preliminary and general section if the bill of quantities adequately allowing for all overhead costs during the construction period.

Materials or equipment stored on or off site and packed in crates or boxes must be opened for inspection and the serial numbers, types or quantities must be easily identifiable by the Engineer before payment for such materials will be processed.

Payment will further not be certified for small materials such as short pieces of cable, conduit, wire, conduit boxes, saddles, screws, etc., that are stored on or off site. Payment for such materials will only be certified once the materials have been built in, installed or commissioned. In special cases, 80% payment for material on site may be considered subject to approval.

Interim payment will only be considered subject to the following conditions:

- a) The equipment must be complete and in a ready state for installation or commissioning. Loose components which are not yet built into or which will form part of the large materials mentioned in the previous paragraph, will not be considered for payment. (An example hereof is, for instance, instruments that must be fitted in a cabinet and are still in separate storage.)
- b) The materials which are to be type tested, performance tested or safety tested should have already passed inspections and/ or tests by the Contractor and/or the supplier of the equipment.
- c) The Contractor shall, prior to submitting interim payment claims, procure financial assurance by means of the guarantee from a registered bank, on the form provided by the Engineer, and equal to the total amount of payments to be made to the Contractor.
- d) The total value of such guarantee, provided by the Contractor to the Employer, may be varied by the Contractor, with the consent of the Employer, from time to time provided that the Employer will be covered at all times to the total amount paid by the Employer to the Contractor for items not yet built into the Works.

The guarantee will lapse 24 months after signed acceptance without reservation by the Engineer and Employer and all the said equipment and/or materials have been built into the permanent Works.

The material must be stored in a cordoned off area in the stores of the Contractor and a notice must be affixed to this area stating that the materials stored in that area are the property of the Employer. The area must be safe and not near flammable liquids or explosive equipment and must be kept clean and dry.

#### **C3.1.14. PROJECT SPECIFICATION**

The following project specifications are integral parts to this project specification, some of which may be included under separate cover:

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

PSE 11 – Subtransmission Overhead Line

PSE 18 – Power Transformers

PSE 20 – NECRT's

PSE 56 – Surge Arrestors

PSE 100 – Using of Manpower

Please note that all references to Eskom will be regarded as Emalahleni Local Municipality. As part of achieving a standard specification countrywide and with Eskom playing a leading role in the compilation thereof, Eskom's specification has been used throughout this document.

It is therefore required that all tenderers must have access to the Eskom specification, via the Eskom Web at <https://scot.eskom.co.za/>. Please note that a fee is payable to Eskom for this service.

Application can be made to:

- a) Mrs Brenda Morrison
- b) Assistant Officer
- c) Tel: (011) 629 5266
- d) Fax: (086) 662 6387
- e) E-mail: Brenda.morrison@eskom.co.za

We, the undersigned ..... hereby acknowledge that copies of the above documents are included in the tender document and confirm that I / We fully understand them and the consequences of non-compliance.

SIGNED AT ..... ON BEHALF OF THE FIRM .....

ON THIS ..... DAY OF ..... 20.....

NAME: .....

SIGNATURE: .....

CAPACITY: .....

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.15. EQUIPMENT SPECIFICATION**

The following equipment forms part of the 132 kV overhead line

**Table 3: Standard Equipment Schedule**

| <b>Title</b>  | <b>Drawing No</b> |
|---|-------------------|
| THIMBLE   | D-DT-3026         |
| SURGE ARRESTOR DISTRIBUTION CLASS                                       | D-DT-3100         |
| CONDUCTOR ACSR  | D-DT-3136         |
| COPPER WIRE   | D-DT-3137         |
| LUG   | D-DT-3166         |
| SPIRAL VIBRATION DAMPER   | D-DT-3175         |
| CLEVIS BALL   | D-DT-6059         |
| SOCKET TONGUE   | D-DT-6061         |
| CLAMP DEAD END ASSEMBLY   | D-DT-7000         |
| CLAMP SHIELD  | D-DT-7004         |
| MULTI-FREQUENCY VIBRATION DAMPER  | D-DT-7005         |
| TURNBUCKLE EYE TONGUE   | D-DT-7007         |
| BALL EYE OVAL   | D-DT-7008         |
| TRUNNION SUSPENSION CLAMP   | D-DT-7010         |
| INSULATED SHIELD WIRE   | D-DT-7012         |
| LINE POST INSULATOR   | D-DT-7013         |
| INSULATOR LONG ROD  | D-DT-7014         |
| SHACKLE STRAIGHT BOLT   | D-DT-7017         |
| PISTOL CLAMP  | D-DT-7022         |
| STAY ROD ADJUSTABLE   | D-DT-7023         |
| CROSBY CLAMP WIRE ROPE  | D-DT-7032         |
| HELICALLY FORMED ARMOUR ROD   | D-DT-7034         |
| GUY GRIP  | D-DT-7035         |
| STL STRANDED WIRE   | D-DT-7036         |
| 132kV STEEL POLE SUSPENSION   | D-DT-7101         |
| 132kV STEEL POLE STRAIN   | D-DT-7104         |
| ADJUSTABLE & NON ADJUSTABLE INSULATOR STRAIN STRING<br>ASSEMBLY DRAWING | D-DT-7311         |
| INTERMEDIATE SUSPENSION ASSEMBLY  | D-DT-7321         |
| POSITIONS OF VIBRATION DAMPERS  | D-DT-7322         |
| NON INSULATED EARTH WIRE ASSEMBLY                                       | D-DT-7323         |
| STRAIN SHIELD WIRE INSULATED ASSEMBLY                                   | D-DT-7324         |
| ADJUSTABLE STAY ASSEMBLY  | D-DT-7325         |
| INSULATOR ATTACHMENT – KEYHOLE BRACKET                                  | D-DT-7330         |
| STAY LOCATION CHART   | D-DT-7346         |
| PERCHING BRACKET  | D-DT-7347         |
| 132kV PLANTED POLE INTERMEDIATE   | D-DT-7611         |
| 132kV PLANTED POLE INTERMEDIATE   | D-DT-7612         |
| 132kV PLANTED POLE STRAIN   | D-DT-7615         |

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

| Title  | Drawing No |
|--|------------|
| FOUNDATION DETAILS INTERMEDIATE  | D-DT-7850  |
| FOUNDATION DETAILS STRAIN  | D-DT-7851  |
| FOUNDATION CAP AND EARTHING DETAILS  | D-DT-7857  |
| EARTHING PIN   | D-DT-8028  |
| PHASE CONFIGURATION  | D-DT-0311  |
| FOOTING EARTH ELECTRODE  | D-DT-0640  |
| MV LV EARTHING ELECTRODE DETAILS   | D-DT-0642  |
| LINE DESIGNATION & STRUCTURE IDENTIFICATION LABELS<br>FOR SUB-TRANSMISSION LINE TOWERS               | D-DT-5050  |
| CLAMP SHIELD WIRE  | D-DT-7003  |
| BRACKET,P/TOP INTER SNG & DBL S/WIRE ASSY  | D-DT-7048  |
| INTERMEDIATE POLE TOP AND SHIELDWIRE BRACKET FOR<br>SINGLE OR DOUBLE SHIELDWIRE UNINSULATED ASSEMBLY | D-DT-7331  |
| 2WT763 - 88 132KV STANDARD POLE STRUCTURES FOOTING<br>EARTH ELECTRODE DETAILS                        | 2WT-763    |
| STAY ROD INSTALLATION  | 2WT-1062   |
| STAY ROD INSTALLATION SOIL TYPE 3 & 4  | 2WT-1143   |
| SINGLE TO DOUBLE EARTH WIRE ARRANGEMENT  | 2-D-WT-816 |
| INSTALLATION OF LINE LABELS ON CONCRETE AND STEEL<br>POLES   | 2-WT-1148  |
| 132 / 88KV INSULATED EARTH WIRE ARRANGEMENT  | 2-WT-1420  |
| 132 / 88KV NON - INSULATED EARTH WIRE ARRANGEMENT  | 2-WT-1421  |
| 132KV STEEL POLE ANGLE STRAIN DOUBLE EARTH WIRE<br>BRACKET   | 2-NT-796   |

#### **C3.1.16. SUBTRANSMISSION OVERHEAD LINE (PSE 11)**

The Contractor shall be responsible for the detail design and certification of all steel supporting structures and foundations. Designs shall be submitted to the Engineer for approval prior to the placing of orders.

- As per the construction regulations all pole holes shall be nominated by a Professional Structural / Geotechnical Engineer to determine the soil type.
- All flange mounted foundations shall be certified by a Professional Structural Engineer.
- All tension and crimping equipment shall have a valid calibration certificate.
- In order to regulate the stringing, a bull wheel shall be used and no part of the conductor shall be dragged over the ground.

The Contractor shall provide:

- General arrangement for every type of support structure indicating equipment mechanical and electrical data as well as the OEM for each component.
- Assembly drawings
- Support structure designs
- Foundation designs
- Soil nominations & foundation selection
- Implementations plan

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

- Quality Plan
- SHE Plan
- Project Programme
- Cash flows
- List of plant & material
- Labour force and hours worked

Activity stages and requirements for implementation of the overhead line construction follows:

#### **Activity Stage 1: Preliminary & General, Environmental, Health & Safety and Site establishment**

The preliminaries / P&G section shall be included as per the Bill of Quantities:

- Preliminary and General cost;
- Environmental requirements;
- Health & Safety requirements;
- Site establishment;
- Security etc.

#### **Activity Stage 2: Establish construction access**

- Supply and transport of new power line servitude gates;
- Complete replacement of existing power line servitude gates;
- Complete installation of new power line servitude gates;
- Complete establishment of property construction access;
- Closure of construction access
- Bush clearing and cutting of trees.

#### **Activity Stage 3: Survey activities**

- Pegging of line route, structure setting-out & stays positions;
- Marking of servitude and access gates;
- Measuring of all over and under crossing clearances.

#### **Activity Stage 4: Construction of temporary By-pass Lines – Not Applicable**

#### **Activity Stage 5: Drilling/Excavating of holes for structure foundations and stays**

- Geotechnical investigation and soil/foundation type nominations;
- Foundation Design Verification
- Foundation installation
- Stay Rod & Foundations Design or Verification;
- Stay Rod and Foundation Installation;
- Barricading/Protecting of all open excavations.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**Activity Stage 6: Assembly and Erection of power line structures**

- Assembly and erection of all structures;
- Assembly and installation of stay assemblies

**Activity Stage 7: Power line Earthing**

- Transport and installation of power line structure earthing material;
- Measure Structure Footing Resistance and Record;

**Activity Stage 8: Dressing of all structures**

- Dressing of all structures

**Activity Stage 9: Stringing, Regulation & Making off**

- Test Joints;
- Stringing;
- Making off and Regulation.
- Mid span joints
- Repair sleeves
- Clamping in
- Vibration dampers
- Bird flappers
- Aircraft warning spheres
- temporary structures
- closing spans to substations

**Activity Stage 10: Labelling**

- Structure/Pole Identification Labels
- Line Designation labels;
- Line Crossing labels;
- Phase Disks.

**Activity Stage 11: Dismantling – Not Applicable**

**Activity Stage 12: Taking Over Of the Works and Clearance of Site**

- Re-instate entire construction site;
- Final inspection of the line;
- Handing over, test & commissioning;
- Submission of 'As Built' Information;
- Site clearance.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.16.1. GENERAL DETAILS**

PLS CAD has been used as a design package to profile the Chickadee line at 70 °C and to calculate the pole strengths of the single circuit mono poles.

Line voltage phase to phase: Built and insulated at 132 kV

Type: Three-phase, single circuit

Phase configuration: Vertically at strainers and intermediates; Horizontal configured at terminal positions.

Number of conductors per phase: Single

Number of earth conductors: Single OPGW.

#### **C3.1.16.2. PHASE CONDUCTOR DETAIL**

The transfer capacity of this single circuit Chickadee line is 559 A at 70 °C which will be adequate for many years to come.

The phase conductor between Vulcan MTS and Siyanqoba Substation is based on the following:

- Conductor type: "Chickadee" ACSR 18/1/3.77
- Conductor overall diameter: 18.87 mm
- Total cross sectional area: 212.1 mm<sup>2</sup>
- Aluminium stranding: 18/3.77 mm
- Steel wires stranding: 1/3.77 mm
- Conductor mass: 640.5 kg/km
- Ultimate tensile strength: 44.9 kN
- AC Resistance @ 20°C: 0.1427 ohm/km
- Final modulus elasticity: 75 787 MPa
- Coefficient of linear expansion: 21.6/°C x10<sup>-6</sup>
- Standard drum length: 1 500 m
- Catenary constant: 1 800 m

The burn-off rating of Chickadee is calculated to be 1,014 s for a fault current of 21 kA.

#### **C3.1.16.3. SHIELD-WIRE DETAIL**

Not Applicable

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.16.4. OPTICAL FIBRE INSTALLATION DETAIL**

OPGW (48 Fibre 10/125 single mode) with a short circuit rating of 18,68 kA for 1 second shall be used as earth wire and spliced to ADSS when entering into the two substations.

The OPGW installation between Vulcan MTS and Siyanqoba Substation is based on the following:

- Conductor type: 48C OPGW 18.68 kA Ungreased
- Conductor overall diameter: 17.7 mm
- Wires stranding: Centre – 1/3.9 mm  
Layer 1 – 5/3.6 mm AA wire + 1/3.4 mm Al Tube  
Layer 2 – 13/3.3 mm AA wire
- Conductor mass: 841 kg/km
- Ultimate tensile strength: 118.3 kN
- DC Resistance @ 20°C: 0.252 ohm/km
- Final modules elasticity: 109 000 MPa
- Coefficient of linear expansion: 15.5/°C x10<sup>-6</sup>
- Catenary constant: 2 100 m
- Standard drum length: min. 4000 m

The burn-off rating of the 48 Fibre, 17,7 mm OPGW is calculated to be 1,0 s for a fault current of 18.68 kA.

NOTE – PLS CADD seed file of the offered OPGW to be provided to Engineer by OEM for verification and approval.

Planning allows for fibres to be spliced at Eskom's Vulcan MTS and Siyanqoba Substation for differential protection and communication purposes in the relevant BME equipment.

The fibre optic cable will be routed from the first Gantry / terminal structure (from the line side) into the substation HV Yards and into the cable trenches. In the cable trenches the fibre cable will run inside HDPE piping for protection. Should the routing of the cable be impossible to achieve using HDPE piping, the cable should then be routed using PVC piping. The duct fibre cable (run inside the pipe in the trenches) shall be armoured cable. Upon entry into the control rooms the fibre cable shall be fed below the main cable tray and supported with the brackets. This also applies to the fibre cabling running inside the control room as a means to protect the fibre from damage by the other cables. A BME cabinet will be installed as part of the substation contracts.

The substation contractor for this project be responsible for supply, delivery, installation, testing and handing over of all fibre related work at Vulcan MTS and Siyanqoba Substation.

Wires offered shall comply with Eskom standards and shall be obtained from Eskom approved suppliers / manufacturers (proof to be submitted with tender).

The following shall form an integral part of the optical fibre installation and shall be catered for in the tenderers priced unit rates unless marked as "excluded" -



## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **VULCAN MTS:**

- Supply and install 40 or 50mm dia. duct
- Installation of HDD fibre cable into duct
- Outdoor splicing installed in dome enclosures
- Concrete draw pits
- 19" Cabinet 600x600mm
- Pigtails
- Mid-couplers
- Termination of fibre to patch panel incl. splicing
- Sarel box and splicing in HV switchgear panels
- OTDR testing including traces in hard and soft copy
- Terminal Equipment (Multiplexer) – future (excluded)
- Interface cards – future (excluded)

#### **SIYANQOBA SUBSTATION:**

- Supply and install 40 or 50mm dia. duct
- Installation of HDD fibre cable into duct
- Outdoor splicing installed in dome enclosures
- Concrete draw pits
- 19" Cabinet 600x600mm
- Pigtails
- Mid-couplers
- Termination of fibre to patch panel incl. splicing
- Sarel box and splicing in HV switchgear panels
- OTDR testing including traces in hard and soft copy
- Terminal Equipment (Multiplexer) – future

Note: Ensure that all cabinets are powered and Patch panels must be labelled correctly.

#### **C3.1.16.5. FIBRE OPTIC CABLE TERMINATING IN A 19" CABINET**

The Fibre optic cable shall be glanded on the outer sheath using a plastic compression gland where it enters the 19" cabinet. The armouring of the cable shall be cut back 10 cm after the gland and shall be insulated using heat shrink or self-vulcanising tape. The armouring shall by no means be connected to the earth. At least 6 m of slack should be left inside the cabinet.

The power line contractor shall be responsible for the fibre end-to-end installation and testing thereof. The end-to-end installation shall include the OPGW installation with all auxiliary equipment such as dome splices boxes on substation termination gantries, OPGW clamps (including down-lead clamps), fibre extensions through the substation trenches etc. Patch panels, ODF and BME shall be provided by the power line contractor at both ends.

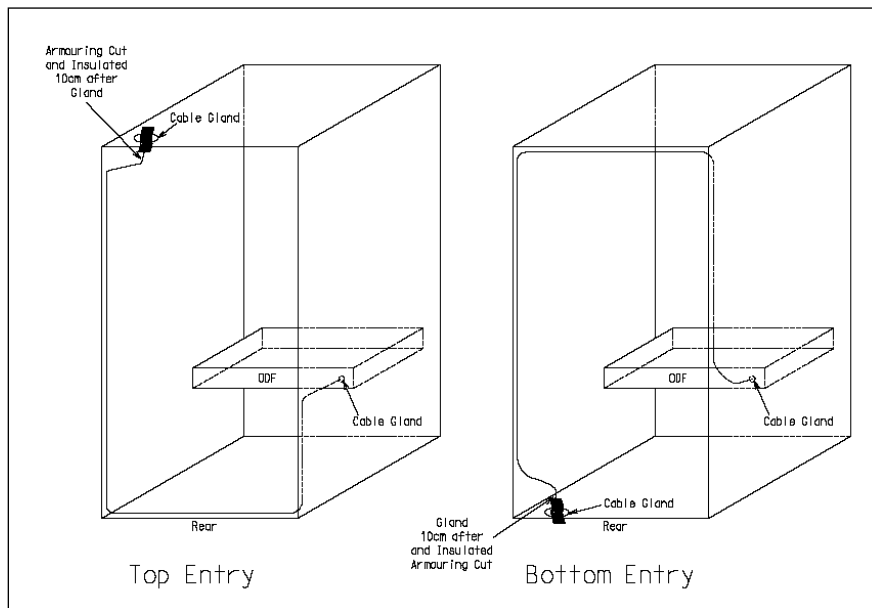
## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C3.1.16.5.1. SPLICING OF CABLES IN THE OPTICAL DISTRIBUTION FRAME

The Optical Distribution Frame must be mounted as indicated in the Cabinet Layout drawing. The slack Fibre optic cable must be routed as shown. This must be done neatly and the minimum bending radius of the cable (typically 250 mm) must be maintained at the bends. The cable should be run in such a way that the Optic Distribution Frame and slack cable can be easily removed from the cabinet.



**Figure 1: Optical Fibre Cable Routing in 19" Fixed frame Cabinet**

The inner sheath of the Fibre optic cable shall be glanded at its entry to the Fibre Distribution unit by means of a plastic compression gland and the central strength member shall be securely fastened.

The fibres shall be neatly organised in the Fibre Distribution Unit with no twists or sharp bends. Plastic clips may be used to organise the bare fibres.

The fibres are to be spliced according to the Fibre Optic Cable Layout Drawing for the station.

For this 48 Fibre system all fibres will be spliced on non-ruggedised tails to be available on the patch panel. The required number of fibres shall be spliced through to equipment on ruggedised cable or on ruggedised pigtails.

#### C3.1.16.5.2. LABELLING OF OPTICAL DISTRIBUTION FRAMES

The Optical Distribution Frames shall be labelled as indicated. The destination name shall appear on the left side of the face plate. The ports shall be labelled below with the corresponding port number and above with the Bearer Code and an indication of which port is RX and which is TX.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

The port at which the light comes out is marked RX and the port into which the light goes in is called TX as indicated.

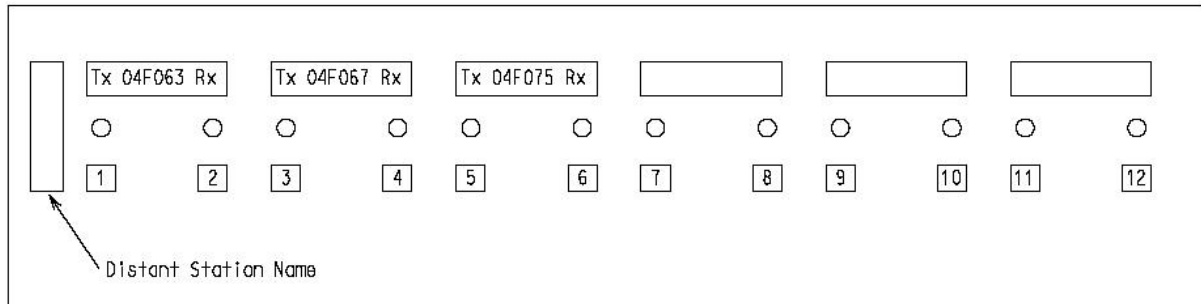


Figure 2: Faceplate labelling

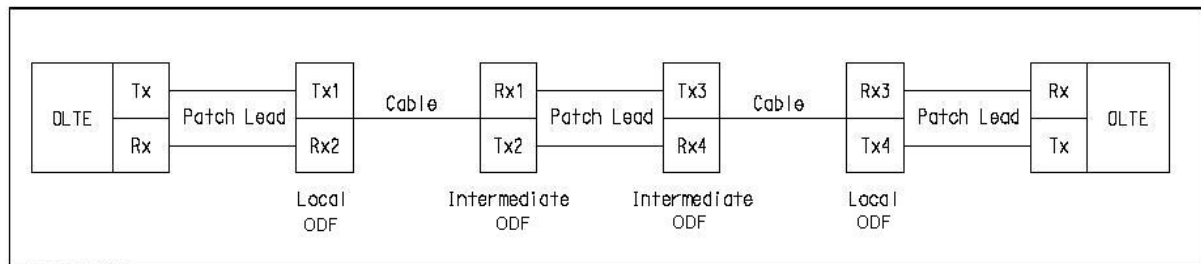


Figure 3: Rx vs Tx port labelling

This method of labelling ensures that patching at intermediate sites is from odd port to odd port and even port to even port. Thus there is no cross patching at the intermediate sites. This simplifies matters in the case of multiple intermediate sites.

The following shall form an integral part of the optical fibre installation and shall be catered for in the tenderers priced unit rates unless marked as “excluded”

#### C3.1.16.6. LINE HARDWARE

All line hardware shall be rated for 120 kN minimum.

#### C3.1.16.7. PROFILING DETAILS

The C-value for “Chickadee” phase conductor must be less or equal to 1 800 m for the Ruling Condition @ 15 °C, every day tension in still air.

The C-value for the OPGW wire must be less or equal to 2 100m (vibration limit) for the Ruling Condition @ 15 °C, every day tension in still air.

Minimum phase conductor clearances to be designed @ 15 °C with 1050 Pa (41.387m/s) wind loading.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

Maximum phase conductor clearances to be designed @ 70 °C with 0 Pa wind loading.

The Project Engineer to supply the PLS Cadd Stringing Sag and Tension Charts for the phase conductor and shield-wire.

The Contractor shall request the final sag-tension charts from the Engineer with at least 7 days' notice prior to the intent of starting with stringing.

#### C3.1.16.8. STRUCTURES

Table 4: Structure Coordinates

| NO | SPAN<br>AHEAD<br>(M) | CAH  |      |      | COMMENT                       |
|----|----------------------|------|------|------|-------------------------------|
|    |                      | T    | M    | B    |                               |
| 1  | 39                   | 10.6 | 10.6 | 10.6 | Gantry-12m beam.106           |
| 2  | 51                   | 12.5 | 12.5 | 12.5 | Str_4pole_in-line_15m_17m.pol |
| 3  | 122                  | 12.5 | 12.5 | 12.5 | Str_4pole_in-line_15m_16m.pol |
| 4  | 70                   | 8    | 8    | 8    | Str_4pole_in-line_10m_11m.pol |
| 5  | 172                  | 8    | 8    | 8    | Str_4pole_90deg_10m_12m.pol   |
| 6  | 184                  | 16.6 | 14.8 | 13   | Str_mono_in-line_20m.pol      |
| 7  | 165                  | 17   | 15.9 | 14.8 | Int_mono_SC_22m.pol           |
| 8  | 163                  | 17   | 15.9 | 14.8 | Int_mono_SC_22m.pol           |
| 9  | 187                  | 16.6 | 14.8 | 13   | Str_mono_SC_7615d_r2_20m.pol  |
| 10 | 234                  | 17   | 15.9 | 14.8 | Int_mono_SC_22m.pol           |
| 11 | 148                  | 17   | 15.9 | 14.8 | Int_mono_SC_22m.pol           |
| 12 | 97                   | 8    | 8    | 8    | Str_4pole_in-line_10m.pol     |
| 13 | 208                  | 8.9  | 8.9  | 8.9  | Str_4pole_in-line_11m.pol     |
| 14 | 259                  | 21.8 | 20.7 | 19.6 | Int_mono_SC_24m_FM.pol        |
| 15 | 239                  | 21.8 | 20.7 | 19.6 | Int_mono_SC_24m_FM.pol        |
| 16 | 89                   | 21.8 | 20   | 18.2 | Str_mono_SC_23-2m_FMSS.pol    |
| 17 | 92                   | 8    | 8    | 8    | Str_4pole_in-line_10m_12m.pol |
| 18 | 42                   | 8    | 8    | 8    | Str_4pole_90deg_10m_12m.pol   |
| 19 | 410                  | 21.8 | 20   | 18.2 | Str_mono_SC_23-2m_FMSS.pol    |
| 20 | 273                  | 21.8 | 20   | 18.2 | Str_mono_SC_23-2m_FMSS.pol    |
| 21 | 317                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 22 | 305                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 23 | 297                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 24 | 423                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 25 | 297                  | 30.5 | 30.5 | 30.5 | Str_3pole_in-line_32m.pol     |
| 26 | 289                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 27 | 326                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 28 | 273                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 29 | 231                  | 16.6 | 14.8 | 13   | Str_mono_in-line_20m.pol      |
| 30 | 275                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 31 | 281                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 32 | 276                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 33 | 260                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |
| 34 | 281                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol      |

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

| NO | SPAN<br>AHEAD<br>(M) | CAH  |      |      | COMMENT                            |
|----|----------------------|------|------|------|------------------------------------|
|    |                      | T    | M    | B    |                                    |
| 35 | 240                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol           |
| 36 | 303                  | 20.6 | 18.8 | 17   | Str_mono_SC_7615d_r2_24.pol        |
| 37 | 333                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol           |
| 38 | 290                  | 23.1 | 22   | 20.9 | Int_mono_SC_25.3m_FM.pol           |
| 39 | 251                  | 20.6 | 18.8 | 17   | Str_mono_SC_7615d_r2_24.pol        |
| 40 | 260                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 41 | 251                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 42 | 236                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 43 | 224                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 44 | 235                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 45 | 68                   | 20.6 | 18.8 | 17   | Str_mono_SC_7615d_r2_24.pol        |
| 46 | 71                   | 21.8 | 20   | 18.2 | Str_2pole_2xSC_23.2mtcah+MV_FM.pol |
| 47 | 150                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 48 | 150                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 49 | 150                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 50 | 150                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 51 | 149                  | 21.8 | 20   | 18.2 | Str_2pole_2xSC_23.2mtcah+MV_FM.pol |
| 52 | 152                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 53 | 149                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 54 | 150                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 55 | 135                  | 21.8 | 20.7 | 19.6 | Int_mono_DCHVdcmv_24m_FM.pol       |
| 56 | 37                   | 17.6 | 15.8 | 14   | Str_2pole_2xSC_19mtcah+MV_FM.pol   |
| 57 |                      | 10.6 | 10.6 | 10.6 | 132kv-12m beam-double.106          |

#### **C3.1.16.9. STRINGING**

All tension and crimping equipment shall have a valid calibration certificate as issued by a SANAS accredited institution. In order to regulate the stringing a bull wheel shall be used and no part of the conductor shall be dragged over the ground.

#### **C3.1.16.10. CUSTOM POLES**

Tenderers are required to price all custom poles and custom pole foundations according to the requirements as included in the project specification. The priced labour rate shall include the detail designs and certification of both the poles and foundations by a Professional Engineer, preferably Rinus v.d. Ende +27 82 570 0149. The detail designs shall be submitted to the Project Engineer for approval prior to commencement of manufacturing.

The design of these structures shall be in accordance with ASCE/SEI 48-11, SANS 10280-1 2013 and DSP\_34-1683.

The maximum wind loading is determined using 1050 Pa wind pressure following the simplified method for poles shorter than 25 m and using 29 m/s reference wind velocity following detailed method as per SANS10280-1.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

Pole deflection under maximum wind load shall not exceed 6% of the pole height above ground.

Poles should have the lowest number of slip joints determined by the manufacturer based on the bending press and galvanizing bath limitations. Step welds shall not be accepted. The base and/or flanges shall be distortion free.

The poles shall be manufactured from hot dipped galvanized 300 WA steel and the minimum thickness of the steel used for manufacture of poles or for circular hollow sections shall be 4,5 mm. The overlap section of a slip joint shall be at least 1.5 times the maximum inside diameter of the female and the poles shall have a continuous taper.

The principle of top and middle shafts being of a constant length with bottom shaft varying in length to accommodate range of pole lengths for the same type of structure should apply.

Pole shall be hot dip galvanised to SANS 121. The finished product shall have a smooth external surface free from steel splinters and welding splatter.

**Table 5: Tube Details**

|              | Overall Length (m) | Embedded (m) | Shape    | Tip dia (mm) | Bott dia (mm) | Length (m) | Thickness (cm) | Lap Length (m) | Yield Stress (MPa) |
|--------------|--------------------|--------------|----------|--------------|---------------|------------|----------------|----------------|--------------------|
| SIYA 15m     | 15                 | 2.3          | 12 sided | 240          | 512           | 9          | 0.5            | 0.7            | 355                |
|              |                    |              |          |              |               | 6.7        | 0.6            | 0              | 355                |
| SIYA 17m_b   | 17                 | 2.3          | 12 sided | 240          | 512           | 11         | 0.5            | 0.7            | 355                |
|              |                    |              |          |              |               | 6.7        | 0.6            | 0              | 355                |
| SIYA 16m     | 16                 | 2.4          | 12 sided | 240          | 528           | 10.4       | 0.5            | 0.8            | 355                |
|              |                    |              |          |              |               | 6.4        | 0.6            | -              | 355                |
| SIYA 10m     | 10                 | 1.8          | 12 sided | 277          | 490           | 7          | 0.5            | 0.7            | 355                |
|              |                    |              |          |              |               | 3.7        | 0.6            | -              | 355                |
| SIYA 11m_b   | 11                 | 1.7          | 12 sided | 240          | 469           | 11         | 0.5            | -              | 355                |
|              |                    |              |          |              |               | -          | -              | -              | 355                |
| SIYA 12m_b   | 12                 | 1.8          | 12 sided | 276          | 492           | 9          | 0.5            | 0.7            | 355                |
|              |                    |              |          |              |               | 3.7        | 0.6            | -              | 355                |
| SIYA 20m     | 20                 | 2            | 12 sided | 240          | 602           | 11         | 0.5            | 0.7            | 355                |
|              |                    |              |          |              |               | 9.7        | 0.6            | -              | 355                |
| 22m-23kN CIS | 22                 | 2.8          | 12 sided | 180          | 654           | 11.5       | 0.6            | 0.8            | 355                |
|              |                    |              |          |              |               | 11.3       | 0.6            | -              | 355                |
| SIYA 11m     | 11                 | 1.9          | 12 sided | 280          | 510           | 8          | 0.5            | 0.7            | 355                |
|              |                    |              |          |              |               | 3.7        | 0.6            | 0              | 355                |

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

|                 | Overall<br>Length<br>(m) | Embedded<br>(m) | Shape    | Tip dia<br>(mm) | Bott<br>dia<br>(mm) | Length<br>(m) | Thickness<br>(cm) | Lap<br>Length<br>(m) | Yield<br>Stress<br>(MPa) |
|-----------------|--------------------------|-----------------|----------|-----------------|---------------------|---------------|-------------------|----------------------|--------------------------|
| SIYA 24m_SM     | 24                       | 0               | 12 sided | 290             | 697                 | 11.5          | 0.6               | 0.8                  | 355                      |
|                 |                          |                 |          |                 |                     | 13.3          | 0.6               | -                    | 355                      |
| CIS 23.2 SM 451 | 23.2                     | 0               | 12 sided | 451             | 1202                | 11.5          | 0.8               | 1.25                 | 355                      |
|                 |                          |                 |          |                 |                     | 9             | 0.8               | 1.65                 | 355                      |
|                 |                          |                 |          |                 |                     | 5.6           | 1                 | -                    | 355                      |
| CIS 25.3 SM 260 | 25.3                     | 0               | 12 sided | 260             | 786                 | 11.5          | 0.5               | 0.8                  | 355                      |
|                 |                          |                 |          |                 |                     | 9             | 0.6               | 1.05                 | 355                      |
|                 |                          |                 |          |                 |                     | 6.65          | 0.8               | -                    | 355                      |
| 3pl12F 32 str   | 32                       | 0               | 12 sided | 260             | 1060                | 11            | 0.6               | 0.74                 | 355                      |
|                 |                          |                 |          |                 |                     | 11            | 0.6               | 1.05                 | 355                      |
|                 |                          |                 |          |                 |                     | 11.79         | 0.6               | -                    | 355                      |
| SIYA 24m        | 24                       | 0               | 12 sided | 290             | 697                 | 11.5          | 0.6               | 0.8                  | 355                      |
|                 |                          |                 |          |                 |                     | 13.3          | 0.6               | -                    | 355                      |
| CIS 19 SM 520   | 19                       | 0               | 12 sided | 520             | 941                 | 11.4          | 0.8               | 1.2                  | 355                      |
|                 |                          |                 |          |                 |                     | 8.8           | 1.2               | -                    | 355                      |

# EMALAHLENI LOCAL MUNICIPALITY

## 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

Table 6: Tube Details

| Dwg. No                            | Structure Qty. | Tube Qty. | SIYA 15m | SIYA 17m_b | SIYA 16m | SIYA 10m | SIYA 11m_b | SIYA 12m_b | SIYA 20m | 22m-23kN CIS | SIYA 11m | SIYA 24m_SM | CIS 23.2 SM 451 | CIS 25.3 SM 260 | 3pl12F 32 str | SIYA 24m | CIS 19 SM 520 |
|------------------------------------|----------------|-----------|----------|------------|----------|----------|------------|------------|----------|--------------|----------|-------------|-----------------|-----------------|---------------|----------|---------------|
| 132kv-12m beam-double.106          | 1              | 0         |          |            |          |          |            |            |          |              |          |             |                 |                 |               |          |               |
| Gantry-12m beam.106                | 1              | 0         |          |            |          |          |            |            |          |              |          |             |                 |                 |               |          |               |
| Int_mono_DCHVdcmv_24m_FM.pol       | 13             | 13        |          |            |          |          |            |            |          |              |          | 13          |                 |                 |               |          |               |
| Int_mono_SC_22m.pol                | 4              | 4         |          |            |          |          |            |            |          | 4            |          |             |                 |                 |               |          |               |
| Int_mono_SC_24m_FM.pol             | 2              | 2         |          |            |          |          |            |            |          |              |          | 2           |                 |                 |               |          |               |
| Int_mono_SC_25.3m_FM.pol           | 15             | 15        |          |            |          |          |            |            |          |              |          |             |                 | 15              |               |          |               |
| Str_2pole_2xSC_19mtcah+MV_FM.pol   | 1              | 2         |          |            |          |          |            |            |          |              |          |             |                 |                 |               |          | 2             |
| Str_2pole_2xSC_23.2mtcah+MV_FM.pol | 2              | 4         |          |            |          |          |            |            |          |              |          |             | 4               |                 |               |          |               |
| Str_3pole_in-line_32m.pol          | 1              | 3         |          |            |          |          |            |            |          |              |          |             |                 |                 | 3             |          |               |
| Str_4pole_90deg_10m_12m.pol        | 2              | 8         |          |            |          | 6        |            | 2          |          |              |          |             |                 |                 |               |          |               |
| Str_4pole_in-line_10m.pol          | 1              | 4         |          |            |          | 4        |            |            |          |              |          |             |                 |                 |               |          |               |
| Str_4pole_in-line_10m_11m.pol      | 1              | 4         |          |            |          | 3        | 1          |            |          |              |          |             |                 |                 |               |          |               |
| Str_4pole_in-line_10m_12m.pol      | 1              | 4         |          |            |          | 3        |            | 1          |          |              |          |             |                 |                 |               |          |               |
| Str_4pole_in-line_11m.pol          | 1              | 4         |          |            |          |          |            |            |          |              | 4        |             |                 |                 |               |          |               |
| Str_4pole_in-line_15m_16m.pol      | 1              | 4         | 3        |            | 1        |          |            |            |          |              |          |             |                 |                 |               |          |               |
| Str_4pole_in-line_15m_17m.pol      | 1              | 4         | 3        | 1          |          |          |            |            |          |              |          |             |                 |                 |               |          |               |
| Str_mono_in-line_20m.pol           | 2              | 2         |          |            |          |          |            |            | 2        |              |          |             |                 |                 |               |          |               |



# EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

| Dwg. No                      | Structure Qty. | Tube Qty. | SIYA 15m | SIYA 17m_b | SIYA 16m | SIYA 10m | SIYA 11m_b | SIYA 12m_b | SIYA 20m | 22m-23kN CIS | SIYA 11m | SIYA 24m_SM | CIS 23.2 SM 451 | CIS 25.3 SM 260 | 3p12F 32 str | SIYA 24m | CIS 19 SM 520 |
|------------------------------|----------------|-----------|----------|------------|----------|----------|------------|------------|----------|--------------|----------|-------------|-----------------|-----------------|--------------|----------|---------------|
| Str_mono_SC_23-2m_FMSS.pol   | 3              | 3         |          |            |          |          |            |            |          |              |          |             | 3               |                 |              |          |               |
| Str_mono_SC_7615d_r2_20m.pol | 1              | 1         |          |            |          |          |            |            | 1        |              |          |             |                 |                 |              |          |               |
| Str_mono_SC_7615d_r2_24.pol  | 3              | 3         |          |            |          |          |            |            |          |              |          |             |                 |                 |              | 3        |               |
|                              | 57             | 84        | 6        | 1          | 1        | 16       | 1          | 3          | 3        | 4            | 4        | 15          | 7               | 15              | 3            | 3        | 2             |

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

##### **C3.1.16.11. D-DT VARIATIONS**

All standard Eskom poles and variations to Eskom poles shall have 12 sided tubes.

##### **C3.1.16.12. FOUNDATIONS**

All pole holes shall be nominated by a Professional Civil Engineer to determine the soil type.

All foundations shall as a standard be raised with 200 mm to create a "clearance buffer". After completion of the overhead power line work, all surfaces of the foundation protruding above natural ground level shall be bitumen painted.

The foundation finishing shall be shaped in a way that no water can accumulate on flat foundation surfaces. The natural ground and soil around the foundation shall be shaped in such a manner to minimize amassing of water in close proximity to the foundation.

The tenderer shall be responsible for the design of custom (non-Eskom-standard) poles. The foundation shall be designed by a professional qualified civil engineer.

##### **C3.1.16.13. COMPRESSION JOINT SAMPLING AND TESTING**

The purpose of the test is to ensure that the assembly meets the required strength of 95% of the rated tensile strength of the conductor. By testing an assembly compressed on site with the compression machine to be used on the project and by the personnel appointed to perform the crimps, the entire system is proven.

Before any stringing activities commence, the Engineer, Engineers Representative or Clerk of Works shall randomly select two dead-end fittings and one joint from those on site supplied for the project. They shall check that the equipment conforms with buyer's guide drawings D-DT-7000 and D-DT-7001, indelibly mark them with his/her signature and give them to the Tenderer to compress.

The Tenderer shall compress, in the presence of the Engineer, Engineers Representative or Clerk of Works and the Employers Representatives, a sample phase conductor assembly. The assembly shall consist of two dead-end fittings and a mid-span joint. The crimping equipment used shall be that allocated for the project and the personnel performing the crimps shall be those appointed to do so. The tenderer shall ensure that the calibration certificate, issued by a SANAS accredited institution, of the crimper used is available onsite during the preparation of the testing sample.

The length of conductor between the fittings shall not be less than 100 times the diameter of the conductor. This test assembly shall be labelled and sent to an approved and accredited test laboratory for tensile testing.

The Tenderer shall, at his/her expense, arrange for the samples to be mechanically tested, in the presence of himself and the Engineer, Engineers Representative or Clerk of Works and

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

the Employers Representatives, at an approved and accredited laboratory. Test certificates to be provided as part of the of the Handing Over Documentation.

If any of the mechanical testing of the assembly takes place outside the Gauteng Province or South Africa, the tenderer shall make all the necessary arrangements for three (3) Engineer representatives and three (3) Employer representatives and one (1) Contractor representative to witness the mechanical testing. The cost thereof shall be for the account of the tenderer.

Should the Test joint fail, the mechanical testing, the tenderer shall, at his/her own cost, re-test another sample at the approved and accredited mechanical testing laboratory.

#### **C3.1.16.14. METHOD STATEMENT (SAFE WORK PROCEDURE TO PERFORM MAIN TASKS)**

The contractor is expected as part of his tender submission documentation submits Method Statements on how to perform the Main Tasks listed below.

The method Statement must in detail describe:

- a) The preparation work.
- b) Equipment.
- c) Resources needed.
- d) Actual procedure to execute.
- e) The checks or critical actions to proof the Task.
- f) Paperwork and sign off. Please include any drawings, sketches or photos that will assist

**Table 7: Method Statement**

| Item | Main Task  | Safe Method of Execution | Risks Dealing with. |
|------|--|--------------------------|---------------------|
| 1    | Assembly of a three piece slip joint steel mono pole           |                          |                     |
| 2    | Planting of intermediate mono pole                             |                          |                     |
| 3    | Planting of a strain mono pole                                 |                          |                     |
| 4    | Installation of stay   |                          |                     |
| 5    | Installation of temporary or construction stay                 |                          |                     |
| 6    | Installation of compression Full tension joint -ACSR conductor |                          |                     |
| 7    | Installation of Compression dead end for ACSR conductor        |                          |                     |

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.16.15. TECHNICAL SPECIFICATION**

It is not possible to specify all works and material in its minutest detail. There is a vast list of national and international standards that applies to the construction of overhead power lines and will therefore not be listed as manufacturers should be cognisance of the applicable specifications and standards.

##### **C3.1.16.15.1. PRELIMINARY AND GENERAL**

###### **WORK SPECIFICATION:**

The Contractor shall allow for the following specific requirements of the Engineer:

- Office accommodation for meetings held on site.

In addition to the specific requirements of the Engineer, detailed above, the Contractor shall allow for his own preliminaries and/or overhead costs as required for the execution of the contract. It shall be divided into the following two sections:

###### **FIXED-CHARGE ITEMS SUCH AS (SANS 1200A - 8.3):**

- Contractual requirements.
- Establishment of facilities on site such as plant, sheds, water, electricity, lighting, etc.
- Removal of facilities from site after completion of work.
- Any other fixed-charge items.

###### **TIME RELATED ITEMS SUCH AS (SANS 1200A - 8.4):**

- Contractual requirements.
- Operation & maintenance of facilities on site.
- Supervision.
- Company and head office overhead costs.
- Comply with Health and Safety requirements.
- Other time related items.

###### **MATERIAL SPECIFICATION:**

The specific Contractor shall supply, transport and off-load his own facilities such as sheds, water, electricity, lighting, etc. on the site. The Contractor shall also be responsible to remove all facilities established on site after his work is completed.

##### **C3.1.16.15.2. LINE CONSTRUCTION**

###### **WORKS SPECIFICATION**

###### **NOTES:**

- All work shall be in accordance to the relevant SABS 1200 documents and Eskom Specification TRMSCAAC1, TRMASAAJ7, SCSASABF9 and SCSASABG1.
- All labour costs shall be included in quoted rate.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

##### **FOUNDATIONS SHALL INCLUDE:**

- Supply and erecting complete foundations according to the relevant drawing from SCSASABG1 including excavations, formation, reinforcing, holding down bolts, concrete casting and backfilling with the appropriate mixture.
- Risk of collapse and keeping excavations free of water shall be included in the quoted rate.
- All excavations shall be kept covered or barricaded, if unattended, in a manner accepted by Eskom to prevent injury to people or livestock.
- The Contractor shall notify the Clerk of Works upon completion of the excavation for the foundation. No shuttering, reinforcing steel or concrete shall be placed until the Clerk of Works has inspected the excavations and acknowledge his approval.
- For construction purposes, the correct foundation shall be installed for the type of soil conditions and structure to be installed.
- The Contractor shall do foundation type nominations before construction of the line takes place.
- The nominations shall be done in the vicinity of each supporting structure position where the foundation is to be installed.
- Steel plates shall be used for setting all holding down bolts.
- The nominated foundation types shall be re-evaluated on site by the Contractor, in conjunction with the Clerk of Works, after the excavation of the initial foundation type has been done.
- The final foundation nomination shall be the responsibility of the Contractor and shall be logged in the Construction Handbook.
- The authorised person responsible for the foundations shall sign the 'Foundation' certificate in the Construction Handbook.

##### **TOWER EARTHING SHALL INCLUDE:**

###### **Steel Poles:**

- Install an earthing electrode should the desired tower footing resistance not be achieved.
- Excavation in all materials 200mm wide trenches for the earth electrode.
- Risk of collapse and keeping excavations free of water shall be included in the quoted rate.
- The earth electrode for the steel poles shall be a three point star as shown on drawing 2-D-WT/763.
- The earth electrode shall be bonded to the steel pole using 7/2.12 (25mm<sup>2</sup>) stranded copper conductor having a crimped lug on the end that will be bonded to the steel pole.
- The lug shall be fastened to the pole with a M12 galvanised bolt.
- All visible copper protruding above the ground shall be painted with the same type and colour paints of the equivalent or supports which it is bonded to.
- The footing resistance of each tower shall be measured before stringing takes place and shall be logged in the Construction Handbook.
- The authorised person responsible for the tower earthing shall sign the 'Earthing' certificate in the Construction Handbook.
- The nominal tower footing resistance shall be less than 20Ω.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

- The first five steel poles from the substation, shall have a footing resistance less than  $10\Omega$ , if not, the shield wire on these structures shall be insulated.
- Where the specified tower footing resistance have not been obtained using standard earthing methods, additional earthing shall be installed.
- The additional earthing shall be counter poise conductors in accordance to SCSASABF9.

#### **Terminal Structures:**

- Earthing of the terminal structure shall be according to the latest revision of SCSASABF9 and to Eskom earthing Standard D-DT 5085.
- The terminal structure shall be bonded to the main substation earth mat with a single 50x3mm copper strap.
- The copper strap will be installed by the substation Contractor and bonded by the line Contractor.
- The copper strap shall be bonded to the terminal tower legs with M16 bolts.
- All visible copper protruding above the ground shall be painted with the same type and colour paint of the equivalent or supports, which it is bonded to.
- The footing resistance of the terminal tower shall be measured before stringing or bonding to the main substation earth mat takes place and shall be logged in the Construction Handbook.
- The authorised person responsible for the tower earthing shall sign the 'Earthing' certificate in the Construction handbook.
- The nominal tower footing resistance shall be less than  $10\Omega$ .
- Where the specified tower footing resistance have not been obtained using standard earthing methods, additional earthing shall be installed.
- The additional earthing shall be in accordance to SCSASABF9.

#### **PLANTING OF STEEL POLES SHALL INCLUDE:**

- All steel poles shall be positioned vertically plumb in the centre of the excavations viewed from any direction according to the relevant steel pole drawings.
- Nylon or fabric slings shall be used when handling steel poles.
- Backfilling shall be done according to SCSASABK8 – Distribution Standard for soil compaction for stay and pole foundations.
- Imported soil shall be used for the soil/cement mixture and shall not consist of any excavated Black Turf.
- The layers shall be compacted to a minimum density of 95% MOD AASHTO before the next layer of soil/cement mixture is placed.
- For stayed poles with concrete anchors, the pole shall not be erected until the concrete has had 21 days in which to cure.
- The authorised person responsible for the installation of the towers shall sign the 'Tower Installation' certificate in the Construction Handbook.

#### **ASSEMBLY AND ERECTION OF TERMINAL STRUCTURES SHALL INCLUDE:**

- The terminal towers shall be assembled and erected on the complete tower foundation.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

- Towers shall not be erected until the concrete foundation has had 14 days in which to cure.
- Terminal tower material in storage shall be blocked off the ground with sufficient number of blocks to prevent bending or warping of individual members.
- Nylon or fabric slings shall be used when handling steel members.
- Tower material shall not be dumped or dropped from trucks, but shall be carefully off-loaded and stacked.
- Steel towers that become bent, twisted or deformed during transport, assembly or erection shall be replaced at the expense of the Contractor.
- The threaded portions of any bolt shall project through the corresponding nuts by an amount not exceeding 15mm and not less than 3mm.
- All bolts shall be tightened and thereafter fixed in position by punching four indentations symmetrically around the threads with a round pointed centre punch.
- All nuts and exposed bolt threads shall be painted with accepted calcium plum bate based galvanised iron primer.
- The authorised person responsible for the installation of the towers shall sign the 'Tower Installation' certificate in the Construction Handbook.

#### **INSTALLING STAY ROD ASSEMBLY SHALL INCLUDE:**

- Supply and install complete stay rod assembly according to specified drawings in Volume 6, including excavations, concrete casting, backfilling and compaction.
- Risk of collapse and keeping excavations free of water shall be included in the quoted rate.
- All excavations shall be kept covered or barricaded in a manner accepted by Eskom to prevent injury to people or livestock when no casting is done.
- The Contractor shall notify the Clerk of Works upon completion of the excavation for the stay rod. No concrete shall be placed until the Clerk of Works has inspected the excavations and acknowledge his approval.
- For construction purposes the correct hole type shall be installed for the type of soil conditions and stay rod assembly to be installed.
- The excavation shall be done at a distance away from the pole so that the angle of the stay wire after being installed is 45° as shown on drawings (See Volume 6, drawing list, e.g. 2-WT/1143 Sheet 1).
- The Contractor shall do excavation nominations before construction of the line takes place.
- The nominations shall be done in the vicinity of each supporting structure position where the stay rod is to be installed.
- The nominated excavations shall be re-evaluated on site by the Contractor, in conjunction with the Clerk of Works, after the excavation of the stay rod hole has been done.
- The final excavation nomination shall be the responsibility of the Contractor and shall be logged in the Construction Handbook.
- The soil will be compacted in strict accordance to SCSASABK8.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**PERCHING BRACKET**

- Perching brackets must be installed on all structures.
- The attachment of the perching bracket must be done as indicated on drawing D-DT-7347.

**INSTALLING STAY WIRE SHALL INCLUDE:**

- The stay wires shall be handled with care to prevent damage to the individual strands.
- The stay wire shall be long enough to be tied to the stay rod at, at least two positions as indicated on drawing e.g. 2-WT/1143 Sheet 1.
- All structures shall be stayed according to applicable drawings. Please ensure compliance.

**DRESSING STRUCTURES SHALL INCLUDE:**

- Installing all hardware according to the relevant assembly drawings.
- All bolts shall be secured with stainless steel split pins.
- All bolts and split pins of the hardware shall be installed pointing in one direction so that the split pins are visible from one side of the line only.
- Earth wire insulators shall be installed on the steel structures where the line runs parallel to the railway lines and 800m or both sides of a pipe line crossing.
- Earth wire at Name
- Substation shall be terminated at the line terminal structures.
- The earth wire shall be bonded to the steel structure for all other structures.

**DISPOSAL OF EXCAVATED MATERIAL SHALL INCLUDE:**

- Removal of excavated Black Turf or any other soil unsuitable for backfilling and transporting it to borrow pits.
- The excavated material shall be disposed of in borrow pits or a suitable place, indicated by the Eskom site representative or the Eskom environmental representative.
- The Contractor shall make own arrangements for the provision to dispose of the excavated material on such a disposal place.
- Free haul shall be the distance within a radius of 5km from the pole/tower position.
- Limited haul shall be the first 1km beyond the end of the free haul distance by the shortest practicable route.
- Long haul shall be the remainder of the distance beyond the limited haul by the shortest practicable route.

**IMPORTING SOIL SHALL INCLUDE:**

- Transporting imported soil from borrow pits to pole/tower position.
- In areas where the excavated soil is Black Turf, imported soil shall be used for the soil/cement mixture.



## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

- The Contractor shall make own arrangements for the provision of a suitable borrow pit for importing soil.
- Free haul shall be the distance within a radius of 5km from the pole/tower position.
- Limited haul shall be the first 1km beyond the end of the free haul distance by the shortest practical route.
- Long haul shall be the remainder of the distance beyond the limited haul by the shortest practical route.

#### **TRANSPORTATION SHALL INCLUDE:**

- Transporting all material and equipment from the construction camp to the pole/tower position.
- Free haul shall be the distance within a radius of 5km from the construction camp.
- Limited haul shall be the first 1km beyond the end of the free haul distance by the shortest practicable route.
- Long haul shall be the remainder of the distance beyond the limited haul by the shortest practicable route.
- If the Contractor is planning to use a batching plant not located in the construction camp, the cost due to transporting the concrete from the batching plant to the construction camp shall be at the expense of the Contractor.

#### **MATERIAL SPECIFICATION**

##### **NOTES:**

- Unless otherwise specified, the Eskom project manager shall specify what material will be provided by Eskom and what material must be provided by the Contractor.
- The Contractor shall book the material from the Eskom store in Store Name, transport and off-load all material at the construction camp.
- The Contractor shall transport all equipment and material for the day's work from the construction camp and off-load it at the specific pole position.

##### **FOUNDATIONS:**

- Unless otherwise specified, the Contractor shall supply all material and equipment necessary for the supporting structure foundations along the line route. The Contractor shall transport all the material and equipment to the construction camp.
- At the end of the day, the Contractor shall transport all the unused equipment and material back to the construction camp.

##### **TOWER EARTHING:**

- The Contractor shall supply all the equipment necessary for installing the tower earthing.
- Conductive concrete where required, shall be supplied by the Contractor.
- The Contractor shall supply the tower earthing bolts with nuts and washers in accordance to the relevant tower drawings.
- All bolts and nuts shall be in accordance to SABS 135 with a strength grade of 4.8.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

- All bolts with nuts and washers used for bonding shall be hot dipped galvanised to SABS ISO 1461.

#### **PLANTING POLES:**

- The Contractor shall supply all the equipment necessary for planting the poles.
- All additional bolts with nuts and washers not supplied with the steel pole shall be supplied by the Contractor and be in accordance to the relevant tower drawings.
- All bolts and nuts shall be in accordance to SABS 135 with a strength grade of 4.8.
- All bolts with nuts and washers used for bonding shall be hot dipped galvanised to SABS ISO 1461.

#### **TERMINAL TOWER ASSEMBLY AND ERECTION:**

- The Contractor shall supply all the equipment necessary for assembling and erecting the terminal towers.
- All additional bolts with nuts and washers not supplied with the steel pole shall be supplied by the Contractor and be in accordance to the relevant tower drawings.
- All bolts and nuts shall be in accordance to SABS 135 with a strength grade of 4.8.
- All bolts with nuts and washers used for bonding shall be hot dipped galvanised to SABS ISO 1461.

#### **STAY ROD INSTALLATION:**

- The Contractor shall supply all the equipment necessary for installing the stay rods.
- The Contractor shall supply the concrete where applicable and imported soil for the stay rod assemblies.

#### **PERCHING BRACKET**

- The Contractor shall supply all the equipment necessary for installing the perching brackets.

#### **INSTALLING STAYS WIRES:**

- The Contractor shall supply all the equipment necessary for installing the stay wires.

#### **DRESSING THE STRUCTURES:**

- The Contractor shall supply all the equipment necessary for dressing all the structures.
- The Contractor shall supply additional bolts with nuts and washers.
- Bolts, nuts and washers shall be hot dipped galvanised to SABS ISO 1461.
- Bolts shall be to SABS 135 with a strength grade of 4.8.

#### **DISPOSAL OF EXCAVATED MATERIAL:**

- The Contractor shall be responsible for disposing of excavated soil not used for backfilling.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

- The Contractor shall transport all the excavated soil not used for backfilling to the suitable borrow pit.

#### **IMPORTING SOIL:**

- The Contractor shall be responsible for supplying imported soil. If not otherwise specified, the imported soil shall be in accordance to SABS 1200.
- The imported soil shall not contain notable quantities of organic matter or stones of average dimension exceeding 150mm.
- The Contractor shall transport all the imported soil from the borrow pit to the pole position.

#### **TRANSPORTATION:**

- The Contractor shall transport the concrete from the batching plant to the pole position.

#### **DOCUMENTATION:**

- The Engineers Clerk of Works or the Engineer's representative shall supply the Construction Handbook.
- The Contractor shall complete all the sections of the Construction Handbook that applies to the construction of the line.
- The sections shall include all the job description and check list tables, building of the line table and earthing table.
- The Contractor shall appoint a responsible person for each task listed on the 'Authorised Persons' sheet and fill their names in on this sheet.
- The Contractor shall ensure that the authorised person shall sign the task certificate after the completion of the work.
- After completing the Construction Handbook, the Contractor shall return the Construction Handbook back to Eskom for review.

#### **C3.1.16.15.3. STRINGING AND REGULATION**

#### **WORKS SPECIFICATIONS**

#### **NOTES:**

- All work shall be done according to Eskom Specification TRMSCAAC1.
- Stringing, jointing, conductor repairs and regulation shall be reported in the Construction Handbook.
- All labour cost shall be included in quoted rate.
- The successful tenderer shall prepare and test a test string according to TRMSCAAC1 before any stringing takes place. The tenderer shall submit four copies of the test report to Eskom for review.
- No stringing shall take place before written approval is received from Eskom.
- Copies of calibration certificates, test reports, etc. for all the instruments and equipment used in the stringing and regulation process shall be submitted to Eskom for review.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

##### **STRINGING CONDUCTORS SHALL INCLUDE:**

- The top phase on the steel poles shall be the WHITE phase.
- If the phases should be rotated, it should be done at the 90° strain tower.
- Tension Stringing shall be used to string the phase conductors and earth wires.
- All stringing shall be done according to the provided Sag and Tension Charts.
- Suitable structures under each phase conductors shall be erected to protect all fences from conductor damage during stringing.
- Adequate protection shall be provided where there may be danger of a conductor being crossed over by vehicles, or damaged by other equipment or objects.
- Conductors shall not be left in contact with the ground, vegetable matter or any conducting or semi-conducting material.
- Wood lagging shall be used to protect the conductor when working at ground level.
- Jumpers shall be formed in a manner as to provide the maximum amount of clearance from earthed hardware, and tower steelwork.
- Where temporary stays are required, the Contractor shall be responsible for making the suitable arrangements.
- Conductors shall not be anchored to any part of the steel poles/towers.

##### **LINE AND RAILWAY CROSSINGS SHALL INCLUDE:**

- All line crossing shall be in accordance to TRMSCAAC1 - Installation of phase and earth conductors.
- All Railway crossing shall be in accordance to TRMSCAAC1 - Installation of phase and earth conductors.
- The price quoted shall include authorised temporary work carried out by the Contractor, transport, erection and dismantling of temporary conductor supports at all crossings, excluding crossings requiring special scaffolding.

##### **CONDUCTOR JOINTS SHALL INCLUDE:**

- Only Eskom coded jointers shall be authorised to carry out joints on phase conductors and earth wires.
- Each coded jointer shall further be issued with his unique identification number or sign, which he shall use to punch, completed joints as a register of his acceptance.
- The number of joints over the total length of the line shall be kept to a minimum.
- Joints shall not be closer than 15m from suspension towers.
- Joints shall not be closer than 30m from strain towers.
- Joints shall not be installed in spans crossing railways, proclaimed roads, power or communication lines.
- In no case shall there be more than one joint in a given span.
- Joints shall not be installed in a span that is dead-ended at both ends.
- No joint shall pass through a stringing pulley.
- All conductor joints shall be reported on in the Construction Handbook.
- The authorised person responsible for the jointing shall sign the 'Joint and Damage' certificate in the Construction Handbook.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**CONDUCTOR DAMAGE REPAIRS:**

- Damage to conductors caused by the Contractor shall be repaired in a manner determined by the Clerk of Works, at the expense of the Contractor.
- Where there is repeated damage in the same span, or in consecutive spans, the entire conductor in such spans shall be replaced.
- All conductor repairs shall be reported on in the Construction Handbook.
- The authorised person responsible for the conductor repairs shall sign the 'Joint and Damage' certificate in the Construction Handbook.

**MAKING OFF SHALL INCLUDE:**

- Making off, phase conductors and earth wires at each steel pole structure, including clamping-in all conductors and attaching armour rods and vibration dampers to the conductor.  
Cutting the conductors where the new lines will be connected onto the existing lines
- Connecting the cut conductors onto the new towers.
- Connecting the jumpers from the old lines to the new lines.
- The earth wire at the terminal structure shall be made off according to drawing 2-D-WT/816.
- All regulation shall be done according to the provided Sag and Tension Charts.
- The conductor temperature shall be determined by means of a Celsius thermometer as shown in Annexure E of the Construction Handbook.
- All conductors in a regulated section shall be clamped-in, beginning at the second structure from the forward end of the pulling, and shall progress structure by structure, until the conductors at all structures are clamped-in.
- The conductors shall be clamped-in in such a manner that no additional tension is placed on the insulators
- Armour rods shall be installed according to the manufacturer's specifications.
- The suspension clamps and U-bolts shall be torque to manufacturer's specifications.
- Asymmetrical vibration dampers shall be installed on the phase conductors and Spiral vibration dampers shall be installed on the earth wires.
- The asymmetrical vibration dampers shall be installed on all tensioned spans as specified in the table and positioned according to the tables in Volume 2 of this document. The placement shall be measured from the middle of a suspension clamp and from the edge of a strain clamp.
- The Spiral dampers shall be installed on all tensioned spans, as specified in the table and positioned according to the tables in Volume 2 of this document.
- Helical preform connected vibration dampers shall be installed according to the manufacturer's specifications.
- The authorised person responsible for the regulation shall sign the 'Sag and Tension' certificate in the Construction Handbook.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **DOCUMENTATION:**

- The Contractor shall complete all the sections of the Construction Handbook that applies to the stringing and regulation of the line.
- The sections shall include all the job description and check list tables and the regulation table.
- The Contractor shall appoint a responsible person for the stringing, jointing and regulation tasks listed on the 'Authorised Persons' sheet and fill their names in on this sheet.
- The Contractor shall ensure that the authorised person shall sign the task certificate after the completion of the work.
- After completing the Construction Handbook, the Contractor shall return the Construction Handbook back to Eskom for review.

#### **C3.1.16.15.4. LABELLING**

#### **WORKS SPECIFICATIONS**

##### **NOTES:**

- All labels shall be in according to Eskom Specification ESKASAAN0, SCSSCAAP5 and to drawings D-DT 5064 and 2-WT-1148.
- All labour cost shall be included in quoted rate.
- All labels shall be manufactured according to Eskom Specification TRMSCAAC5.
- All labels, except line crossing labels, shall be black lettering on yellow background.

##### **POLE IDENTIFICATION LABELS:**

- The bottom of the identification labels shall not be less than 5000mm from the base of the steel pole.
- The pole identification labels shall be strapped to the pole with not less than three 12mm stainless steel straps.
- The off structure shall be numbered as the first structure.
- The numbers shall be changed to correlate with the existing numbering.

##### **LINE DESIGNATION LABELS:**

- A line designation labels shall be installed on the third suspension structure from the substations
- The line designation labels shall be installed between the top phase conductor and the earth wire.
- The line designations shall be installed below the line-crossing label.
- The line designation labels shall be strapped to the pole with not less than three 12mm stainless steel straps.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **LINE CROSSING LABELS:**

- All line crossing labels shall be installed so that it would be visible from the direction of approaching the line crossing, line deviation or T-off.
- All line crossing labels shall be installed above line designation labels.
- All line crossing labels shall be a black diagonal cross on an orange background.
- The line crossing labels on the steel poles shall be installed between the top phase conductor and the earth wire
- The line crossing labels shall be strapped to the pole with not less than three 12mm stainless steel straps.
- Line crossing labels will only be installed where the new line crosses underneath other lines

#### **MATERIALS SPECIFICATIONS**

- Unless otherwise specified, the Eskom project manager shall specify what material will be supplied by Eskom for installing the line labels.
- The Contractor shall book the material from the Eskom store in the nearest depot, transport and off-load all material at the construction camp. The Contractor shall also supply all the equipment necessary for installing the line labels.
- The Contractor shall transport all equipment and material from the construction camp to the pole positions.
- pole identification labels, Line designation labels and Line crossing labels:
- All fixing straps, bolts with nuts and the Contractor shall supply washers for the labels.
- The fixing straps shall be 12mm stainless steel straps.
- All bolts, nuts and washers shall be hot dipped galvanised to SABS ISO 1461.
- All bolts shall be in accordance to SABS 135 with a strength grade of 4.8.
- All labels shall be in accordance to ESKASAAN0 and DISASZAA2.
- All labels shall have a vitreous enamel finish.

#### **C3.1.16.16. OHL PROCEDURES**

The following are typical procedures for some of the risks listed in the table above. The Contractor as part of his health and safety plan must draw up a procedure like this for all the risks shown on the previous page and all other risks identified by Contractor/ Project Manager/

All Safe Work Procedures must be adhered to. Special attention must be given to the following procedures:

- PC-09-GC-21 : Stringing (Tension and Terminate)
- PC-09-GC-29 : Dismantling of MV and LV overhead power lines
- PC-09-GC-31 : Stringing of conductors across a road
- PC-09-GC-34 : How to do closing span on existing/new lines
- PC-09-GC-39 : Outages

The following sections are extracts from the above procedures.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.16.16.1. STRINGING (TENSION AND TERMINATE) (PC-09GC-21)**

##### **DEFINITION**

Stringing means the tensioning and termination of conductors in the prescribed manner and specifications.

##### **DANGERS**

- Falling objects
- Workmen can fall from towers
- Induction from other lines
- Traffic-Roads and/or railway

##### **PROCEDURE**

- The equipment and methods used for stringing the conductors (including earth conductors) shall be such that the conductors will not be damaged. Particular care shall be taken at all times to ensure that the conductors do not become kinked, twisted or abraded in any manner.
- Stringing shall be done in daylight hours only.
- Tensions, while pulling, must be sufficient to clear all obstacles safely without damage to the conductor. At no time shall the pulling tension exceed the tension shown on the sag charts.
- Adequate protection shall be provided where there may be danger of a conductor being crossed over by vehicles, or damaged by other equipment and objects.
- Radio communications shall be used to relay information and instructions between the conductor tensioning station, intermediate check points, mobile stations and the pulling station at all times during the stringing-tensioning operation.
- Whenever joints or dead-ends are made, auxiliary erection clamps and hauling devices shall not be placed closer than 8m to the point of joint or dead-end.
- The conductor shall be cut with a ratchet or guillotine cutter to produce a clean cut, retaining the normal strand lay and producing minimum burrs. The aluminium strands shall then be stripped from the steel core by using an acceptable stripper. Under no circumstances shall high tensile hacksaw blades be used to cut conductor.
- The Contractor shall string all conductors and earth conductor to the appropriate sags and tensions as determined from the conditions specified in the contract documents.
- Conductors and earth conductors shall be strung to the appropriate sag determined for the actual span length, and the equivalent span of the strain section involved.
- The Contractor shall provide, and maintain in good condition, suitable dynamometers, sag boards or other accepted apparatus for the proper checking of the work. Dynamometers shall read in Newton's and shall be tested and re- calibrated at regular intervals
- In pulling the conductor, caution shall be used to avoid pulling the conductor above sag.
- All conductors, except for conductors in sag sections over flat terrain, shall be plumb-marked at each structure for the complete section regulated, before clamping-in or dead-ending of the conductor is begun.



## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.16.16.2. DISMANTLING OF MV AND LV OVERHEAD POWER LINES (PC-09-GC-29)**

Not Applicable

#### **C3.1.16.16.3. STRINGING OF CONDUCTOR ACROSS A ROAD (PC-09-GC-31)**

##### **DEFINITION**

Stringing means the tensioning and termination of conductors in the prescribed manner and specifications.

##### **DANGERS**

- Traffic/Pedestrians
- Falling from heights
- Falling objects
- Hand injuries

##### **PROCEDURES**

- Assign workers with red flags and road signs to strategic points on either side of the road crossing position.
- The assistance of the Traffic Department can be requested where national roads are involved.
- Regulate traffic as required to execute the work safely.
- Run out conductor as per procedure number PC-09-RC-04.
- String conductors as per procedure number PC-09-GC-13.
- Tension and sag conductor as per procedure number PC-09-GC-11.
- Ensure correct clearances are obtained as indicated on profile.
- Recall workers with flags and road signs.

#### **C3.1.16.16.4. HOW TO DO CLOSING SPAN ON EXISTING/NEW LINES (PC-09-GC-34)**

##### **DEFINITION**

Closing span means the connection of newly built lines onto an existing live line.

##### **DANGERS**

- Energised overhead power lines
- Falling objects

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **PROCEDURES**

- Ensure existing live line is isolated and earthed in accordance with Reg. 5.04.5 (HV Regs).
- Dress the existing pole with the necessary hardware.
- String conductor according to Procedures PC-09-GC-11 and PC-09-GC-13.
- Install jumpers according to procedure PC-09-GC-22.
- Remove all personnel, equipment and tools.
- Cancel permit (if issued).

#### **C3.1.16.16.5. OUTAGES (PC-09-GC-39)**

#### **DEFINITION**

Outages mean the switching off of all sources of supply of power so that work can be done on a specific point or apparatus.

#### **DANGERS**

- Switching, linking and earthing errors
- Static
- Fall from heights
- Falling objects
- Weather (e.g. lightning)
- Back feed through network
- Work on wrong line

#### **PROCEDURE**

##### **PRIOR TO OUTAGE DATE**

- Ensure work planning is complete and reflected in the duration of outage required.
- Supervisor liaise with Project Management timeously to allow a 14 day notification period to national control so that liaison may occur on site with all stake holders present. A date, time and duration is set and minuted.

##### **ON OUTAGE DATE**

- OTSC represented by the Appointed Operator perform the required operating. Make the area required safe for work and issues a work permit to Construction's appointed Responsible Person.
- Responsible Person ensures asset to be worked on is safe according to regulations and accepts the permit by signing as Responsible Person.
- Responsible Person informs all Construction persons under his supervision of the status of the asset as well as to their specific duties.
- Responsible Person constantly supervises to ensure adherence to ORHVS and general safe working practices during the outage period.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **COMPLETION AND HANDING OVER**

- Responsible Person ensures that all elements of the asset are as per contract requirement and that all materials, personnel, equipment and machinery are removed to enable safe operation of the asset.
- Responsible Person hands back the asset to the Appointed Operator by signing off the permit after which the Appointed Operator will carry out his function. This is also done in liaison with national control. In the case of a new asset being put into operation, a handing over certificate to TSC by Project Management.

#### **C3.1.16.17. QUALITY PLAN**

- The Contractor needs to submit a quality plan indicating the control points for quality to ensure that the works are done according to specification.
- The Contractor is required to employ a competent Supervisor or Foreman on site for the duration of the project to implement workmanship quality checks. .
- The Engineer or his representative will do inspections and quality checks on installations completed by the Contractor prior to hand-over of each project.

#### **C3.1.16.18. ACCESS TO THE SITE**

- The Employer will provide the Contractor with an Access Certificate to formally provide access to the site and works implementation.
- The Contractor shall ensure that he is familiar with conditions of access roads and sites as well as subsurface conditions prior to tendering and to include this in his pricing.

#### **C3.1.16.19. INTERACTION WITH CUSTOMERS / PARTIES AFFECTED**

- The Tenderer shall be responsible for negotiation with customers with regard to use of access routes on farms etc.
- The Tenderer will be responsible for negotiation with land or business owners and / or the Local Authority with regard to the construction activities of the works.
- The Tenderer will be responsible for external disputes which may occur with regard to the construction activities of the works.
- The Tenderer is required to make all the necessary arrangements with the Local Authorities for road crossing structures and removal thereof, e.g. Removal of pavements, thrust boring under roads, way leaves, etc.

#### **C3.1.16.20. CARRYING OUT THE WORKS**

- The Scope of "Works" is an extension of the drawings, specifications and bills of quantities listed. The Contractor shall notify the Employer of any discrepancies before commencement of the works
- The onus is on the Contractor to obtain the latest revision of standards applicable.

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

#### **CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

- The Contractor is required to supply all material, labour, plant, equipment, loose tools, consumables and transport for the duration and completion of the project unless alternatively requested in the "Services Supplied - Section 5".
- Contractor to provide summary of all costs for the execution of the works of the complete project.
- The Contractor must immediately notify the Employer in writing of scope and site variations.
- The Contractor will report all obstacles on site that could impact negatively on time and cost in writing to the Employer.
- Contractor to clear and de-establish total site on completion of proposed works.
- Contractor is required to clear and cart away rubble and surplus works

#### **C3.1.16.21. VEGETATION MANAGEMENT**

The supplier must ensure:

- that all indigenous and protected trees (in terms of national and provincial legislation) are identified and permits obtained from the relevant authority prior to the cutting of such trees.
- that written permission is obtained from the owner of protected trees prior to the cutting of such trees.
- that permits be available on site where such trees are cut.
- That the owner be consulted, and his/her consent being obtained, prior to the cutting of trees.

#### **C3.1.16.22. WASTE DISPOSAL**

The supplier shall ensure:

- That waste is disposed of on a permitted waste site, for the applicable waste type, in terms of the Environment Conservation Act, 73 of 1989.
- A disposal certificate is issued to the Employer or his Agent prior to final payment, as proof of disposal.
- That where appropriate, waste is being recycled or re-used.

#### **C3.1.16.23. SUPPLYING CLEANING MATERIAL**

The supplier shall ensure:

- That products sold to the Employer or his Agent is not in contravention of any international or national environmental treaty, agreement or environmental legislation.
- That products sold to Employer or his Agent are biodegradable,
- That material data sheets are provided for all products as well as an assurance letter providing assurance in terms of above two bullets.
- That a service be provided for the re-use or safe disposal of hazardous substances.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.1.16.24. EMERGENCY WORK**

The supplier shall ensure:

- That all environmental risks associated with the activity be assessed and documented prior to the execution of the activity.
- Identified environmental risks must be avoided and where it cannot be avoided, be remediated to the satisfaction of the Employer or his Agent, the landowner, or any relevant Government authority.
- That all environmental incidents and complaints are reported to the project manager within 24 hours.

#### **C3.1.17. POWER TRANSFORMERS (PSE 18)**

This section of the specification provides for the manufacture, supply, testing before shipment, delivery, off-loading and positioning on a concrete base, installation, site testing, handing over in a working condition and maintenance of one (1), 20 MVA, 132 000/11 000 V step down transformers with on-load tap changing equipment at Siyanqoba Substation.

The Contract also includes the supply and delivery of all auxiliary materials and equipment necessary for a complete installation and all drawings, plans and instructions.

The power transformers to be supplied shall comply with the latest Eskom Specification (240-68973110) "SPECIFICATION FOR POWER TRANSFORMERS RATED FOR 1.25MVA AND ABOVE AND WITH HIGHEST VOLTAGE OF 2.2kV OR ABOVE".

Transformers offered shall comply with the following specific requirements:

- |  |                                   |
|--|-----------------------------------|
| a) Application:                                | Outdoor                           |
| b) Number required                             | One (1)                           |
| c) Dry type or oil immersed:                   | Oil immersed                      |
| d) Rated Frequency:                            | 50 Hz                             |
| e) Continuous maximum rating at rated voltage: | 20 MVA                            |
| f) Vector Group:                               | Ynd1                              |
| g) On load voltages                            |                                   |
| h) Primary                                     | 132 kV                            |
| i) Secondary                                   | 11 kV                             |
| j) Tertiary                                    |                                   |
| k) Earthing                                    |                                   |
| l) Primary                                     | Solid or via 66 kV surge arrestor |
| m) Secondary                                   | NECRT                             |
| n) Tertiary                                    | Not Applicable.                   |
| o) Anti-vibration                              | 20 mm malthoid (Three ply)        |

If there is any uncertainty to any of the transformer parameters, it shall be clarified in writing with the Engineer prior to closing of the tender. Transformers within the substation shall be capable of short time parallel operation for load transfer.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

The cooling system of the transformer shall be an Oil-Neutral and Air-Neutral (ONAN) system for the maximum transformer rating.

The transformers are required to be supplied with open air insulated tank top mounted bushings for both the 132 kV as well as the 11 kV side. The HV bushings on all transformers are to be of the Resin Impregnated Paper (RIP) condenser core type, with composite external insulation with silicone or porcelain weather sheds. The 11 kV side bushings of the transformers shall have a minimum insulation level for 33 kV with a creepage distance of 31mm/kV.

It is a requirement of this contract that the power transformers are equipped with radiator banks fitted to the transformer in the space allocated on the project drawings. The power transformer, radiator banks and auxiliary transformers shall be effectively earthed to the substation earth system.

#### **C3.1.17.1. CLEARANCES**

The electrical clearance shall be:

##### HV (132 kV – 145 kV RMS)

- a) Phase – Earth: 1000mm
- b) Working Clearance: 3400mm (Vertical)  
2400mm (Horizontal)

##### MV (11 kV – 12 kV RMS)

- a) Phase – Earth: 200mm
- b) Working Clearance: 2600mm (Vertical)  
1600mm (Horizontal)

#### **C3.1.17.2. NEUTRAL BUSHING**

The neutral bushing shall be solidly earthed by means of a 50 x 3 mm Cu strap painted silver. The neutral bushing must be equipped with two CT cores in turret arrangement as an integral or in built part of the transformer:

- a) Core 1 – Class X for LV REF Protection
- b) Core 2 – SEF Protection
- c) CT wiring to be brought out into a CT JB and wired to the transformer marshalling box or kiosk.

#### **C3.1.17.3. TESTS**

The transformer shall be tested in accordance with GSE18

The transformer test methodology and connection diagrams for testing shall be submitted together with the bid offer.

#### **C3.1.18. NECRT (PSE 20)**

This section of the specification provides for the manufacture, supply, testing before shipment, delivery, off-loading and positioning on a concrete base, installation, site testing, handing over

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

in a working condition and maintenance of combined oil-immersed 11 kV three phased neutral electro-magnetic couplers with neutral earthing resistors and auxiliary transformers (NECRT's)

The Contract also includes the supply and delivery of all auxiliary materials and equipment necessary for a complete installation as well as drawings, plans and instructions as further specified herein.

The NECRT's to be supplied shall comply with the latest Eskom Specification (240-57648848) "SPECIFICATION FOR COMBINED THREE-PHASE NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH NEUTRAL EARTHING RESISTORS AND AUXILIARY TRANSFORMERS (NECRT's)".

- |   |               |
|---|---------------|
| a) Application:   | Outdoor       |
| b) Number required:   | One (1)       |
| c) Continuous maximum rating at rated voltage of auxiliary transformer: | 100 kVA       |
| d) Indoor or outdoor:   | Outdoor       |
| e) Dry type or oil immersed:  | Oil immersed  |
| f) Rated Frequency:   | 50 Hz         |
| g) Normal "on-load" voltages:   |               |
| Primary for NECRT   | 11 kV         |
| LV for Aux. Trfr.   | 420 V         |
| h) Method of system earthing  |               |
| MV System   | via NEC / NEC |
| LV  | Solid         |
| i) Vector group of NEC  | Zig-Zag       |
| j) Vector group of auxiliary transformer                                | Dyn 11        |

The NECRT's will be installed on concrete plinths as indicated on the project drawings.

All low voltage circuit breakers to be supplied for this project shall be complete with flash barriers and inter phase barriers with rear insulating screens, Cable and Power connectors, chassis side plates as well as IP40 Escutcheons.

The supply and installation of a 11 kV cable, as well as the LV supply connections between the transformer and the auxiliary transformers form an integral part of this part of the contract.

The auxiliary transformers will be fitted with the following integrated mechanical protection devices, complete with the necessary wiring to the abovementioned control cable boxes:

- Oil/winding over temperature alarm and trip contacts.
- Gas (Buchholz) over pressure alarm and trip functions, complete with sufficient alarm and trip contacts to comply with the protection scheme, shall be provided.
- A common set of alarm/trip contacts for alarm and indication functions in the transformer protection panel.
- A common set of alarm and trip contacts to provide alarm and trip indication for the SCADA system.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

- e) The contractor shall make allowance for the witnessing of the FAT by the Employer / End-User and the Engineer, in the priced unit rate.

#### **C3.1.19. SURGE ARRESTORS (PSE 56)**

The surge arresters to be supplied and installed shall primarily consist of the following:

- a) Supply and install heavy duty station type surge arresters.
- b) Supply and install 3 x 132kV heavy duty station class surge arresters close to the 88kV bushings of the new power transformers with the respective 11 kV surge arresters close to the secondary transformer bushings.
- c) Supply and install 1 x 66 kV neutral surge arresters on the neutral star points of the primary winding on the power transformers.

All the transformer primary and secondary surge arresters shall be mounted on tailor made supports to be fixed and fitted directly on the transformer.

The following surge arrestors are required as part of this contract:

- a) 11 kV Surge arrestor: station class, gapless, metal oxide, polymer housed, minimum MCOV of 12 kV, maximum residual voltage of 45 kV, 10 kA discharge current, Class 2 - line discharge (IEC), 31 mm/kV creepage; [D-DT-6216]
- b) 66 kV Surge arrestor: station class, gapless, metal oxide, polymer housed, minimum MCOV of 48 kV, maximum residual voltage of 165 kV, 10 kA discharge current, Class 2 - line discharge (IEC), 31 mm/kV creepage (used for the protection of unearthed transformer primary neutrals); [D-DT-6212]
- c) 132 kV Surge arrestor: station class, gapless, metal oxide, polymer housed, minimum MCOV of 84 kV, maximum residual voltage of 210 kV, 10 kA discharge current, Class 2 - line discharge (IEC), 31 mm/kV creepage; [D-DT-6211]

Surge arresters shall all preferably be fitted with grading rings. Grading rings shall be rigid and shall be securely fitted to the surge arrester.

Surge counters are required to be provided and installed on all of surge arresters, an insulated base on all PCD attachments shall therefore be included on surge arrester footings. The earthed ends of all surge arresters shall each be independently connected to the substation earthing system, by means of a copper earth conductor with a minimum cross-sectional area of 250mm<sup>2</sup>. In the installation of the surge arrester earth conductors, 90° bends in the earth conductors shall be avoided.

Type Test Certificates indicating full compliance with IEC 60099, IEC 60815 and the relevant Eskom Specification, shall be submitted with all Tenders.

#### **C3.1.20. SUBSTATION TECHNICAL SPECIFICATION – CONTROL PLANT**

The contractor will be responsible for all aspects of the control plant installation.



## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

##### **C3.1.20.1. PROTECTION PHILOSOPHY**

In order to achieve the necessary performance requirements at all voltage levels, protection of the network shall follow the philosophy whereby no single failure of protection and its associated systems shall permit a fault to remain connected to the primary system.

To implement this philosophy, it is necessary to ensure that all faults are detected by independent high speed protection systems, including Main and Back-Up protections, the outputs of which are selectively allocated to independent tripping systems with separate D.C. supplies.

Circuit-breaker fail protection shall be provided to cater for failure of circuit-breakers and associated tripping circuits. The function shall be duplicated and integrated within both main protection systems.

Redundancy of critical functions (e.g. tripping) shall be achieved via hardwired signals in parallel with the specified communication protocol.

The successful tenderer shall be responsible for the detail design, detail schematic drawings, installation, testing, commissioning and handing over of the secondary plant according to the information and equipment offered. All drawings must be submitted to the Engineer for approval prior to manufacturing. The design shall be based on underlying Eskom Distribution Standards.

The control technology design shall be done according to the following schemes:

- Eskom based Transformer protection schemes
- Eskom based On-load Tap Change Control protection schemes

The protection design philosophies for the above mentioned schemes are outlined in the paragraphs to follow. Philosophies given are high level requirements, all details shall be submitted by the Contractor for approval, including a Functional Design Specification for approval detailing all proposed schemes.

HV Protection panels shall be equipped with tiled Mimics and Semaphores or painted Mimics with Semaphores if approved by the Engineer.

##### **C3.1.20.2. PROTECTION PANELS**

The schemes are to be housed in a single free-standing panel.

Two versions of scheme constructions are required: one using a swing frame panel with only front access, the other using a fixed frame panel with front and rear access. This is to cater for the following applications:

- a) Where space is a premium and panels need to be mounted either back to back or against the wall;
- b) Where there is enough space to allow front and rear access and thus make working within the panel considerably easier.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

For this project all panels shall have front and rear access.

Protection panel shall comprise of the following:

- a) Ethernet switch where required
- b) Bay control device
- c) Main protection
- d) Breaker control switches (HV, MV and or LV)( Open /Close)
- e) SIS (Supervisory Isolating Switch)
- f) Lamp check push button
- g) Test normal pushbuttons
- h) MCB's
- i) Panel not healthy lamp, etc.

#### **C3.1.20.3. BREAKER FAIL PHILOSOPHY**

Circuit breaker fail tripping shall be implemented using the relevant circuit's (Intelligent Electronic Device) IED (Circuit Breaker Fail) CBF functionality.

#### **C3.1.20.4. SCHEME SUPPLY SUPERVISION PHILOSOPHY**

All 110 V<sub>D.C.</sub> and 230 V<sub>ac</sub> supply MCBs in the protection control panels shall have mechanically attached auxiliary signal contacts, which when switched off or tripped, will indicate on the protection panels as "Protection/Control Unhealthy" via a red LED and signal to the SCADA system.

Trip circuit supervision of the trip coils shall be via inputs in the IEDs, time delayed to 400 msec (pickup and drop-off) to prevent flicker (operation) during normal switching, and shall monitor the trip coil integrity in the both open and close positions.

#### **C3.1.20.5. INTERLOCKING PHILOSOPHY**

Two transformers may operate in parallel should the operator wish to do so.

For the transformer schemes, a take-along trip shall be implemented so that when the 132 kV (HV) CB is opened, the respective 11 kV incomer CB will also be tripped. An 11 kV CB close shall be inhibited, should the HV circuit be de-energised. For a transformer OC/EF trip the MV breaker shall trip first to unload the transformer following by a trip of the HV breaker – breakers shall be interlocked.

If the 11 kV incomer cable earth is applied, an interlock shall prevent the HV CB from closing if the MV isolator is closed or immediately tripped the HV CB, if last mentioned, is closed.

#### **C3.1.20.6. PERFORMANCE REQUIREMENTS**

The protection shall remain stable for all load conditions, charging and discharging arrangements, harmonic currents, oscillatory currents, resonant effects, or travelling wave effects caused by the transmission system or caused by primary transducers. The protection equipment shall be designed so that a minimum or no routine maintenance is required, in terms of total accumulated time and frequency.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

The design should allow fault location, rectification (possibly by replacement sub-units) and returning to service, to be performed as quickly as possible, preferably with the equipment in service and in situ. Provision of spare fibre cables shall be considered to allow rapid repairs if problems arise.

#### **C3.1.20.7. RELIABILITY**

The supplier shall specify the correct commissioning procedure so that the reliability of the protection is maintained.

#### **C3.1.20.8. SPEED**

To avoid damage to transformer, the protection IED used should operate as quickly as possible. The speed of operation should not compromise the selectivity capability of the IED. Preference will be given to relays with fast tripping times.

It is essential that, under internal fault conditions, the power transformer be isolated from the network in a minimum time. It is imperative therefore that any relay element placed in series with the unit protection be extremely fast acting.

#### **C3.1.20.9. TRIPPING D.C CIRCUIT**

Double-pole miniature circuit-breakers (DP MCBs) shall be provided for the protection and isolation of the D.C. supplies to each scheme.

#### **C3.1.20.10. CLOSING D.C. CIRCUIT**

Anti-pumping - In the event that a breaker is closed into a fault, while the operator is applying a closed signal via a closed control switch, the circuit breaker should trip and prevent closing again until the closing circuit has been de-energized by the operator's releasing the control switch.

#### **C3.1.20.11. PROTECTION CT CIRCUITS**

For each circuit the protection CT core shall feed onto standard terminals and then to the CT test block and IED measuring elements.

A MMLG test block shall be used in all the wired CT circuits. Each test block shall include integral shorting of the incoming terminals when the cover is removed.

For this application, the CT circuits shall be used for the Differential, REF, Breaker-fail, and Over-Current, Earth Fault, and Instantaneous Over-current protection functions and for the Measurements functions.

The neutral of each CT circuit shall be earthed at one place only: on the incoming neutral terminal inside the protection panel. A sliding link terminal shall be provided on the earth connection for isolation proposes in order to facilitate insulation resistance testing.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C3.1.20.12. IED BINARY INPUTS

The main IED is required to be provided with the status of all external plant, trips and alarms so as to relay this information to SCADA system via the serial and Ethernet communication links. This includes indication of each individual element that operates the Master Trip (relay) functionality. It is thus a requirement that the main IED has sufficient binary inputs to accumulate this data.

Changes in states of the inputs shall be logged by the IED's built-in sequence of event recorder function. All trips shall be used to start the IED's disturbance recorder.

#### C3.1.20.13. LOCAL INDICATIONS, PANEL MIMIC AND ANNUNCIATOR

Local indication of the following alarms and trips shall be provided:

- i. Transformer Buchholz Alarm
- ii. Transformer Buchholz Trip
- iii. OLTC Buchholz Alarm
- iv. OLTC Buchholz Trip
- v. Transformer tank over pressure Trip
- vi. Transformer Winding and Oil Temperature Alarm
- vii. Transformer Winding Temperature Trip
- viii. Transformer Oil Temperature Trip
- ix. Transformer Oil Level (High/Low) or Cooler Fail Alarm
- x. Bus zone trip for each busbar.

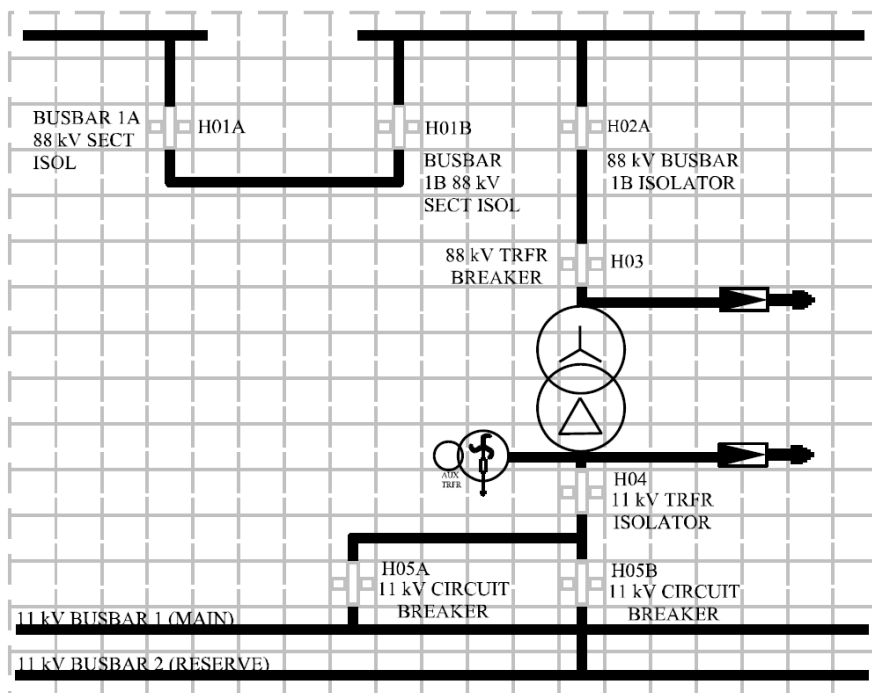


Figure 4: Typical Tiled Mimic Layout

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C3.1.20.14. 132 / 11 KV TRANSFORMER PROTECTION PHILOSOPHY

The 20 MVA, 132 / 11 kV, YNd1 transformers will be protected by the same Eskom based transformer protection scheme and both schemes shall be installed as part of this contract. The following protection functions (provided by the SEL 487 or similar) are to be employed:

**Table 8: SEL487 Transformer Protection Functions**

|                                      |                               |
|--------------------------------------|-------------------------------|
| SEL 487 Relay or similar             | HV Overcurrent                |
|                                      | HV Breaker Fail               |
|                                      | HV Ref (Direction Comparison) |
|                                      | HV Earth Fault                |
|                                      | Differential Protection       |
|                                      | LV REF (High Impedance)       |
|                                      | LV Earth Fault                |
| Back-up Protection SEL751 or similar | Backup directional OC/EF      |
|                                      | Standby E/F                   |

Cabling requirements shall be as indicated on the project drawings. The contractor shall submit detail control cabling schedules indicating the cable types, sizes, glands, lengths, connector types etc. for approval.

#### C3.1.20.15. VOLTAGE TRANSFORMER REQUIREMENT

Voltage transformer (VT) input to the transducers will be obtained from the respective transformer's 11 kV, VT JB. The VT inputs to the Tap Change Schemes are to be looped from the transformer protection schemes.

#### C3.1.20.16. CURRENT TRANSFORMER RATIOS TO BE EMPLOYED

The new (2P2M2B) 132 kV, CT's will have two multi-ratio (MR) 1600/1 protection cores, two MR 1600/1 bus zone cores and two MR 1600/1 metering cores. The new (1P2M), 11 kV CT's include one protection and two metering (metering and indication) multi-ratio 1200/1 cores.

- For the 20 MVA, 132 / 11 kV transformers, the full-load-current is 87.5 A at 132 kV and 1049.7 A at 11 kV. These two values are guidelines in selecting the appropriate CT ratios for the HV and LV protection functions.
- The high voltage (HV) restricted-earth-fault (REF) function is to operate via direction comparison of the currents from the Differential CT inputs and the transformer's HV **neutral CT**. The transformer's HV neutral CT has a fixed ratio of 300/1.
- The HV differential protection (diff), HV REF and HV overcurrent functions are to receive CT inputs from the same sets of **post type CT** cores. A CT ratio of 200/1 will be used.
- CT inputs to the high impedance LV REF will be provided via the 11 kV CT's and a neutral CT on the NEC/R.
- CT inputs to the Transformer Differential protection will be provided via the 11 kV CT's and the post top HV CT's.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

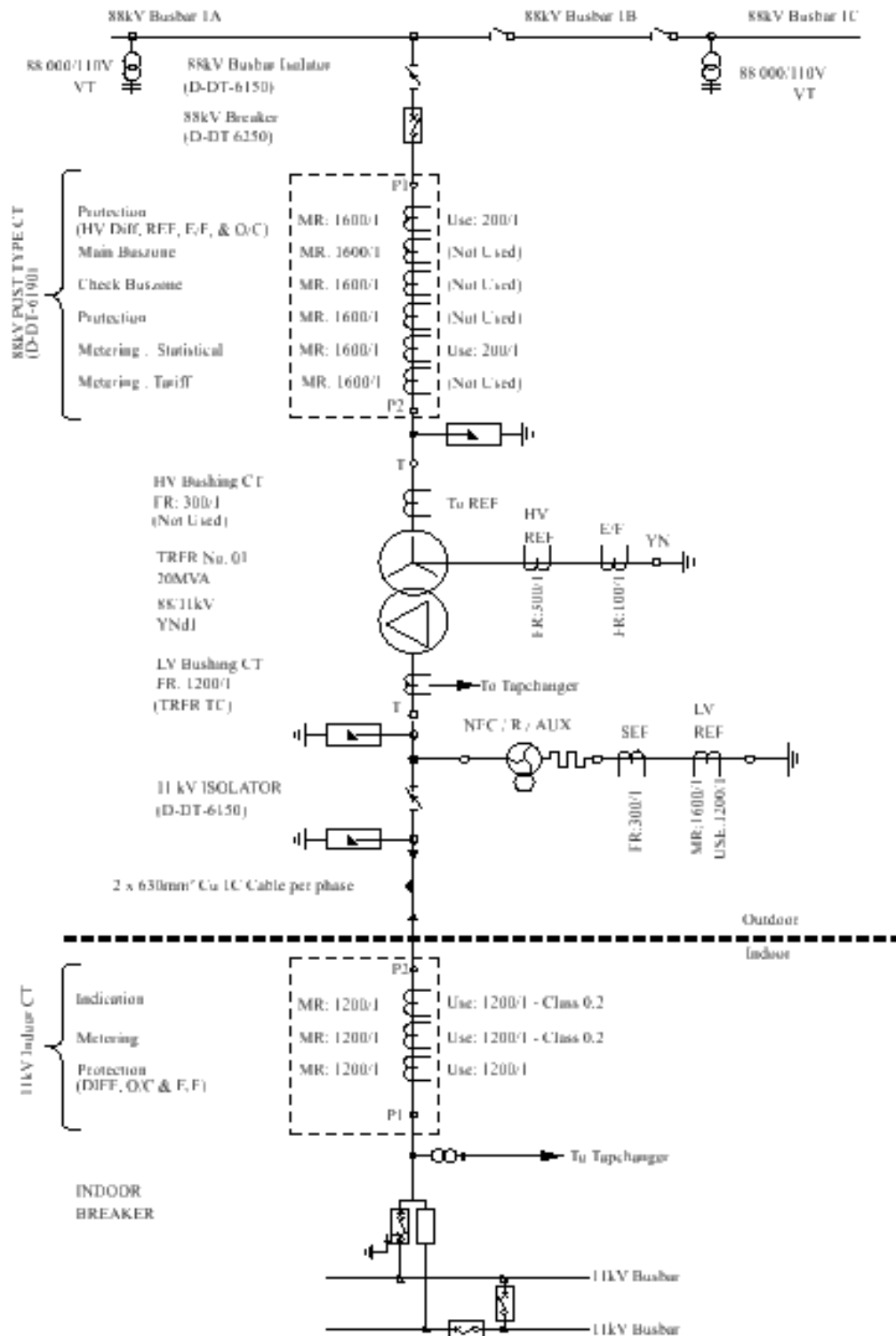


Figure 5: 20MVA 132/11kV Transformer Single Line Diagram

# EMALAHLENI LOCAL MUNICIPALITY

## 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

Table 9: CT Ratio's

|               |   |                   |
|---------------|---|-------------------|
| HV CT ratio's | Differential, O/C & E/F (HV Post-type CT's) | 200/1             |
|               | HV REF (Transformer HV Neutral)             | 300/1             |
|               | Bus Zone (Main)<br>Bus Zone (Check)         | Not<br>Applicable |
| MV CT ratio's | Differential (LV indoor CT)<br>LV O/C & E/F | 1200/1<br>1200/1  |
|               | LV REF (NEC)                                | 1200/1            |
|               | LV SEF (NEC) (STANDBY E/F)                  | 300/1             |

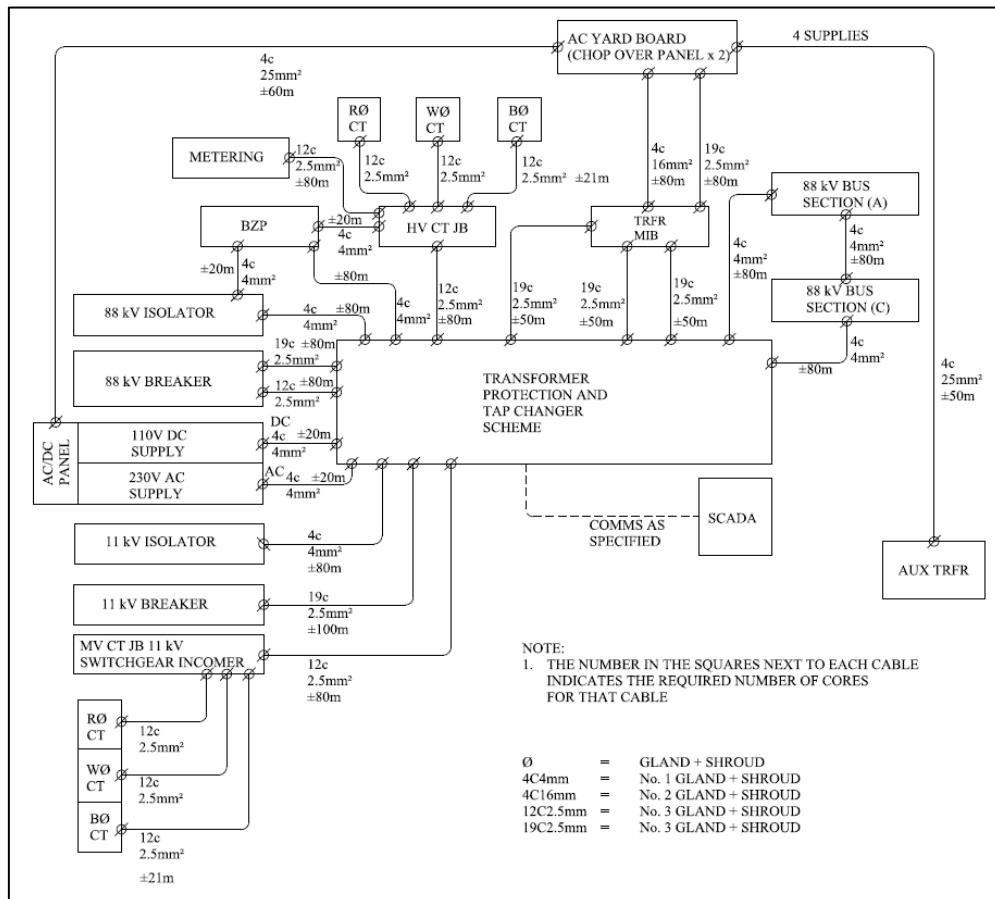


Figure 6: 20MVA 132/11KV Transformer and Tap Changer Cabling Diagram

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

##### **C3.1.20.16.1. 132/11 KV TRANSFORMER TAP CHANGER PROTECTION PHILOSOPHY**

On-Load Tap Change Protection and Control will be achieved using the Eskom base scheme (A. Eberle REG-DA or similar). The schemes are to be mounted below the transformer protection schemes in each transformer's swing-frame panel.

The tap change scheme requires status inputs from all breakers and isolators on the HV and MV sides of the transformer. HV and MV bus section breaker and isolator status information must be supplied to the second transformer. Provision must also be made for circulating current scheme to ensure parallel operation of the transformers.

##### **C3.1.20.16.2. INSTRUMENT TRANSFORMER REQUIREMENTS**

The VT inputs to the Tap Change Schemes are to be looped from the transformer protection schemes (transformer protection panel).

Current transformer inputs to the tap change scheme are to be obtained from the transformer's MV bushing CT's as indicated.

**Table 10: Tap Change Current Input**

|   |        |
|---|--------|
| Tap Change current input (Bushing CT's) | 1200/1 |
|---|--------|

##### **C3.1.20.17. 132 KV FEEDER PROTECTION PANEL**

It is a requirement that the 132 kV Eskom Feeder protection panel installed at Siyanqoba Substation match the Eskom 6FZD3600 Feeder protection Scheme. The scheme utilises the ABB RED670 IED as the main protection relay, with the backup protection IED's being a REF615 Directional protection relay.

##### **C3.1.21. USING OF OWN MANPOWER (PSE 100)**

It is a requirement of the Contract that the work be executed in such a manner as to maximize the use of labour in order to provide the local community with employment opportunities (where applicable) in accordance with the approved Council Policy and Guidelines.

It should be noted that the local labours can be from any area within the Emfuleni Municipal area, which is within a reasonable distance from the construction site.

The Contractor shall only use skeleton staff and skilled staff for implementation of the project. The contractor shall appoint local labourers for all unskilled tasks. Should it prove to be impossible to identify people from the community to perform the expected tasks identified by the Contractor, written approval shall be obtained from the Engineer, or the community, prior to utilising his own manpower to complete the project. The Contractor's own personnel will be responsible for all specialised work. The Contractor shall therefore use only skilled labour of his own workforce. All other unskilled labour required shall be local labour.

The identification of the approved CLO to be appointed by the Contractor under the Contract shall be resolved by the Contractor, the particular Ward Councillors in collaboration with the Local Community in the form of a Project Steering Committee. It will be required, therefore,



## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

that the successful Tenderer (i.e. the Contractor) enter into a contract for the employment of the above-mentioned CLO, the parties to which will be the Contractor, the Local Authority and the CLO.

In order to achieve the recruitment of local labour, the Local Communities would establish, together with the Local Authority, a database of unemployed persons, indicating their specialized training, previous experience and employment, etc. The successful Tenderer will be required to follow the approved Council Policy and Guidelines and to liaise with the Member of the Mayoral: Engineering Services (MMC) in recruiting his/her workforce and will be required to produce weekly records suitably detailed to enable the Engineer/Employer, or his/her authorized representative, and the Local Communities to ascertain that the abovementioned labour requirements are achieved. The Contractor is required to provide informal skills training so that the required standard of workmanship is maintained. Any difficulty experienced by the Tenderer/Contractor in the procurement of the requirement percentages of local labour is to be referred immediately to the Engineer.

The contractor will also be required to report monthly on the amount of local labour in accordance with the EPWP program reporting formats which will be provided to the successful contractor.

#### **C3.1.21.1. EXPECTED TASKS AND RESPONSIBILITIES**

The different tasks and responsibilities are as follows:

##### **C3.1.21.1.1. SERVICES REQUIRED**

- a) 1 x CLO - Community Liaison Officer
- b) Unskilled labourers

The contractor shall provide for the necessary facilities for the workforce i.e. water, toilets, guard houses, stationary, PPE, identification etc.

##### **C3.1.21.1.2. DUTIES, TASKS AND RESPONSIBILITIES**

###### **CLO**

- a) Represent the local community in matters concerning the use of local labour on the works and to assist with and facilitate communication between the Contractor, the Engineer and the local communities.
- b) Ensure labourers obey Contractors instructions.
- c) Terminate, retrench, expel and discipline workers
  - Not obeying Contractors instructions
  - Refuse to work
  - Not reporting for work without excuse
  - Misbehave, steal, drink, intimidating etc. during working hours etc.
- d) Settlement of disputes.
- e) Obtain way leaves.
- f) Any other reasonable instructions required by the Contractor, Project Manager or Employer.

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### LOCAL LABOUR

- a) Perform and execute tasks such as:
  - Minor excavation work.
  - Excavation of cable trenches.
  - General unskilled labour.
- b) Any other reasonable instructions required by the Contractor, Project Manager or Employer.

#### CONTRACTOR

- a) Employ the CLO, security officers and local labour.
- b) The period of appointment of the CLO shall be as stated in the Contract for Temporary Employment as a Community Liaison officer referred to below. The date of commencement of temporary employment of the CLO shall be as agreed with the Engineer.
- c) Provide and supply all clothing, tools and materials to perform the tasks required.
- d) Manage the workforce with the assistance of the CLO to ensure that the programme to carry out the work is met.
- e) Manage all material. The Contractor will be responsible for the management, issuing and verification of all material.
- f) Conduct and convene meetings on a daily base, to dish out work and tasks and to record progress.
- g) To ensure all safety requirements are met.
- h) Pay and remunerate the workforce once a month by means of a cash cheque and record all payments with relevant signatures.
- i) The Contractor will register all local labourers for unemployment insurance.
- j) Enter into written agreement with CLO and workforce and appoint workforce in writing in accordance with the relevant Emfuleni procedure.

The contract shall be between the Contractor and the CLO and the local labour, all costs involved shall be borne by the Contractor and the tender shall be deemed to include for this.

#### C3.1.21.1.3. CONDITIONS OF EMPLOYMENT

- a) Obey Contractors instructions.
- b) Sign time sheets and report for work from Monday to Friday.
- c) Work overtime if required by Contractor.
- d) Working hours is 45 hours per week from 07:00 to 16:30 with 30 minutes lunch break from 12:00 to 12:30.
- e) Payment will be effected according to attendance register, with no work no pay policy.
- f) Payment will be done by means of a cash cheque once a month on the last Friday of the month at 14:00.
- g) Unemployment insurance funds will be deducted.
- h) Tax will be deducted if applicable and when deducted, IRP5 certificates will be issued.
- i) Payment categories:
  - CLO - Estimated R 6 000,00 per month or pro rata for days working
  - Labourers - Estimated R 150,00 per day

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

The above are estimated minimum amounts and shall be negotiated between the Contractor, Municipality relevant manpower. To prevent disputes arising any manpower shall not be paid more or paid less than the rates being used within the Municipal area.

- j) Overtime will be paid according to time plus a third.
- k) If the required progress is not met after actions taken by the CLO, the Contractor will have the right to strengthen his own workforce with the approval of the Project Manager.

#### C3.1.22. MAINTENANCE COMPUTER)

It is a requirement under this contract that the contractor supply a Full High Definition (FHD) Notebook computer with the following specifications:

- Slate Gray Colour.
- Windows 10 Professional Edition (64 bit).
- 15.6 inch FHD Display.
- NVME 512 GB Solid State Drive (SSD) (preferably upgradable).
- 8GB, 2 133 MHz RAM or faster (upgradable to 16 GB).
- 3.6 GHz Core i5 1035G1 (four cores) Processor or later generation.
- Intel UHD Graphics.
- HDMI Port
- Backlit Chiclet Keyboard with separate integrated numeric keypad.
- Up to 37WHrs, 2S1P, 2-cell Li-ion
- HDMI Port
- Integrated USB-C port (Thunderbolt enabled preferably).
- 3 x Type A USB ports (at least one port should be USB3.X)
- Integrated SD Card Reader.
- Integrated Bluetooth
- Integrated Wifi
- Integrated Headset/Microphone port
- Notebook Bag
- Notebook lock
- Mouse
- Portable CD Rom

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**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**



**THE CONTRACT PART 3: SCOPE OF THE WORKS**

**C3.2: TECHNICAL SCHEDULES**

# TSE11 – TECHNICAL SCHEDULE ELECTRICAL

## SUBTRANSMISSION OVERHEAD LINES

## **TABLE OF CONTENTS**

|    |                         |   |
|----|-------------------------|---|
| 1. | GENERAL .....           | 1 |
| 2. | TECHNICAL SCHEDULE..... | 1 |

## **TABLE OF TABLES**

NO TABLE OF FIGURES ENTRIES FOUND.

## **TABLE OF FIGURES**

NO TABLE OF FIGURES ENTRIES FOUND.

## 1. GENERAL

The general requirements for subtransmission overhead lines are covered by GSE11. The detail project requirements shall be covered in the Project Specification, Drawings and Bill of Quantities.

## 2. TECHNICAL SCHEDULE

The following additional information is required for the overhead power line portion of the works:

### 2.1. CONDUCTORS

#### 2.1.1. CHICKADEE CONDUCTOR

Supplier : .....

Material of conductor : .....

Number and diameter of wires : .....

In accordance with the specification : .....Yes / No

#### 2.1.2. SHIELD WIRE

Supplier : .....

Material of conductor : .....

Number and diameter of wires : .....

In accordance with the specification : .....Yes / No

#### 2.1.3. OPGW

The technical schedule for OPGW is covered in GSE48.

### 2.2. INTERMEDIATE / SUSPENSION ASSEMBLY (132 KV)

#### 2.2.1. POST INSULATORS (132 KV)

Material : .....

Insulator type number : .....

Maximum working load : .....

Minimum failing load : .....

Outside diameter : .....

Distance between centres of unit : ..... mm

Mass of unit : ..... kg

Minimum dry flashover : ..... kV

Minimum wet flashover : ..... kV

Minimum puncture voltage : ..... kV

In accordance with the specification : .....Yes / No

#### 2.2.2. ARMOUR ROD

- Manufacturer : .....
- Type : .....
- In accordance with the specification : .....  
Yes / No

#### 2.2.3. LINE POST TRUNNION CLAMPS

- Manufacturer : .....
- Type : .....
- In accordance with the specification : .....  
Yes / No

### 2.3. STRAIN ASSEMBLY (132 KV)

#### 2.3.1. LONG ROD INSULATORS

- Material : .....
- Insulator type number : .....
- Maximum working load : .....
- Minimum failing load : .....
- Outside diameter : .....
- Distance between centre of unit : ..... mm
- Mass of unit : ..... kg



- Minimum dry flashover : ..... kV
- Minimum wet flashover : ..... kV
- Minimum puncture voltage : ..... kV
- In accordance with the specification : .....Yes / No

#### 2.3.2. COMPRESSION DEAD END CLAMPS

- Manufacturer : .....
- Type : .....
- Maximum working load : .....
- In accordance with the specification : .....  
Yes / No

#### 2.3.3. D SHACKLES

- Manufacturer : .....
- Type : .....
- Maximum working load : .....
- In accordance with the specification : .....  
Yes / No

#### 2.3.4. TONGUE SOCKET

- Manufacturer : .....
- Type : .....
- Maximum working load : .....
- In accordance with the specification .....:  
Yes / No

#### 2.3.5. BALL CLEVIS

- Manufacturer : .....
- Type : .....

- Maximum working load : .....
- In accordance with the specification : .....  
Yes / No

#### 2.3.6. TURNBUCKLE OVAL EYE TONGUE

- Manufacturer : .....
- Type : .....
- Maximum working load : .....
- In accordance with the specification : .....  
Yes / No

#### 2.4. PGW SUSPENSION HARDWARE

- Manufacturer : .....
- Type : .....
- In accordance with the specification : .....  
Yes / No

#### 2.5. OPGW STRAIN HARDWARE

- Manufacturer : .....
- Type : .....
- In accordance with the specification : .....Yes /  
No

#### 2.6. VIBRATION DAMPERS

- Manufacturer : .....
- Type : .....
- In accordance with the specification : .....  
Yes / No

**2.7. POLE STAYS**

- Stay wire number and diameter of wires.....:

**2.7.1. STAY ROD ASSEMBLY**

- Type : .....
- Size : .....
- Stay plate - size : .....
- In accordance with the specification : .....  
Yes / No

**2.7.2. STEEL THIMBLE**

- Supplier : .....
- Type : .....
- Complies with specification : .....Yes / No

**2.7.3. PREFORMED STEEL DEAD-END GUY GRIP**

- Supplier : .....
- Type : .....
- Complies with specification : .....Yes / No

**2.8. LABELS**

- Manufacturer : .....
- Type : .....
- In accordance with the specification : .....  
Yes / No

**2.9. AIR CRAFT WARNING DEVICE**

- Manufacturer : .....

- Type : .....
- In accordance with the specification :.....  
Yes / No

## 2.10. POLES

- Manufacturer : .....
- Shape : .....
- Steel type :.....
- Galvanizing by : .....
- Design specification : .....

## 2.11. FOUNDATIONS

- Soil Nomination by : .....
- Foundation Certification by : .....
- Qualification for above person : .....
- ECSA Pr.Eng Registration # : .....

SIGNED ON BEHALF OF TENDERER :.....

COMPANY NAME : .....

NAME IN BLOCK LETTERS : .....

DATE : .....

## **EMALAHLENI LOCAL MUNICIPALITY**

### **40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C3.2. TECHNICAL SCHEDULES**

The following list outlines the Technical Schedule for tendering which shall be populated by the contractor / OEM. Failure to complete any schedule may result in the bid submitted being disqualified.

At no stage during the delivery of the works may the contractor change supplier / manufacturer without the written consent from the Engineer.

##### **C3.2.1. TSE11 – SUBTRANSMISSION OVERHEAD LINE**

- a) Conductor and Line Hardware

##### **C3.2.2. TSE18 - POWER TRANSFORMERS**

- b) 20 MVA, 88/11 kV Power Transformer in accordance with Eskom 240-68973110

##### **C3.2.3. TSE20 – NECRT'S**

- a) 11 kV / 300-360 A: Neutral electromagnetic coupler with neutral earthing resistor and auxiliary transformer (NECRT) in accordance with Eskom specification 240-576488480.

##### **C3.2.4. TSE48 - OPGW**

- a) Optical Ground Wire (OPGW) in accordance with NRS specifications NRS 061 and NRS 081

##### **C3.2.5. TSE56 - SURGE ARRESTORS**

- b) Station class surge arresters for an 11 kV system in accordance with Eskom specification DSP\_34-419.
- c) Station class surge arresters for a 66 kV system in accordance with Eskom specification DSP\_34-419.
- d) Station class surge arresters for an 132 kV system in accordance with Eskom specification DSP\_34-419.

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

SIGNED AT ..... ON BEHALF OF THE FIRM .....

ON THIS ..... DAY OF ..... 20.....

NAME: .....

SIGNATURE: .....

CAPACITY: .....

# TSE18 – TECHNICAL SCHEDULE ELECTRICAL

POWER TRANSFORMERS:  
1.25 MVA AND ABOVE  
2.2 kV AND ABOVE

## TABLE OF CONTENTS

|    |   |    |
|----|---|----|
| 1. | GENERAL .....   | 1  |
| 2. | TECHNICAL A & B SCHEDULE.....   | 1  |
| 3. | TECHNICAL A & B DEVIATION SCHEDULE .....                                | 8  |
| 4. | DESIGN PARAMETER SCHEDULES A AND B FOR A YND1 POWER<br>TRANSFORMER..... | 9  |
| 5. | SPEC 240-68973110.....  | 12 |

## TABLE OF TABLES

|   |    |
|---|----|
| Table 1: Technical Schedule .....                                     | 1  |
| Table 2: Deviations schedule.....                                     | 8  |
| Table 3: Design Parameter Schedules and B for a YNd1 Power trfr ..... | 9  |
| Table 4: Design Parameter Schedules and B for a YNd1 Power trfr ..... | 12 |

## TABLE OF FIGURES

|                                |   |
|--------------------------------|---|
| Figure 1: Winding Design ..... | 9 |
|--------------------------------|---|



## 1. GENERAL

The general requirements for power transformers rated for 1.25 MVA and above and with highest voltage of 2.2 kV or above are covered by Eskom specification 240-68973110. The detail project requirements shall be covered in the Project Specification, Drawings and Bill of Quantities.

## 2. TECHNICAL A & B SCHEDULE

Schedule A: Purchaser's specific requirements

Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

**Table 1: Technical Schedule**

| Item      | Description   | Schedule A             | Schedule B |
|-----------|---|------------------------|------------|
| <b>1.</b> | <b>Purchasing Details</b>   |                        |            |
| 1.1       | SAP No  | N.A.                   | xxxxxxxxxx |
| 1.2       | Class   | Class 1                |            |
| <b>2</b>  | <b>Delivery and off-loading</b>   |                        |            |
| 2.1       | Transformer delivered to:   | Siyanqoba              |            |
| 2.2       | Off-loaded from transport vehicle and transferred to intended operating position by supplier.                                 | Yes                    |            |
| 2.3       | Distance from off-loading position m  | ± 10                   |            |
| 2.4       | Rise or fall to off-loading position mm   | ± 500                  |            |
| 2.5       | Acceleration limit in any direction g   | 10                     |            |
| <b>3</b>  | <b>Erection</b>   |                        |            |
| 3.1       | Erected ready for service   | Yes                    |            |
| 3.2       | Place 3 ply Malthoid on plinth  | Yes                    |            |
| <b>4</b>  | <b>Tests (Type Tests are for first of design units only, although Customer has right to request this for any transformer)</b> |                        |            |
| 4.1       | Temperature rise tests  | Yes                    |            |
| 4.2       | Lightning Impulse Withstand Test  | Yes                    |            |
| 4.3       | Chopped Impulse Test  | Yes                    |            |
| 4.4       | Acoustic noise level measurements   | Yes                    |            |
| 4.5       | Determination of capacitances, windings to earth & between windings as well as bushing dielectric loss (tan delta)            | Yes                    |            |
| 4.6       | Zero sequence impedance measurement for three winding transformers  | Yes                    |            |
| 4.7       | Short-circuit withstand tests   | Provide design details |            |
| 4.8       | Insulation resistance to earth  | Yes                    |            |
| 4.9       | Short duration AC tests (partial discharge)   | Yes                    |            |
| 4.10      | Frequency Response Analysis Test (Factory &   | Yes                    |            |

| Item      | Description  | Schedule A   | Schedule B |
|-----------|--|--------------|------------|
|           | Site)  |              |            |
| 4.11      | Impact Recorders (Active part & Tank)  | Yes          |            |
| 4.12      | Voltage Ratio and Phase Displacement   | Yes          |            |
| 4.13      | Winding DC Resistance  | Yes          |            |
| 4.14      | Separate Source Voltage Withstand  | Yes          |            |
| 4.15      | Over Voltage Withstand   | Yes          |            |
| 4.16      | Short Circuit Impedence and Load Loss  | Yes          |            |
| 4.17      | No Load Loss and Magnetizing Current   | Yes          |            |
| 4.18      | On Load Tap Changing   | Yes          |            |
| 4.19      | Oil DGA  | Yes          |            |
| 4.20      | Paint Thickness and Quality  | Yes          |            |
| 4.21      | Auxiliary Wiring Functionality and Pressure Test   | Yes          |            |
| <b>5.</b> | <b>Continuous rated power for all tapping's</b>  |              |            |
| 5.1       | ONAN MVA   | 20           |            |
| 5.2       | ONAF MVA   | N/A          |            |
| <b>6</b>  | <b>Rated voltage (Un) on principal tapping</b>   |              |            |
| 6.1       | Primary kV r.m.s   | 132          |            |
| 6.2       | Secondary kV r.m.s   | 11           |            |
| <b>7.</b> | <b>Voltage tapping range of Primary/Secondary ratio (% of the ratio on the principal tapping):</b> |              |            |
| 7.1       | Max %  | 5            |            |
| 7.2       | Min %  | -15          |            |
| 7.3       | Size of steps %  | 1.25         |            |
| 7.4       | Number of positions (including transition positions)   | 17           |            |
| <b>8.</b> | <b>Resulting no-load voltage appearing having MV constant</b>                                      |              |            |
| 8.1       | On principal tapping kV  | 132          |            |
| 8.2       | On extreme plus tapping kV   | 138.6        |            |
| 8.3       | On extreme minus tapping kV  | 112.2        |            |
| <b>9.</b> | <b>Transformer Type</b>  |              |            |
| 9.1       | Vector Group   | YNd1         |            |
| 9.2       | Type of transformer  | Core         |            |
| 9.3       | Number of limbs  | 3            |            |
| 9.4       | Winding Arrangement (Core/Secondary/Primary/Regulating)  | As Specified |            |

| Item        | Description   | Schedule A | Schedule B |
|-------------|---|------------|------------|
| 9.5         | Type of cooling   | ONAN       |            |
| <b>10</b>   | <b>Operating environment</b>  |            |            |
| 10.1        | Corrosion protection  | Yes        |            |
| 10.2        | Pollution level   | Very Heavy |            |
| <b>11</b>   | <b>Maximum current density in windings</b>  |            |            |
| 11.1        | Primary (outer winding) A/mm <sup>2</sup>   | ≤ 3.0      |            |
| 11.2        | Secondary (inner winding) A/mm <sup>2</sup>   | ≤ 3.2      |            |
| <b>12</b>   | <b>Transformer losses</b>   |            |            |
| <b>12.1</b> | <b>No load losses (Maximum rated power)</b>   |            |            |
| 12.1.1      | @ 90% kW  | ≤ 10.65    |            |
| 12.1.2      | @ 100% (This value will be used in fin evaluation) kW   | ≤ 14.65    |            |
| 12.1.3      | @ 110% kW   | ≤ 19.5     |            |
| <b>12.2</b> | <b>Load losses</b>  |            |            |
| 12.2.1      | Extreme Plus tap position kW  | ≤ 130      |            |
| 12.2.2      | Nominal tap position kW   | ≤ 130      |            |
| 12.2.3      | Extreme Minus tap position kW   | ≤ 135      |            |
|             | (Note: Loss evaluation will be performed using the average of the above three values)               |            |            |
| <b>13.</b>  | <b>Core Design</b>  |            |            |
| 13.1        | Maximum flux density @ Un T   | < 1.75     |            |
| <b>14</b>   | <b>Losses for cooling equipment (Fans)</b>  |            |            |
| 14.1        | Power kW  | N/A        |            |
| 14.2        | Current A   | N/A        |            |
| <b>15</b>   | <b>Primary / Secondary impedance at 75 °C at rated MVA (Refer 7.1 of Design Parameter Schedule)</b> |            |            |
| 15.1        | On principal tapping %  | 11         |            |
| 15.2        | On extreme plus tapping (maximum impedance) %   | 11.2       |            |
| 15.3        | On extreme minus tapping (minimum impedance) %  | >10        |            |
| <b>16</b>   | <b>Primary / Secondary tolerances applicable to guaranteed impedances</b>                           |            |            |
| 16.1        | On principal tapping  | IEC        |            |
| 16.2        | On extreme plus tapping   | IEC        |            |
| 16.3        | On extreme minus tapping (minimum impedance) %  | +10 / -0   |            |
| <b>17.</b>  | <b>Temperature rises at altitude of 1 800 m</b>   |            |            |
| 17.1        | Top oil °C  | 55         |            |

| Item   | Description  |          | Schedule A | Schedule B |
|--------|--|----------|------------|------------|
| 17.2   | Windings (by resistance)   | °C       | 60         |            |
| 17.3   | Hotspot of winding   | °C       | < 73       |            |
| 17.4   | Hotspot of metal parts in contact with oil   | °C       | < 105      |            |
| 18.    | Maximum acoustic noise   | dB(A)    | 73         |            |
| 19.    | Heavy Duty Type  |          | Yes        |            |
| 20.    | Minimum insulation for windings<br>(Note: Provide detailed test plan for evaluation) |          |            |            |
| 20.1   | Impulse withstand test voltage for line terminal:                                    |          |            |            |
| 20.1.1 | Primary  | kV peak  | 550        |            |
| 20.1.2 | Secondary  | kV peak  | 95         |            |
| 20.2   | Sixty-second, separate source  |          |            |            |
| 20.2.1 | Primary  | kV r.m.s | 230        |            |
| 20.2.2 | Secondary  | kV r.m.s | 28         |            |
| 20.3   | Sixty-second, induced-overvoltage withstand test voltages                            |          |            |            |
| 20.3.1 | Primary to earth   | kV r.m.s | 230        |            |
| 20.3.2 | Secondary  | kV r.m.s | 22         |            |
| 21     | Main terminals & Bushing   |          |            |            |
| 21.1   | Type   |          | Outdoor    |            |
| 21.2   | Details of Primary bushing / terminal (composite)                                    |          |            |            |
| 21.2.1 | Make & Model   |          | xxxxxxxxxx |            |
| 21.2.2 | Stem size (dia x length)   | mm       | 26 x 125   |            |
| 21.2.3 | Current Rating (incl 20% overcurrent)  | A        | > 160      |            |
| 21.2.4 | Impulse withstand voltage at sea level   | kV peak  | 650        |            |
| 21.2.5 | Power frequency withstand voltage  | kV r.m.s | 275        |            |
| 21.2.6 | Total Creepage   | mm       | > 4500     |            |
| 21.2.7 | Protected Creepage (<50% of Total Creepage)  | mm       | xxxxxxxxxx |            |
| 21.3   | Details of Secondary bushing / terminal (composite)                                  |          |            |            |
| 21.3.1 | Make & Model   |          | xxxxxxxxxx |            |
| 21.3.2 | Stem size (dia x length)   | mm       | 38 x 125   |            |
| 21.3.3 | Current Rating (incl 20% overcurrent)  | A        | > 1300     |            |
| 21.3.4 | Impulse withstand voltage at sea level   | kV peak  | 200        |            |
| 21.3.5 | Power frequency withstand voltage  | kV r.m.s | 70         |            |

| Item        | Description  |          | Schedule A                   | Schedule B |
|-------------|--|----------|------------------------------|------------|
| 21.3.6      | Total Creepage   | mm       | > 375                        |            |
| 21.3.7      | Protected Creepage (<50% of Total Creepage)              | mm       | xxxxxxxxxx                   |            |
| <b>21.4</b> | <b>Details of Neutral bushing / terminal (composite)</b> |          |                              |            |
| 21.4.1      | Make & Model   |          | xxxxxxxxxx                   |            |
| 21.4.2      | Stem size (dia x length)                                 | mm       | 26 x 125                     |            |
| 21.4.3      | Current Rating (incl. 20% overcurrent)                   | A        | > 160                        |            |
| 21.4.4      | Impulse withstand voltage at sea level                   | kV peak  | 350                          |            |
| 21.4.5      | Power frequency withstand voltage                        | kV r.m.s | 140                          |            |
| 21.4.6      | Total Creepage   | mm       | > 1500                       |            |
| 21.4.7      | Protected Creepage (<50% of Total Creepage)              | mm       | xxxxxxxxxx                   |            |
| <b>22</b>   | <b>Physical arrangement</b>                              |          |                              |            |
| <b>22.1</b> | <b>Compliance with Figure 2 &amp; 3</b>                  |          | Yes                          |            |
| <b>22.2</b> | <b>Overall dimensions of complete unit</b>               |          |                              |            |
| 22.2.1      | Height   | mm       | < 5500                       |            |
| 22.2.2      | Length   | mm       | < 6400                       |            |
| 22.2.3      | Width  | mm       | < 5000                       |            |
| <b>22.3</b> | <b>Overall dimensions of tank only</b>                   |          | xxxxxxxxxx                   |            |
| 22.3.1      | Base plate type (flat / prefabricated)                   | mm       | Flat                         |            |
| 22.3.2      | Length   | mm       | ± 3200 (< 4400)              |            |
| 22.3.3      | Width  | mm       | ≤ 1500                       |            |
| 22.3.4      | Base plate thickness                                     | mm       | ± 20                         |            |
| <b>23</b>   | <b>Cooling equipment</b>                                 |          |                              |            |
| <b>23.1</b> | <b>Radiators</b>   |          |                              |            |
| 23.1.1      | Material Type (Cooler tubes / press sheet radiators)     |          | xxxxxxxxxx                   |            |
| 23.1.2      | Material Thickness                                       | mm       | xxxxxxxxxx                   |            |
| <b>23.2</b> | <b>Motors (Forced cooling)</b>                           |          |                              |            |
| 23.2.1      | Make   |          | N/A                          |            |
| 23.2.2      | Type   |          | N/A                          |            |
| <b>24</b>   | <b>Safe withstand vacuum at sea level</b>                | kPA      | 1.5                          |            |
| <b>25</b>   | <b>Transformer oil type</b>                              |          | 240-75661431<br>ESKOM 32-406 |            |
| <b>26</b>   | <b>Tap-changers</b>                                      |          |                              |            |
| <b>26.1</b> | Type   |          | OLTC                         |            |

| Item        | Description                                   | Schedule A         | Schedule B |
|-------------|---|--------------------|------------|
| <b>26.2</b> | Tap-changer                                   | xxxxxxxxxx         |            |
| 26.2.1      | Manufacturer                                  | xxxxxxxxxx         |            |
| 26.2.2      | Model Number                                  | xxxxxxxxxx         |            |
| 26.2.3      | Precise electrical location of tapplings.     | Y-neutral end      |            |
| 26.2.4      | Diagrammatic arrangement shown on Drawing No. | xxxxxxxxxx         |            |
| 26.2.5      | Number of maintenance free operations         | 300,000            |            |
| <b>26.3</b> | Nominal <b>50 Hz ratings of tap-changer:</b>  |                    |            |
| 26.3.1      | Voltage kV                                    | > 45               |            |
| 26.3.2      | Current (non-vacuum type) A                   | > 300              |            |
| 26.3.3      | Current (vacuum type) A                       | > 160              |            |
| <b>26.4</b> | Insulation levels of tap-changer              |                    |            |
| 26.4.1      | phase-to-phase peak kV peak                   | 380                |            |
| <b>26.5</b> | Tap-changer 50 Hz withstand                   |                    |            |
| 26.5.1      | phase-to-phase kV r.m.s                       | 125                |            |
| <b>26.6</b> | Tap-changer contacts                          |                    |            |
| 26.6.1      | Selector kV/A                                 | xxxxxxxxxx         |            |
| 26.6.2      | Selector switch kV/A                          | xxxxxxxxxx         |            |
| 26.6.3      | Diverter switch kV/A                          | xxxxxxxxxx         |            |
| 26.6.4      | Tie-in Resistor used?                         | <del>Yes</del> /No |            |
| 26.6.5      | Value of tie-in resistor $\Omega$             | xxxxxxxxxx         |            |
| <b>26.7</b> | Tap-changer transition resistor kV/A          | xxxxxxxxxx         |            |
| <b>26.8</b> | Tap-changer driving motor                     |                    |            |
| 26.8.1      | Type of driving motor                         | 3 phase            |            |
| 26.8.2      | Supply voltage to motor $V_{ac}$              | 420V               |            |
| 26.8.3      | Power kW                                      | xxxxxxxxxx         |            |
| 26.8.4      | Current A                                     | xxxxxxxxxx         |            |
| <b>27</b>   | Drawings & Manuals                            |                    |            |
| 27.1        | Quantity of drawings as per 3.2.2             | 1                  |            |
| 27.2        | Quantity of Manuals (hard copy + electronic)  | 5 + 1              |            |
| <b>28</b>   | Indicating and protective devices             |                    |            |
| 28.1        | Tap-changer protective device (detail)        | Specify Type       |            |
| 28.2        | Pressure relief device                        | Specify Type       |            |
| 28.3        | Oil- and gas-actuated relay                   | Specify Type       |            |

## POWER TRANSFORMERS

| Item       | Description  | Schedule A       | Schedule B |
|------------|--|------------------|------------|
| 28.4       | Conservator bag required   | No               |            |
| 28.5       | Conservator bag type   | N/A              |            |
| 28.6       | Dehydrating breathers  | Specify Type     |            |
| 28.7       | Oil level indicators   | Specify Type     |            |
| 28.8       | Oil temperature thermometer  | Specify Type     |            |
| 28.9       | Winding temperature thermometer(s)                                     | Specify Type     |            |
| <b>29</b>  | <b>Schedule of type test &amp; routine test certificates submitted</b> | Yes - compulsory |            |
| <b>30</b>  | <b>Spares recommended by manufacturer (Provide detailed list)</b>      |                  |            |
| <b>31.</b> | <b>OTHER (OPTIONAL ITEMS)</b>  |                  |            |
| 31.1       | Online Gas Monitoring System   | Not Required     |            |
| 31.2       | Moisture Management System   | Not Required     |            |

### 3. TECHNICAL A & B DEVIATION SCHEDULE

### Table 2: Deviations schedule

| Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification. |            |                    |
|---|------------|--------------------|
| Item  | Sub-clause | Proposed deviation |
|   |            |                    |

SIGNED ON BEHALF OF TENDERER: \_\_\_\_\_ :

---

COMPANY NAME :

---

SIGNATURE \_\_\_\_\_ :

---

NAME IN BLOCK LETTERS :

---



DATE \_\_\_\_\_ :

#### 4. DESIGN PARAMETER SCHEDULES A AND B FOR A YNd1 POWER TRANSFORMER

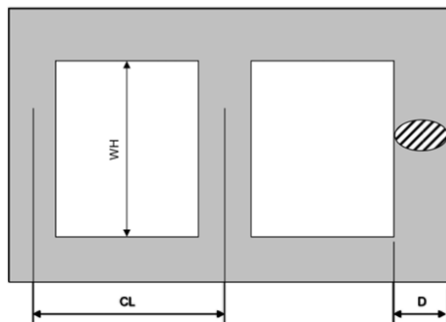
Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Table 3: Design Parameter Schedules and B for a YNd1 Power trfr

| Item      | Description   |                 | Schedule A | Schedule B |
|-----------|---|-----------------|------------|------------|
| <b>1.</b> | <b>Core Steel</b>                                       |                 |            |            |
| 1.1       | Manufacturer of core steel                              |                 | XXXXXXXXXX |            |
| 1.2       | Grade of core steel                                     |                 | XXXXXXXXXX |            |
| 1.3       | Thickness of core steel                                 | mm              | XXXXXXXXXX |            |
| <b>2</b>  | <b>Core Dimensions</b>                                  |                 |            |            |
| 2.1       | Window height (WH)                                      | mm              | XXXXXXXXXX |            |
| 2.2       | Distance between core limb centres (CL)                 | mm              | XXXXXXXXXX |            |
| 2.3       | Core Diameter (D)                                       | mm              | XXXXXXXXXX |            |
| 2.4       | Filling Factor  |                 | XXXXXXXXXX |            |
| <b>3</b>  | <b>Cross sectional areas</b>                            |                 |            |            |
| 3.1       | Wound limbs   | mm <sup>2</sup> |            |            |
| 3.2       | Yoke  | mm <sup>2</sup> |            |            |
| <b>4</b>  | <b>Total Core mass</b>                                  | Kg              |            |            |
| <b>5</b>  | <b>The design flux density at <math>U_n</math> for:</b> |                 |            |            |
| 5.1       | Wound limbs   | T               | XXXXXXXXXX |            |
| 5.2       | Yoke  | T               | XXXXXXXXXX |            |
| <b>6</b>  | <b>Volts/turn at the above flux</b>                     | V/turn          |            |            |

#### 7. Winding Design



| Item       | Description                                       | Schedule A | Schedule B |
|------------|---|------------|------------|
| <b>7.1</b> | <b>Winding arrangement (CORE / LV / HV / TAP)</b> | XXXXXXXXXX |            |
| <b>7.2</b> | <b>Conductor Yield strength</b> N/mm <sup>2</sup> | XXXXXXXXXX |            |
| <b>7.3</b> | <b>Winding 1</b>                                  | LV         |            |
| 7.3.1      | Type (i.e. multilayer helix)                      | XXXXXXXXXX |            |
| 7.3.2      | Lead type (End Fed / Centre Fed)                  | XXXXXXXXXX |            |
| 7.3.3      | Number of turns                                   | XXXXXXXXXX |            |
| 7.3.4      | Inner Diameter mm                                 | XXXXXXXXXX |            |
| 7.3.5      | Outer Diameter mm                                 | XXXXXXXXXX |            |
| 7.3.6      | Radial build mm                                   | XXXXXXXXXX |            |
| 7.3.7      | Magnetic height mm                                | XXXXXXXXXX |            |
| 7.3.8      | Conductor configuration                           | XXXXXXXXXX |            |
| 7.3.9      | - Size  | XXXXXXXXXX |            |
| 7.3.10     | - Number  | XXXXXXXXXX |            |
| 7.3.11     | Conductor insulation mm                           | XXXXXXXXXX |            |
| 7.3.12     | Current density A/mm <sup>2</sup>                 | XXXXXXXXXX |            |
| 7.3.13     | Temperature gradient winding – oil °C (K)         | XXXXXXXXXX |            |
| 7.3.14     | Total conductor mass kg                           | XXXXXXXXXX |            |
| <b>7.4</b> | <b>Winding 2</b>                                  | HV         |            |
| 7.4.1      | Type (i.e. multilayer helix)                      | XXXXXXXXXX |            |
| 7.4.2      | Lead type (End Fed / Centre Fed)                  | XXXXXXXXXX |            |
| 7.4.3      | Number of turns                                   | XXXXXXXXXX |            |
| 7.4.4      | Inner Diameter mm                                 | XXXXXXXXXX |            |
| 7.4.5      | Outer Diameter mm                                 | XXXXXXXXXX |            |
| 7.4.6      | Radial build mm                                   | XXXXXXXXXX |            |
| 7.4.7      | Magnetic height mm                                | XXXXXXXXXX |            |
| 7.4.8      | Conductor configuration                           | XXXXXXXXXX |            |
| 7.4.9      | - Size  | XXXXXXXXXX |            |
| 7.4.10     | - Number  | XXXXXXXXXX |            |
| 7.4.11     | Conductor insulation mm                           | XXXXXXXXXX |            |
| 7.4.12     | Current density rated A/mm <sup>2</sup>           | XXXXXXXXXX |            |
| 7.4.13     | Temperature gradient winding – oil °C (K)         | XXXXXXXXXX |            |
| 7.4.14     | Total conductor mass kg                           | XXXXXXXXXX |            |
| <b>7.5</b> | <b>Winding 3</b>                                  | TAP        |            |

| Item       | Description                               | Schedule A | Schedule B |
|------------|---|------------|------------|
| 7.5.1      | Type (i.e. multilayer helix)              | XXXXXXXXXX |            |
| 7.5.2      | Lead type (End Fed / Centre Fed)          | XXXXXXXXXX |            |
| 7.5.3      | Number of turns                           | XXXXXXXXXX |            |
| 7.5.4      | Inner Diameter mm                         | XXXXXXXXXX |            |
| 7.5.5      | Outer Diameter mm                         | XXXXXXXXXX |            |
| 7.5.6      | Radial build mm                           | XXXXXXXXXX |            |
| 7.5.7      | Magnetic height mm                        | XXXXXXXXXX |            |
| 7.5.8      | Conductor configuration                   | XXXXXXXXXX |            |
| 7.5.9      | - Size                                    | XXXXXXXXXX |            |
| 7.5.10     | - Number                                  | XXXXXXXXXX |            |
| 7.5.11     | Conductor insulation mm                   | XXXXXXXXXX |            |
| 7.5.12     | Current density A/mm <sup>2</sup>         | XXXXXXXXXX |            |
| 7.5.13     | Temperature gradient winding – oil °C (K) | XXXXXXXXXX |            |
| 7.5.14     | Total conductor mass kg                   | XXXXXXXXXX |            |
| <b>8.</b>  | <b>Inter-winding Insulation</b>           | XXXXXXXXXX |            |
| <b>8.1</b> | <b>CORE - LV winding</b>                  | XXXXXXXXXX |            |
| 8.1.1      | Number of barriers                        | XXXXXXXXXX |            |
| 8.1.2      | Barrier thickness mm                      | XXXXXXXXXX |            |
| 8.1.3      | Distance from windings mm                 | XXXXXXXXXX |            |
| 8.1.4      | Distance between barriers mm              | XXXXXXXXXX |            |
| <b>8.2</b> | <b>LV winding to HV winding</b>           | XXXXXXXXXX |            |
| 8.2.1      | Number of barriers                        | XXXXXXXXXX |            |
| 8.2.2      | Barrier thickness mm                      | XXXXXXXXXX |            |
| 8.2.3      | Distance from windings mm                 | XXXXXXXXXX |            |
| 8.2.4      | Distance between barriers mm              | XXXXXXXXXX |            |
| <b>8.3</b> | <b>HV winding to TAP winding</b>          | XXXXXXXXXX |            |
| 8.3.1      | Number of barriers                        | XXXXXXXXXX |            |
| 8.3.2      | Barrier thickness mm                      | XXXXXXXXXX |            |
| 8.3.3      | Distance from windings mm                 | XXXXXXXXXX |            |
| 8.3.4      | Distance between barriers mm              | XXXXXXXXXX |            |

**5. SPEC 240-68973110**

Schedule A: Purchasers specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

**Table 4: Design Parameter Schedules and B for a YNd1 Power trfr**

| <b>Item</b> | <b>Description</b>                                  | <b>Schedule A</b> | <b>Schedule B</b> |
|-------------|---|-------------------|-------------------|
| <b>1</b>    | <b>Transformer general information</b>              |                   |                   |
| 1.1         | Manufacturer  | xxxxxxxxxx        |                   |
| 1.2         | Place of manufacture                                | xxxxxxxxxx        |                   |
| <b>2</b>    | <b>Oil quantities:</b>                              |                   |                   |
| 2.1         | Transformer tank                                    | xxxxxxxxxx        |                   |
| 2.2         | Tap-changer   | xxxxxxxxxx        |                   |
| 2.3         | Radiators   | xxxxxxxxxx        |                   |
| 2.4         | Conservator (Main & tap-changer)                    | xxxxxxxxxx        |                   |
| <b>3</b>    | <b>Masses</b>                                       |                   |                   |
| 3.1         | Mass of core steel                                  | kg xxxxxxxxxxxx   |                   |
| 3.2         | Total dry insulation mass                           | kg xxxxxxxxxxxx   |                   |
| 3.3         | Total mass of active part                           | kg xxxxxxxxxxxx   |                   |
| 3.4         | Mass of tank and fittings                           | kg xxxxxxxxxxxx   |                   |
| 3.5         | Mass of coolers (dry)                               | kg xxxxxxxxxxxx   |                   |
| 3.6         | Mass of oil   | kg xxxxxxxxxxxx   |                   |
| 3.7         | Greatest transportation mass                        | kg xxxxxxxxxxxx   |                   |
| <b>4</b>    | <b>Primary / Secondary zero sequence impedances</b> | % xxxxxxxxxxxx    |                   |
| 4.1         | On principal tapping                                |                   |                   |
| 4.2         | On extreme plus tapping                             | % xxxxxxxxxxxx    |                   |
| 4.3         | On extreme minus tapping                            | % xxxxxxxxxxxx    |                   |
| <b>5</b>    | <b>Filling medium for transport</b>                 | xxxxxxxxxx        |                   |
| <b>6.</b>   | <b>Training of purchaser's staff</b>                |                   |                   |

## POWER TRANSFORMERS

| Item | Description   | Schedule A | Schedule B |
|------|---|------------|------------|
| 6.1  | Training provided on components   | Yes        |            |
| 6.2  | Details provided of how training is going to be conducted on purchaser's staff? | Yes        |            |

SIGNED ON BEHALF OF TENDERER : .....

COMPANY NAME : .....

NAME IN BLOCK LETTERS : .....

DATE : .....

# **TSE20 – TECHNICAL SCHEDULE ELECTRICAL**

**SPECIFICATION FOR COMBINED THREE-PHASED  
NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHING RESISTORS AND AUXILIARY  
TRANSFORMERS  
(NECRT'S)**

## **TABLE OF CONTENTS**

|    |  |   |
|----|--|---|
| 1. | GENERAL .....                            | 1 |
| 2. | TECHNICAL A & B SCHEDULE.....            | 1 |
| 3. | TECHNICAL A & B DEVIATION SCHEDULE ..... | 7 |

## **TABLE OF TABLES**

|                                    |   |
|------------------------------------|---|
| Table 1: Technical Schedule .....  | 1 |
| Table 2: Deviations Schedule ..... | 7 |

## **TABLE OF FIGURES**

NO TABLE OF FIGURES ENTRIES FOUND.

# NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH NEUTRAL EARTHING RESISTORS AND AUX TRFR (NECRT'S)

## 1. GENERAL

The general requirements for three phase neutral electro-magnetic couplers with neutral earthing resistors and auxiliary transformers (NECRT'S) are covered by Eskom specification 240-57648848. The detail project requirements shall be covered by the Project Specification, Drawings and Bill of Quantities.

## 2. TECHNICAL A & B SCHEDULE

11 kV/360 A: Neutral electromagnetic coupler with neutral earthing resistor and auxiliary transformer (NECRT)

Eskom standard number: 34-1690 (240-57648848) 2015/03-30

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

**Table 1: Technical Schedule**

| Item     | Description                       | Schedule A | Schedule B |
|----------|-----------------------------------|------------|------------|
| <b>1</b> | <b>Identification</b>             |            |            |
|          | a) Supplier's name                | xxxxxxxxxx |            |
|          | b) Manufacturer's name            | xxxxxxxxxx |            |
|          | c) Type designation               | xxxxxxxxxx |            |
| <b>2</b> | <b>Site conditions</b>            |            |            |
|          | a) Altitude m                     | 1521       |            |
|          | b) Maximum ambient temperature °C | 45         |            |
|          | c) Minimum ambient temperature °C | -10        |            |
|          | d) Maximum diurnal variation °C   | 35         |            |
|          | e) Seismic Shocks g               | 0.3        |            |
|          | f) Relative humidity %            | ≤ 100      |            |
|          | g) Life expectancy y              | 40         |            |
| <b>3</b> | <b>Electrical conditions</b>      |            |            |
|          | a) Nominal system voltage (Um) kV | 11         |            |
|          | b) Maximum system voltage (Um) kV | 12         |            |
|          | c) Nominal frequency Hz           | 50         |            |
| <b>4</b> | <b>Rated requirements</b>         |            |            |
|          | General                           |            |            |



NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHNG RESISTORS AND AUX TRFR (NECRT'S)

| Item       | Description  | Schedule A    | Schedule B |
|------------|--|---------------|------------|
|            | a) Nominal short time (10 s) current of NEC and NER (r.m.s.)A      | 360           |            |
|            | b) Nominal continuous current of NEC and NER (r.m.s.)A             | 10            |            |
|            | c) Zero sequence reactance ( $X_0$ ) $\Omega/\text{ph}$            | 23,7 to 28,4  |            |
|            | d) Zero sequence resistance ( $R_0$ ) at 100°C $\Omega/\text{ph}$  | 47,3 to 56,8  |            |
|            | e) Zero sequence impedance ( $Z_0$ ) at 100°C $\Omega/\text{ph}$   | 52,32 to 61,5 |            |
|            | <b>NEC</b>   |               |            |
|            | a) Zero sequence reactance ( $X_c$ ) $\Omega$                      | xxxxxxxxxx    |            |
|            | b) Zero sequence resistance ( $R_c$ ) at 100°C $\Omega$            | xxxxxxxxxx    |            |
|            | c) No load loss of NEC at $U_n$ kW                                 | xxxxxxxxxx    |            |
|            | d) Flux density of NEC core T                                      | xxxxxxxxxx    |            |
|            | e) Magnetization current (r.m.s.)A                                 | xxxxxxxxxx    |            |
|            | f) Current density at nominal short time current A/mm <sup>2</sup> | xxxxxxxxxx    |            |
|            | <b>NER</b>   |               |            |
|            | a) Zero sequence reactance ( $X_r$ ) $\Omega$                      | xxxxxxxxxx    |            |
|            | b) Zero sequence resistance ( $R_r$ ) at 100 °C $\Omega$           | xxxxxxxxxx    |            |
|            | c) Nominal voltage ( $U_n/\sqrt{3}$ ) kV                           | 6,35          |            |
|            | d) Temperature coefficient at 100 °C $\Omega/^\circ\text{C}$       | xxxxxxxxxx    |            |
|            | e) Specific heat capacity kJ/kg °C                                 | xxxxxxxxxx    |            |
|            | f) Temperature range in which (d) and (e) apply °C                 | xxxxxxxxxx    |            |
| <b>4.1</b> | <b>Auxiliary transformer</b>                                       |               |            |
|            | a) Nominal rating kVA  | 100           |            |
|            | b) Primary nominal voltage kV                                      | 11            |            |
|            | c) No load secondary voltage V                                     | 420           |            |
|            | d) Vector group Dyn11 or Yzn11                                     | xxxxxxxxxx    |            |
|            | e) Flux density of aux core T                                      | xxxxxxxxxx    |            |
|            | f) Magnetizing current A   | xxxxxxxxxx    |            |
|            | g) Load loss kW  | xxxxxxxxxx    |            |
|            | h) No-load loss kW   | xxxxxxxxxx    |            |

NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHNG RESISTORS AND AUX TRFR (NECRT'S)

| Item | Description  |    | Schedule A  | Schedule B |
|------|--|----|-------------|------------|
| 5    | i) Percentage impedance                              | %  | As SANS 780 |            |
|      | <b>Temperature rise</b> (at site altitude)           |    |             |            |
|      | Conditions:  |    |             |            |
|      | I Passage of maximum continuous neutral              | A  | xxxxxxxxxx  |            |
|      | II Passage of rated current of auxiliary transformer | A  | xxxxxxxxxx  |            |
|      | III Passage of nominal short time current for        | A  | xxxxxxxxxx  |            |
|      | Top oil temperature for condition:                   |    |             |            |
|      | a) I   | °C | xxxxxxxxxx  |            |
|      | b) II  | °C | xxxxxxxxxx  |            |
|      | c) III   | °C | xxxxxxxxxx  |            |
|      | d) I and II  | °C | xxxxxxxxxx  |            |
|      | e) I and II and III                                  | °C | xxxxxxxxxx  |            |
|      | NEC winding temperature (calculated) for condition   |    |             |            |
|      | a) I   | °C | xxxxxxxxxx  |            |
|      | b) II  | °C | xxxxxxxxxx  |            |
|      | c) III   | °C | xxxxxxxxxx  |            |
|      | d) I and II  | °C | xxxxxxxxxx  |            |
|      | e) I and II and III                                  | °C | xxxxxxxxxx  |            |
|      | Metallic NER temperature (measured) for condition:   |    |             |            |
|      | a) I   | °C | xxxxxxxxxx  |            |
|      | b) II  | °C | xxxxxxxxxx  |            |
|      | c) III   | °C | xxxxxxxxxx  |            |
| 6    | <b>Material</b>                                      |    |             |            |
|      | a) NEC winding                                       |    | xxxxxxxxxx  |            |
|      | b) AUX HV winding                                    |    | xxxxxxxxxx  |            |
|      | c) AUX LV winding                                    |    | xxxxxxxxxx  |            |
|      | d) Grade of NER elements                             |    | xxxxxxxxxx  |            |
| 7    | <b>Material thickness</b>                            |    |             |            |

NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHING RESISTORS AND AUX TRFR (NECRT'S)

| Item      | Description  | Schedule A      | Schedule B |
|-----------|--|-----------------|------------|
|           | a) Tank top mm                                     | xxxxxxxxxx      |            |
|           | b) Tank bottom mm                                  | xxxxxxxxxx      |            |
|           | c) Tank sides mm                                   | xxxxxxxxxx      |            |
|           | d) Conservator mm                                  | xxxxxxxxxx      |            |
|           | e) Radiator tubes (if any) mm                      | xxxxxxxxxx      |            |
| <b>8*</b> | <b>Housing and corrosion protection</b>            |                 |            |
|           | a) Material - Inland                               | xxxxxxxxxx      |            |
|           | - Coastal  | xxxxxxxxxx      |            |
|           | b) Corrosion protection - Inland                   | As<br>SCSSCAAP9 |            |
|           | - Coastal  | As<br>SCSSCAAP9 |            |
|           | c) Tank colour                                     | Admiralty Grey  |            |
|           | d) Conservator colour                              | White           |            |
| <b>9*</b> | <b>HV Bushings</b>                                 |                 |            |
|           | a) Profile characteristics - Inland                | As IEC 60815    |            |
|           | - Coastal  | As IEC 60815    |            |
|           | b) Minimum creepage - Inland mm/kV                 | 25              |            |
|           | - Coastal mm/kV                                    | 31              |            |
|           | c) Material - Inland                               | xxxxxxxxxx      |            |
|           | - Coastal  | xxxxxxxxxx      |            |
|           | d) Manufacturer and type - Inland                  | xxxxxxxxxx      |            |
|           | - Coastal  | xxxxxxxxxx      |            |
| <b>10</b> | <b>Current transformers</b>                        |                 |            |
|           | REF and differential                               |                 |            |
|           | a) Manufacturer                                    | xxxxxxxxxx      |            |
|           | b) Ratio   | 2400/1          |            |
|           | c) Accuracy class (on 600/1 ratio)                 | TPS             |            |
|           | d) Max excitation current at 300 V mA              | 100             |            |
|           | e) Max internal resistance on 600/1 ratio $\Omega$ | 2,4             |            |

NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHNG RESISTORS AND AUX TRFR (NECRT'S)

| Item      | Description  | Schedule A | Schedule B |
|-----------|--|------------|------------|
|           | f) Secondary voltage/turn V/turn                             | 0,5        |            |
|           | g) Secondary internal resistance/turn mΩ/turn                | 4          |            |
|           | h) Location: (earthed end of NER nearer to earthed terminal) | xxxxxxxxxx |            |
|           | i) Reference number of mag. curve                            | xxxxxxxxxx |            |
|           | IDMTEF   |            |            |
|           | a) Manufacturer  | xxxxxxxxxx |            |
|           | b) Ratio   | 100/1      |            |
|           | c) Accuracy class  | 10P10      |            |
|           | d) Location: (earthed end of NER near resistor)              | xxxxxxxxxx |            |
|           | e) Reference number of mag. curve                            | xxxxxxxxxx |            |
| <b>11</b> | <b>NER elements</b>  |            |            |
|           | a) Manufacturer  | xxxxxxxxxx |            |
|           | b) Type designation  | xxxxxxxxxx |            |
|           | c) Number of elements  | xxxxxxxxxx |            |
| <b>12</b> | <b>Buchholz relay</b>  |            |            |
|           | a) Manufacturer  | xxxxxxxxxx |            |
|           | b) Type designation  | xxxxxxxxxx |            |
|           | c) Minimum size mm   | 50         |            |
| <b>13</b> | <b>Dial type thermometer</b>                                 | xxxxxxxxxx |            |
|           | a) Manufacturer  |            |            |
|           | b) Type designation  | xxxxxxxxxx |            |
| <b>14</b> | <b>Overall dimensions</b>                                    |            |            |
|           | a) Height mm   | xxxxxxxxxx |            |
|           | b) Length mm   | xxxxxxxxxx |            |
|           | c) Width mm  | xxxxxxxxxx |            |
|           | <b>Mass</b>  |            |            |
| <b>15</b> | a) NEC core and winding kg                                   | xxxxxxxxxx |            |
|           | b) NER kg  | xxxxxxxxxx |            |

**NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHNG RESISTORS AND AUX TRFR (NECRT'S)**

| <b>Item</b> | <b>Description</b>                                       | <b>Schedule A</b> | <b>Schedule B</b> |
|-------------|--|-------------------|-------------------|
|             | c) AUX core and winding kg                               | xxxxxxxxxx        |                   |
|             | d) Tank and fittings kg                                  | xxxxxxxxxx        |                   |
|             | e) Oil kg  | xxxxxxxxxx        |                   |
|             | f) Total kg  | xxxxxxxxxx        |                   |
| <b>16</b>   | <b>Documentation</b><br>Provide reference number for:    |                   |                   |
|             | a) Outline drawings                                      | xxxxxxxxxx        |                   |
|             | b) Rating and diagram plate                              | xxxxxxxxxx        |                   |
|             | c) Internal general assembly drawing                     | xxxxxxxxxx        |                   |
|             | d) AUX transformer wiring diagram                        | xxxxxxxxxx        |                   |
| <b>17</b>   | <b>Type and special test</b><br>Provide test report for: |                   |                   |
|             | a) Power-frequency voltage withstand test.               | xxxxxxxxxx        |                   |
|             | b) Impulse test.   | xxxxxxxxxx        |                   |
|             | c) Separate source voltage withstand test.               | xxxxxxxxxx        |                   |
|             | d) Induced over voltage test.                            | xxxxxxxxxx        |                   |
|             | e) Measurement of zero sequence ....                     | xxxxxxxxxx        |                   |
|             | f) Temperature rise test.                                | xxxxxxxxxx        |                   |
|             | g) Short-circuit test on AUX                             | xxxxxxxxxx        |                   |
|             | h) Short-time current test on NEC/NER                    | xxxxxxxxxx        |                   |
|             | i) Vacuum test   | xxxxxxxxxx        |                   |
|             | j) Accelerated ageing test for composite bushings.       | xxxxxxxxxx        |                   |

**NOTE:**

\*The schedule makes provision for both coastal/high-corrosive environments and inland/low-corrosive applications.

\*Insulation shall be based on coastal/high-corrosive environments, even if installed inland.

NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHING RESISTORS AND AUX TRFR (NECRT'S)

**3. TECHNICAL A & B DEVIATION SCHEDULE**

**Table 2: Deviations Schedule**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.

| Item | Sub-clause | Proposed deviation |
|------|------------|--------------------|
|      |            |                    |

Show formulae according to which the zero-sequence inductance and resistance will be designed to limit the fault to 300 A.

SIGNED ON BEHALF OF TENDERER : .....

COMPANY NAME : .....

NAME IN BLOCK LETTERS : .....

DATE : .....

# TSE48 – TECHNICAL SCHEDULE ELECTRICAL

OPTICAL GROUND WIRE (OPGW)

## TABLE OF CONTENTS

|    |  |   |
|----|--|---|
| 1. | GENERAL .....                            | 1 |
| 2. | TECHNICAL A & B SCHEDULE.....            | 1 |
| 3. | TECHNICAL A & B DEVIATION SCHEDULE ..... | 3 |

## TABLE OF TABLES

|  |   |
|--|---|
| Table 1: NRS 061-1 - Technical Schedule..... | 1 |
| Table 2: NRS 081 - Technical Schedule.....   | 2 |
| Table 2: Deviations schedule.....            | 3 |

## TABLE OF FIGURES

NO TABLE OF FIGURES ENTRIES FOUND.



## 1. GENERAL

The general requirements for Optical Ground Wire (OPGW) are covered by NRS 061 and NRS 081. The detail project requirements shall be covered in the Project Specification, Drawings and Bill of Quantities.

## 2. TECHNICAL A & B SCHEDULE

Schedule A: Purchaser's specific requirements

Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

**Table 1: NRS 061-1 - Technical Schedule**

| Item | Clause   | Description                                       |        | Schedule A | Schedule B |
|------|----------|---|--------|------------|------------|
| 1    | 4.1.4    | Grease conductor in accordance with SANS 61089?   | Yes/No | Ungreased  | xxxxxxxxxx |
|      | 4.1.5 a) | Pollution level, if other than heavy              |        | Heavy      | xxxxxxxxxx |
|      | 4.1.5 b) | Maximum temperature, if other than 50 °C          | °C     | 50 °C      | xxxxxxxxxx |
|      | 4.1.5 c) | Minimum temperature, if other than –10 °C         | °C     | -10 °C     | xxxxxxxxxx |
|      | 4.1.5 d) | Maximum wind speed, if other than 36 m/s          | m/s    | 36         | xxxxxxxxxx |
|      | 4.1.5 e) | Route altitude, if other than 2 000 m             | m      | < 2000     | xxxxxxxxxx |
|      | 4.1.6 a) | Name of manufacturer                              |        | xxxxxxxxxx |            |
|      | 4.1.6 b) | Place of manufacture                              |        | xxxxxxxxxx |            |
|      | 4.1.6 c) | Manufacturer's reference number                   |        | xxxxxxxxxx |            |
| 2    | 4.2.1.1  | Type of fibre in accordance with NRS 081 (G.652D) | Yes/No | xxxxxxxxxx |            |
|      |          | If no, state fibre type                           |        | xxxxxxxxxx |            |
|      | 4.2.2.1  | OPGW 1 s current rating                           | kA     | 18.68      |            |
|      | 4.2.2.2  | Stranding and wire diameter                       |        | xxxxxxxxxx |            |
| 3    | 4.3.1.1  | Number of fibres                                  |        | 48         | xxxxxxxxxx |
|      | 4.3.2.1  | Conductor material                                |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Nominal cross-section                             |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Actual cross-sectional area                       |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Maximum overall diameter                          |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Maximum mass per metre of cable                   | kg/m   | xxxxxxxxxx |            |
|      | 4.3.2.1  | Rated tensile strength (RTS)                      |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Initial modulus of elasticity                     |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Final modulus of elasticity                       |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Maximum drum length                               |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Direction of lay of outer layer                   |        | xxxxxxxxxx |            |
|      | 4.3.2.1  | Diameter of outer strands                         |        | xxxxxxxxxx |            |

| Item | Clause  | Description   |        | Schedule A  | Schedule B  |
|------|---------|---|--------|-------------|-------------|
|      | 4.3.2.1 | Short-circuit 1 s current rating  |        | xxxxxxxxxxx |             |
|      | 4.3.2.1 | DC resistance at 20 °C/km   |        | xxxxxxxxxxx |             |
|      | 4.3.2.1 | Continuous current-carrying capability  | A      | xxxxxxxxxxx |             |
|      | 4.3.2.2 | Complete details of cable construction, including measures to minimize hydrogen absorption and water ingress. |        | xxxxxxxxxxx |             |
| 4    | 4.4.1   | Is a sample required?   | Yes/No | Yes         | xxxxxxxxxxx |
|      | 4.4.3   | Length of sample, if not 1 m  |        | 1 m         | xxxxxxxxxxx |
| 5    | 5.1.3.2 | Specify class of cable 0, 1, 2 or 3   |        | Class 2     | xxxxxxxxxxx |
| 6    | 6.2.1   | Maximum drum length of OPGW   |        | xxxxxxxxxxx |             |
|      |         | Mass of drum including max. length of OPGW cable  |        | xxxxxxxxxxx |             |
| 7    | 6.3     | Is documentation required?  | Yes/No | Yes         |             |

Table 2: NRS 081 - Technical Schedule

| Item | Clause | Description                                       | Schedule A               | Schedule B  |
|------|--------|---|--------------------------|-------------|
| 1    | 4.1    | Grease conductor in accordance with SANS 61089?   | Comply                   |             |
| 2    | 4.2    | Pollution level, if other than heavy              | Comply                   |             |
| 3    | 4.3    | Maximum temperature, if other than 50 °C          | Comply                   |             |
| 4    | 4.3.12 | Minimum temperature, if other than –10 °C         | ≤ 0,35 dB/km at 1 310 nm | xxxxxxxxxxx |
| 5    | 4.3.12 | Maximum wind speed, if other than 36 m/s          | ≤ 0,35 dB/km at 1 383 nm | xxxxxxxxxxx |
| 6    | 4.3.12 | Route altitude, if other than 2 000 m             | ≤ 0,22 dB/km at 1 550 nm | xxxxxxxxxxx |
| 7    | 4.3.16 | Name of manufacturer                              | ≤ 0,2 ps/√km             |             |
| 8    | 7      | Place of manufacture                              | xxxxxxxxxxx              |             |
| 9    | 7      | Manufacturer's reference number                   | xxxxxxxxxxx              |             |
| 10   | 7      | Type of fibre in accordance with NRS 081 (G.652D) | xxxxxxxxxxx              |             |

**3. TECHNICAL A & B DEVIATION SCHEDULE****Table 3: Deviations schedule**

| Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification. |            |                    |
|---|------------|--------------------|
| Item  | Sub-clause | Proposed deviation |
|   |            |                    |

SIGNED ON BEHALF OF TENDERER : .....

COMPANY NAME : .....

NAME IN BLOCK LETTERS : .....

DATE : .....

EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

C3.3. GENERAL SPECIFICATIONS

C3.3.1. PREAMBLE

**Note:**

Failure to duly complete Technical Schedules in full will result in the disqualification of the tenderer's offer.

**No change in supplier is permitted without a written application by the contractor and written consent by the Engineer. Should any change in supplier be noted at any stage during implementation of the project the Engineer will instruct the Contractor to revert back to suppliers as per the tender offer with any time and cost implications for the Contractors account.**

It shall be noted that specifications are for the general use of project construction, certain sections or paragraphs may not be relevant to this particular contract in which case such irrelevant items are to be considered as not applicable. Any uncertainties shall be communicated to the Engineer. Where equivalent South African standards (SANS / NRS) exist, such standards are to be used in preference to foreign standards quoted.

The documents referenced contain provisions that constitutes requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

I / We, the undersigned ..... hereby acknowledge that  
I / We have obtained copies of the mentioned documents and confirm that I / We fully understand them and the consequences of non-compliance.

SIGNED AT ..... ON BEHALF OF THE FIRM .....

ON THIS ..... DAY OF ..... 20....

NAME: .....

SIGNATURE: .....

CAPACITY: .....

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C3.3.2. LAW - NATIONAL AND INTERNATIONAL STANDARDS

All IEC, NRS, SANS, ASCE, ISO codes and National Law applicable to the disciplines listed below shall apply to this project:

|     |     |      |   |
|-----|-----|------|---|
| ACT | 31  |      | Fencing Act.  |
| ACT | 73  | 1989 | Environmental Conservation act.   |
| ACT | 85  | 1993 | Machinery and Occupational Safety Act 85 of 1993 with special reference to Section 1 (Act & Regulations), Section 2 (Administrative Regulations), Section 6 (Electrical Installation Regulations) and Section 16 (General Safety Regulations) |
| ACT | OHS | 1993 | Occupational Health and Safety Act 1993   |

The following specifications are included on the Tender CD issued together with the tender. It is the responsibility of the tenderer to ensure that he/she obtains the tender CD.

|        |  |
|--------|--|
| GSE 11 | Subtransmission Overhead Lines                       |
| GSE 14 | Inspections, Testing, Commissioning and Handing Over |
| GSE 18 | Power Transformer                                    |
| GSE 20 | NECRT  |
| GSE 48 | OPGW   |

Standards are obtainable on the SABS Web store [www.store.sabs.co.za](http://www.store.sabs.co.za).

#### C3.3.3. ESKOM SPECIFICATIONS / STANDARDS

applicable to this project. This listed specifications included on the Tender CD issued together with the Tender. It is the responsibility of the tenderer to ensure that he/she obtains the tender CD. In addition, these specifications are also available on the Eskom website ([www.scot.eskom.co.za](http://www.scot.eskom.co.za)).

**Table 11: Eskom Specifications/Standards**

| NO.          | REV / YEAR | DESCRIPTION  |
|--------------|------------|--|
| 240-68973110 | 2014-2019  | Specification for power transformers rated for 1.25MVA and above and with highest voltage of 2.2kV or above  |
| 240-57648848 |            | Specification for combined three-phase neutral electromagnetic couplers with neutral earthing resisters and auxiliary power transformers (NECRT's) |
| 240-86100853 | 0          | Standard for Barricading prohibited area and live chamber  |
| 240-87605434 | 2015-2020  | Quality control process for the checking of distribution substation construction before handing over for commercial operation                      |
| 34-1245      | Latest     | Distribution Standard – Part 2: Earthing Section 3. Substation earthing  |
| 34-1439      | 2012-2017  | Standard for the labelling of substations and networks   |

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

| <b>NO.</b>   | <b>REV / YEAR</b> | <b>DESCRIPTION</b>  |
|--------------|-------------------|---|
| 34-254       | Latest            | Manufacturing Specification for Distribution Equipment Labels                           |
| 34-2057      | 2010-2015         | Sweep frequency response analysis test procedure  |
| 34-333       | 1                 | OHS act requirements to be met by principal contractors employed by Eskom Distribution. |
| 32-94        | 0                 | Safety, Health and Environment (SHE) Policy.  |
| 32-136       | 2                 | Contractor Health and Safety Requirements.  |
| 32-345       | 2                 | Eskom Vehicle Safety Specification.   |
| 240-62196227 | 5                 | Life-saving Rules.  |
| EPC_32-36    | 0                 | Smoking.  |
| EPC_32-93    | 2                 | Vehicle and Driver Safety.  |
| CPL_32-418   | 0                 | Working at Height.  |
| TST_41-120   | 0                 | Environmental Requirements for Procurement.   |
| ESKPBAAA9    | Latest            | Environmental impact assessment procedure   |
| ESKPBAAD6    | Latest            | Environmental management policy   |
| ESKPVAAL7    | Latest            | Environmental impact assessment procedure   |
| ESKPVAAZ1    | 2                 | Environmental Management Programme (EMP) Procedure                                      |

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

#### C3.3.4. SANS/IECSPECIFICATIONS

The following National and International standards shall be adhered to and can be obtained through the SABS webstore.

##### C3.3.4.1. SUBTRANSMISSION OVERHEAD LINE

|              |   |   |
|--------------|---|---|
| NRS 061-1    | - | Overhead Ground Wire with Optical Fibre                   |
| NRS 061-2    | - | Specification for Overhead Ground Wire with Optical Fibre |
| NRS 081      | - | Single-Mode Non-Dispersion Shifted Optical Fibres         |
| SANS 182-3   | - | Conductors for overhead electrical transmission lines     |
| SANS 10280-1 | - | OHL – Minimum Clearances for Power Lines                  |

##### C3.3.4.2. POWER TRANSFORMER

|           |   |   |
|-----------|---|---|
| IEC 60076 | - | Power Transformers (all applicable parts) |
| IEC 60137 | - | Bushings for AC voltages above 1000V      |
| NRS 054   | - | Design of large Power transformers        |

Relevant Eskom specifications.

##### C3.3.4.3. EARTHING AND LIGHTNING PROTECTION SYSTEM

|             |   |  |
|-------------|---|--|
| SANS 725/   |   |  |
| IEEE 80     | - | Guide for safety in AC Substation Grounding  |
| IEEE 81     | - | Guide for measuring earth resistivity, ground impedance and earth surface potentials of a ground system                          |
| SANS 10199  | - | The design and installation of an earth electrode  |
| IEC 62305   | - | Protection against lightning   |
| SANS 10292  | - | Earthing of low-voltage (LV) distribution systems  |
| SANSA 10313 | - | Protection against lightning – Physical damage to structures and life hazards  |
| NRS 060     | - | Code of Practice for clearances for electrical systems with rated voltages up to and including 145 kV, for the safety of persons |
| IEC 61024   | - | Protection of structures against lightning   |

##### C3.3.4.4. SURGE ARRESTERS

|           |   |  |
|-----------|---|--|
| IEC 60099 | - | Surge Arrestors. Metal-Oxide. Surge Arresters without gaps for AC Systems. |
|-----------|---|--|

Relevant Eskom specifications.

##### C3.3.4.5. INSULATION

|           |   |   |
|-----------|---|---|
| SANS 1019 | - | Standard voltages, currents and insulation levels for electricity supply                                    |
| IEC 60273 | - | Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V |
| IEC 60168 | - | Tests on indoor and outdoor post insulators of ceramic material   |

## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

#### CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

- IEC 60383 - or glass for systems greater than 1000 V  
Insulators for overhead lines with a nominal voltage above 1000 V
- IEC 60815 - Selection and dimensioning of high-voltage insulators intended for use in polluted conditions
- IEC 60168 - Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1 000 V
- IEC 60455 - Resin based reactive compounds used for electrical insulation
- IEC 60071-1 - Insulation co-ordination
- Relevant Eskom specifications.

#### C3.3.4.6. ELECTROMAGNETIC COMPATIBILITY

- IEC 61000-6-2 - Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments
- IEC 61000-6-4 - Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
- IEC 61000-6-5 - Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for power station and substation
- Relevant Eskom specifications.

I / We, the undersigned ..... hereby acknowledge that I / We have obtained copies of the mentioned documents and confirm that I / We fully understand them and the consequences of non-compliance.

SIGNED AT ..... ON BEHALF OF THE FIRM .....

ON THIS ..... DAY OF ..... 20.....

NAME: .....

SIGNATURE: .....

CAPACITY: .....



# TSE56 – TECHNICAL SCHEDULE ELECTRICAL

## SURGE ARRESTERS

## TABLE OF CONTENTS

|    |  |    |
|----|--|----|
| 1. | GENERAL .....  | 1  |
| 2. | TECHNICAL A & B SCHEDULE – 11 KV SURGE ARRESTER.....           | 1  |
| 3. | TECHNICAL A & B DEVIATION SCHEDULE – 11 KV SURGE ARRESTER..... | 8  |
| 4. | TECHNICAL A & B SCHEDULE – 66 KV SURGE ARRESTERS .....         | 9  |
| 5. | TECHNICAL A & B DEVIATION SCHEDULE – 66 KV SURGE ARRESTER..... | 16 |
| 6. | TECHNICAL A & B SCHEDULE – 88 KV SURGE ARRESTER.....           | 17 |
| 7. | TECHNICAL A & B DEVIATION SCHEDULE – 88 KV SURGE ARRESTER..... | 24 |

## TABLE OF TABLES

|   |    |
|---|----|
| Table 1: Technical Schedule – 11 kV Surge Arrester .....  | 1  |
| Table 2: Deviation Schedule – 11 kV Surge Arrester .....  | 8  |
| Table 3: Technical Schedule - 66 kV Surge Arrester .....  | 9  |
| Table 4: Deviation Schedule - 66 kV Surge Arrester .....  | 16 |
| Table 5: Technical Schedule – 88 kV Surge Arresters ..... | 17 |
| Table 6: Deviation Schedule - 88 kV Surge Arrester .....  | 24 |

## TABLE OF FIGURES

**NO TABLE OF FIGURES ENTRIES FOUND.**

## 1. GENERAL

The general requirements for station class surge arresters are covered by Eskom specification DSP\_34-419. The detail project requirements shall be covered by the Project Specification, Drawings and Bill of Quantities.

## 2. TECHNICAL A & B SCHEDULE – 11 kV SURGE ARRESTER

Schedule A: Purchaser's specific requirements

Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

**Table 1: Technical Schedule – 11 kV Surge Arrester**

| Sub clause of 34-419 | Description                              |                   | Schedule A      | Schedule B |
|----------------------|--|-------------------|-----------------|------------|
|                      | <b>1. SURGE ARRESTER IDENTIFICATION</b>  |                   |                 |            |
|                      | a) Supplier                              |                   | xxxxxxxxxx      |            |
|                      | b) Manufacturer                          |                   | xxxxxxxxxx      |            |
|                      | c) MOV block manufacturer                |                   | xxxxxxxxxx      |            |
|                      | d) Product code: Item 3 (Coastal)        |                   | xxxxxxxxxx      |            |
|                      | • Item 4 (Inland)                        |                   | xxxxxxxxxx      |            |
| <b>4.1</b>           | <b>2. OPERATING CONDITIONS</b>           |                   |                 |            |
|                      | a) Altitude                              | m                 | up to 1800      | xxxxxxxxxx |
|                      | b) Average humidity                      | %                 | 30 to 90        | xxxxxxxxxx |
|                      | c) Minimum ambient temperature           | °C                | -10             | xxxxxxxxxx |
|                      | • Maximum ambient temperature            | °C                | 40              | xxxxxxxxxx |
|                      | • Maximum diurnal variation              | °C                | 30              | xxxxxxxxxx |
|                      | d) Intensity of solar radiation          | kW/m <sup>2</sup> | 1,1             | xxxxxxxxxx |
|                      | e) IEC pollution level: Item 3 (Coastal) |                   | HVH             | xxxxxxxxxx |
|                      | • Item 4 (Inland)                        |                   | LM              | xxxxxxxxxx |
|                      | f) Lightning activity                    |                   | High            | xxxxxxxxxx |
|                      | g) System earthing                       |                   | Non-effective   | xxxxxxxxxx |
|                      | h) System configuration                  |                   | 3-phase, 3-wire | xxxxxxxxxx |
|                      | i) Nominal system voltage (Un)           | kV                | 11              | xxxxxxxxxx |

| Sub clause of 34-419 | Description   |  | Schedule A            | Schedule B |
|----------------------|---|--|-----------------------|------------|
|                      | j) Maximum system voltage (Um) kV   |  | 12                    | xxxxxxxxxx |
|                      | k) Supply frequency Hz  |  | 50                    | xxxxxxxxxx |
|                      | l) BIL of equipment to be protected kV peak   |  | 95                    | xxxxxxxxxx |
| <b>4.3</b>           | <b>3. ELECTRICAL CHARACTERISTICS OF ARRESTER</b>  |  |                       |            |
|                      | a) Arrester classification  |  | Station class         |            |
|                      | b) IEC line discharge class   |  | 2                     |            |
|                      | c) Nominal lightning discharge current (8/20µs) kA  |  | 10                    |            |
|                      | d) Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of MCOV kJ/kV |  | 3,4                   |            |
|                      | e) Arrester rated voltage (Ur) kV   |  | xxxxxxxxxx            |            |
|                      | f) MCOV (Uc) kV   |  | 12                    |            |
|                      | g) Maximum residual voltage (Ures) at 10kA (8/20µs ) kV   |  | 45                    |            |
| <b>4.4</b>           | <b>4. ARRESTER HOUSING</b>  |  |                       |            |
|                      | a) Housing material   |  |                       |            |
|                      | • Item 3 (Coastal)  |  | xxxxxxxxxx            |            |
|                      | • <del>Item 4 (Inland)</del>  |  | <del>xxxxxxxxxx</del> |            |
|                      | b) Minimum external creepage distance:  |  |                       |            |
|                      | • Item 3 (Coastal) [Um x 31 mm/kV] mm   |  | 372                   |            |
|                      | • <del>Item 4 (Inland) [Um x 20 mm/kV] mm</del>   |  | <del>240</del>        |            |
| <b>4.4.3</b>         | <b>5. ARRESTER HOUSING PROFILE DESIGN</b>   |  |                       |            |
|                      | IEC 60815 annex D parameters:   |  |                       |            |
|                      | a) c  |  | ≥ 20                  |            |
|                      | b) s/p  |  | ≥ 0,65                |            |
|                      | c) Ld/d   |  | ≤ 5                   |            |
|                      | d) P1 – P2  |  | ≥ 15                  |            |
|                      | e) CF   |  | ≤ 3,5                 |            |

| Sub clause of 34-419 | Description   | Schedule A       | Schedule B |
|----------------------|---|------------------|------------|
|                      | f) PF   | $\geq 0,7$       |            |
| 4.5                  | <b>6. ARRESTER MOUNTING DETAILS</b>   |                  |            |
|                      | a) Orientation  | Vertical         | xxxxxxxxxx |
|                      | b) Method of mounting   | Base             | xxxxxxxxxx |
|                      | c) Reference number of drawing showing mounting details   | xxxxxxxxxx       |            |
| 4.6.1                | <b>7. ARRESTER LINE TERMINAL</b>  |                  |            |
|                      | a) Type   | Threaded         |            |
|                      | b) Diameter   | M12              |            |
|                      | c) Minimum length mm  | 50               |            |
|                      | d) Orientation  | Vertical         |            |
|                      | e) Supplied with: M12 nut, two flat washers and spring washer   | Yes              |            |
|                      | f) Material   | xxxxxxxxxx       |            |
|                      | g) Reference number of drawing showing details of line terminal   | xxxxxxxxxx       |            |
| 4.6.2                | <b>8. ARRESTER EARTH TERMINAL</b>   |                  |            |
|                      | a) Type   | Threaded         |            |
|                      | b) Diameter   | M12              |            |
|                      | c) Minimum length mm  | 50               |            |
|                      | d) Orientation  | Vertical         |            |
|                      | e) Supplied with nut, two flat washers and spring washer  | Yes              |            |
|                      | f) Material   | xxxxxxxxxx       |            |
|                      | g) Reference number of drawing showing details of line terminal   | xxxxxxxxxx       |            |
| 4.7.1                | <b>9. DRAWINGS TO BE SUBMITTED WITH TENDER</b>  |                  |            |
|                      | Single copies of drawings shall be submitted as part of the original tender showing the following detail: |                  |            |
|                      | a) Outline dimensions of arrester, fit as for service   | Reference number |            |
|                      | b) Mounting details   | Reference number |            |

| Sub clause of 34-419 | Description   | Schedule A        | Schedule B |
|----------------------|---|-------------------|------------|
|                      | c) Line and earth terminal, conductor clamping arrangement  | Reference number  |            |
|                      | d) Details of grading rings   | Reference number  |            |
| <b>4.7.2</b>         | <b>10. ARRESTER CHARACTERISTIC DATA REQUIRED</b>  |                   |            |
|                      | a) V-I characteristic curve, AC   | Reference Number: |            |
|                      | b) V-I characteristic curve, DC   | Reference Number: |            |
|                      | c) Temporary overvoltage withstands capability curve in per unit of MCOV, with and with-out prior duty.                   | Reference Number: |            |
|                      | <b>11. ARRESTER TEMPORARY OVERVOLTAGE CAPABILITY, WITH PRIOR DUTY.</b><br>(prior duty as defined in annex D, IEC 60099-4) |                   |            |
|                      | a) Overvoltage applied for 1 s<br>pu of MCOV  | xxxxxxxxx         |            |
|                      | b) Overvoltage applied for 5 s<br>pu of MCOV  | xxxxxxxxx         |            |
|                      | c) Overvoltage applied for 10 s<br>pu of MCOV   | xxxxxxxxx         |            |
|                      | <b>12. PHYSICAL DIMENSIONS OF ARRESTERS</b>   |                   |            |
|                      | d) Overall height of arrester<br>mm   | xxxxxxxxx         |            |
|                      | e) Minimum external flashover distance<br>mm  | 200               |            |
|                      | f) External diameter of arrester housing<br>mm  | xxxxxxxxx         |            |
|                      | g) Diameter of voltage grading rings<br>mm  | xxxxxxxxx         |            |
|                      | h) Distance of grading ring from top of arrester<br>mm  | xxxxxxxxx         |            |
|                      | <b>13. MOV ELEMENTS</b>   |                   |            |
|                      | a) Diameter of elements<br>mm   | xxxxxxxxx         |            |
|                      | b) Thickness of elements<br>mm  | xxxxxxxxx         |            |
|                      | c) Number of elements per arrester  | xxxxxxxxx         |            |
| 4.2.2                | d) Number of stacks in parallel   | 0                 |            |
|                      | <b>14. MISCELLANEOUS</b>  |                   |            |
| 4.2.1                | a) Live spray washing (Yes/No)  | No                | xxxxxxxxx  |
|                      | b) Total mass of assembled unit<br>kg   | xxxxxxxxx         |            |

| Sub clause of 34-419 | Description  |             | Schedule A | Schedule B |
|----------------------|--|-------------|------------|------------|
|                      | c) Minimum expected life of arrester at 40 °C and MCOV                             | yrs         | 25         |            |
| 4.2.7                | d) Sample available for inspection   |             | Yes        |            |
| 5.2.10               | e) Declared specified long-term load   | kN          | xxxxxxxxxx |            |
| <b>5.2.1</b>         | <b>15. INSULATION WITHSTAND TEST</b>   |             |            |            |
|                      | a) Reference number of test report   |             | xxxxxxxxxx |            |
|                      | b) Lightning impulse (1,2/50µs) withstand level [(1,3/0,82) × Ures]                | kV          | 71         |            |
|                      | c) 60 s wet power frequency withstand  | r.m.s kV    | 28         |            |
| <b>5.2.2</b>         | <b>16. RESIDUAL VOLTAGE TEST</b>   |             |            |            |
|                      | a) Reference number of test report   |             | xxxxxxxxxx |            |
|                      | b) Maximum residual voltage for a 10 kA steep current impulse (1/20µs)             | kV          | 49         |            |
|                      | c) Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude: |             |            |            |
|                      | • 5 kA   | kV          | xxxxxxxxxx |            |
|                      | • 10 kA  | kV          | 45         |            |
|                      | • 20 kA  | kV          | xxxxxxxxxx |            |
|                      | d) Maximum residual voltage for a 500 A switching current impulse                  | kV          | xxxxxxxxxx |            |
| <b>5.2.3</b>         | <b>17. LONG DURATION CURRENT IMPULSE WITHSTAND TEST</b>                            |             |            |            |
|                      | a) Reference number of test report   |             | xxxxxxxxxx |            |
|                      | b) Charging voltage  | pu of $U_r$ | 3,2        |            |
|                      | or   |             |            |            |
|                      | • charging current   | A           | xxxxxxxxxx |            |
|                      | c) Virtual duration of peak  | µs          | 2000       |            |
|                      | d) Number of discharge operations  |             | 18         |            |
|                      | e) Number of grouped operations  |             | 6          |            |
|                      | f) Operations per group  |             | 3          |            |
|                      | g) Maximum interval between operations   | s           | 60         |            |

| Sub clause of 34-419 | Description  |             | Schedule A      | Schedule B |
|----------------------|--|-------------|-----------------|------------|
|                      | h) Interval between groups   |             | Cool to ambient |            |
|                      | i) Maximum permitted change in residual voltage after long duration current impulse withstand test | %           | 5               |            |
| <b>5.2.4</b>         | <b>18. OPERATING DUTY TESTS</b>  |             |                 |            |
|                      | a) Reference number of test report   |             | xxxxxxxxxx      |            |
|                      | <b>Conditioning part 1:</b>  |             |                 |            |
|                      | b) 10 kA current impulse (8/20 $\mu$ s), energized at 1,2 x MCOV                                   | kV          | 14.5            |            |
|                      | c) Number of discharge operations  |             | 20              |            |
|                      | d) Number of grouped operations  |             | 4               |            |
|                      | e) Operations per group  |             | 5               |            |
|                      | f) Interval between operations   | s           | 60              |            |
|                      | g) Intervals between groups  | min         | 30              |            |
|                      | <b>Conditioning part 2:</b>  |             |                 |            |
|                      | h) High current impulse (4/10 $\mu$ s)   | kA          | 100             |            |
|                      | i) Number of applications  |             | 2               |            |
|                      | <b>Conditions for switching surge test:</b>  |             |                 |            |
|                      | j) Charging voltage  | pu of $U_r$ | 3.2             |            |
|                      | or   |             |                 |            |
|                      | • charging current   | A           | xxxxxxxxxx      |            |
|                      | k) Virtual duration of peak  | $\mu$ s     | 2000            |            |
|                      | l) Number of discharge operations  |             | 2               |            |
|                      | m) Interval between operations   | s           | 60              |            |
|                      | n) Starting temperature for first impulse  | °C          | 60              |            |
|                      | o) Energy dissipated during second impulse   | kJ          | xxxxxxxxxx      |            |
|                      | <b>Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:</b>            |             |                 |            |
|                      | p) Interval between last long duration current impulse and power frequency test                    | ms          | 100             |            |



| Sub clause of 34-419 | Description  |              | Schedule A    | Schedule B |
|----------------------|--|--------------|---------------|------------|
|                      | q) Elevated rated voltage ( $U_r^*$ ) applied for 10 s   | kV           | xxxxxxxxxx    |            |
|                      | r) Elevated continuous operating voltage ( $U_c^*$ ) applied for 30 min                            | kV           | xxxxxxxxxx    |            |
|                      | s) Maximum permitted change in residual voltage after long duration current impulse withstand test | %            | 5             |            |
|                      |  |              |               |            |
| <b>5.2.5</b>         | <b>19. POWER FREQUENCY VOLTAGE VERSUS TIME CHARACTERISTIC</b>                                      |              |               |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx    |            |
| <b>5.2.6</b>         | <b>20. SHORT-CIRCUIT TEST</b>  |              |               |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx    |            |
|                      | b) High current  | kA<br>r.m.s. | 40            |            |
|                      | c) Low current   | kA<br>r.m.s. | $0,6 \pm 0,2$ |            |
| <b>5.2.7</b>         | <b>21. NATURAL AGEING AND POLLUTION PERFORMANCE TEST</b>   |              |               |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx    |            |
| <b>5.2.8</b>         | <b>22. INTERNAL PARTIAL DISCHARGE TEST</b>   |              |               |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx    |            |
|                      | b) Power frequency voltage applied [1,05 x MCOV]   | kV           | 7,6           |            |
|                      | c) Maximum partial discharge   | pC           | 10            |            |
| <b>5.2.9</b>         | <b>23. MOISTURE INGRESS TEST</b>   |              |               |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx    |            |
| <b>5.2.10</b>        | <b>24. BENDING MOMENT TEST</b>   |              |               |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx    |            |

**3. TECHNICAL A & B DEVIATION SCHEDULE – 11 kV SURGE ARRESTER****Table 2: Deviation Schedule – 11 kV Surge Arrester**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.

| Item | Sub-clause | Proposed deviation |
|------|------------|--------------------|
|      |            |                    |

SIGNED ON BEHALF OF TENDERER : .....

COMPANY NAME : .....

NAME IN BLOCK LETTERS : .....

DATE : .....

#### 4. TECHNICAL A & B SCHEDULE – 66 kV SURGE ARRESTERS

Schedule A: Purchaser's specific requirements

Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

**Table 3: Technical Schedule - 66 kV Surge Arrester**

| Sub clause of 34-419 | Description                              |                   | Schedule A      | Schedule B |
|----------------------|--|-------------------|-----------------|------------|
|                      | <b>1. SURGE ARRESTER IDENTIFICATION</b>  |                   |                 |            |
|                      | a) Supplier                              |                   | xxxxxxxxxx      |            |
|                      | b) Manufacturer                          |                   | xxxxxxxxxx      |            |
|                      | c) MOV block manufacturer                |                   | xxxxxxxxxx      |            |
|                      | d) Product code: Item 9 (Coastal)        |                   | xxxxxxxxxx      |            |
|                      | • Item 10 (Inland)                       |                   | xxxxxxxxxx      |            |
| <b>4.1</b>           | <b>2. OPERATING CONDITIONS</b>           |                   |                 |            |
|                      | a) Altitude                              | m                 | up to 1800      | xxxxxxxxxx |
|                      | b) Average humidity                      | %                 | 30 to 90        | xxxxxxxxxx |
|                      | c) Minimum ambient temperature           | °C                | -10             | xxxxxxxxxx |
|                      | • Maximum ambient temperature            | °C                | 40              | xxxxxxxxxx |
|                      | • Maximum diurnal variation              | °C                | 30              | xxxxxxxxxx |
|                      | d) Intensity of solar radiation          | kW/m <sup>2</sup> | 1,1             | xxxxxxxxxx |
|                      | e) IEC pollution level: Item 9 (Coastal) |                   | HVH             | xxxxxxxxxx |
|                      | • Item 10 (Inland)                       |                   | LM              | xxxxxxxxxx |
|                      | f) Lightning activity                    |                   | High            | xxxxxxxxxx |
|                      | g) System earthing                       |                   | Effective       | xxxxxxxxxx |
|                      | h) System configuration                  |                   | 3-phase, 3-wire | xxxxxxxxxx |
|                      | i) Nominal system voltage (Un)           | kV                | 66              | xxxxxxxxxx |
|                      | j) Maximum system voltage (Um)           | kV                | 73              | xxxxxxxxxx |
|                      | k) Supply frequency                      | Hz                | 50              | xxxxxxxxxx |

| Sub clause of 34-419 | Description   | Schedule A         | Schedule B |
|----------------------|---|--------------------|------------|
| <b>4.3</b>           | <b>3. ELECTRICAL CHARACTERISTICS OF ARRESTER</b>  |                    |            |
|                      | a) Arrester classification  | Station class      |            |
|                      | b) IEC line discharge class   | 2                  |            |
|                      | c) Nominal lightning discharge current (8/20 $\mu$ s) kA  | 10                 |            |
|                      | d) Minimum energy absorption capability for a single high current impulse, 100kA 4/10 $\mu$ s in per unit of MCOV kJ/kV | 3,4                |            |
|                      | e) Arrester rated voltage (Ur) kV   | xxxxxxxxxx         |            |
|                      | f) MCOV (Uc) kV   | 48                 |            |
|                      | g) Maximum residual voltage (Ures) at 10kA (8/20 $\mu$ s ) kV   | 165                |            |
| <b>4.4</b>           | <b>4. ARRESTER HOUSING</b>  |                    |            |
|                      | a) Housing material   |                    |            |
|                      | • Item 9 (Coastal)  | xxxxxxxxxx         |            |
|                      | • <del>Item 10 (Inland)</del>   | <del>xxxxxxx</del> |            |
|                      | b) Minimum external creepage distance:  |                    |            |
|                      | • Item 9 (Coastal) [Um x 31 mm/kV] mm   | 2263               |            |
|                      | • <del>Item 10 (Inland) [Um x 20 mm/kV]</del> mm  | <del>1460</del>    |            |
| <b>4.4.3</b>         | <b>5. ARRESTER HOUSING PROFILE DESIGN</b>   |                    |            |
|                      | IEC 60815 annex D parameters:   |                    |            |
|                      | a) c  | $\geq 20$          |            |
|                      | b) s/p  | $\geq 0,65$        |            |
|                      | c) Ld/d   | $\leq 5$           |            |
|                      | d) P1 – P2  | $\geq 15$          |            |
|                      | e) CF   | $\leq 3,5$         |            |
|                      | f) PF   | $\geq 0,7$         |            |
| <b>4.5</b>           | <b>6. ARRESTER MOUNTING DETAILS</b>   |                    |            |
|                      | a) Orientation  | Vertical           | xxxxxxxxxx |

| Sub clause of 34-419 | Description   | Schedule A       | Schedule B |
|----------------------|---|------------------|------------|
|                      | b) Method of mounting   | Tripod base      | xxxxxxxxxx |
|                      | c) Diameter of mounting holes in base mm  | xxxxxxxxxx       |            |
|                      | d) PCD (see Figure 1 of SCSSCAA00) mm   | 110 - 255        |            |
|                      | e) Supplied with: 3 bolts, 3 nuts, 3 tapered washers and 6 flat washers.                                  | Yes              |            |
|                      | f) Reference number of drawing showing mounting details   | xxxxxxxxxx       |            |
| <b>4.6.1</b>         | <b>7. ARRESTER LINE TERMINAL</b>  |                  |            |
|                      | a) Type   | Stem             |            |
|                      | b) Diameter   | 26               |            |
|                      | c) Minimum length mm  | 100              |            |
|                      | d) Orientation  | Vertical         |            |
|                      | e) Material   | xxxxxxxxxx       |            |
|                      | f) Reference number of drawing showing details of line terminal   | xxxxxxxxxx       |            |
| <b>4.6.2</b>         | <b>8. ARRESTER EARTH TERMINAL</b>   |                  |            |
|                      | Earth terminal to be provided with clamping arrangement suitable for clamping of the following conductor: |                  |            |
|                      | a) Conductor material   | Copper           |            |
|                      | b) Conductor type   | Strap            |            |
|                      | c) Conductor dimensions mm  | 50 x 3           |            |
|                      | d) Material used for clamping arrangement   | xxxxxxxxxx       |            |
|                      | e) If dissimilar metals are used for clamping arrangement, state types                                    | xxxxxxxxxx       |            |
|                      | f) Reference number of drawing showing details of earth terminal  | xxxxxxxxxx       |            |
| <b>4.7.1</b>         | <b>9. DRAWINGS TO BE SUBMITTED WITH TENDER</b>  |                  |            |
|                      | Single copies of drawings shall be submitted as part of the original tender showing the following detail: |                  |            |
|                      | a) Outline dimensions of arrester, fit as for service   | Reference number |            |
|                      | b) Mounting details   | Reference number |            |
|                      | c) Line and earth terminal, conductor clamping arrangement  | Reference number |            |

| Sub clause of 34-419 | Description   | Schedule A        | Schedule B  |
|----------------------|---|-------------------|-------------|
|                      | d) Details of grading rings   | Reference number  |             |
| <b>4.7.2</b>         | <b>10. ARRESTER CHARACTERISTIC DATA REQUIRED</b>  |                   |             |
|                      | a) V-I characteristic curve, AC   | Reference Number: |             |
|                      | b) V-I characteristic curve, DC   | Reference Number: |             |
|                      | c) Temporary overvoltage withstands capability curve in per unit of MCOV, with and with-out prior duty.                   | Reference Number: |             |
|                      | <b>11. ARRESTER TEMPORARY OVERVOLTAGE CAPABILITY, WITH PRIOR DUTY.</b><br>(prior duty as defined in annex D, IEC 60099-4) |                   |             |
|                      | a) Overvoltage applied for 1 s<br>pu of MCOV  | xxxxxxxxx         |             |
|                      | b) Overvoltage applied for 5 s<br>pu of MCOV  | xxxxxxxxx         |             |
|                      | c) Overvoltage applied for 10 s<br>pu of MCOV   | xxxxxxxxx         |             |
|                      | <b>12. PHYSICAL DIMENSIONS OF ARRESTERS</b>   |                   |             |
|                      | a) Overall height of arrester<br>mm   | xxxxxxxxx         |             |
|                      | b) Minimum external flashover distance<br>mm  | 450               |             |
|                      | c) External diameter of arrester housing<br>mm  | xxxxxxxxx         |             |
|                      | d) Diameter of voltage grading rings<br>mm  | xxxxxxxxx         |             |
|                      | e) Distance of grading ring from top of arrester<br>mm  | xxxxxxxxx         |             |
|                      | <b>13. MOV ELEMENTS</b>   |                   |             |
|                      | a) Diameter of elements<br>mm   | xxxxxxxxx         |             |
|                      | b) Thickness of elements<br>mm  | xxxxxxxxx         |             |
|                      | c) Number of elements per arrester  | xxxxxxxxx         |             |
| <b>4.2.2</b>         | d) Number of stacks in parallel   | 0                 |             |
|                      | <b>14. MISCELLANEOUS</b>  |                   |             |
| <b>4.2.1</b>         | a) Live spray washing (Yes/No)  | No                | xxxxxxxxxxx |
|                      | b) Total mass of assembled unit<br>kg   | xxxxxxxxxxx       |             |
|                      | c) Minimum expected life of arrester at 40 °C and MCOV<br>yrs   | 25                |             |

| Sub clause of 34-419 | Description  | Schedule A | Schedule B |
|----------------------|--|------------|------------|
| 4.2.7                | d) Sample available for inspection   | Yes        |            |
| 5.2.10               | e) Declared specified long-term load kN  | xxxxxxxxxx |            |
| <b>5.2.1</b>         | <b>15. INSULATION WITHSTAND TEST</b>   |            |            |
|                      | a) Reference number of test report   | xxxxxxxxxx |            |
|                      | b) Lightning impulse (1,2/50µs) withstand level $[(1,3/0,82) \times U_{res}]$ kV   | 262        |            |
|                      | c) 60 s wet power frequency withstand r.m.s kV                                     | 90         |            |
| <b>5.2.2</b>         | <b>16. RESIDUAL VOLTAGE TEST</b>   |            |            |
|                      | a) Reference number of test report   | xxxxxxxxxx |            |
|                      | b) Maximum residual voltage for a 10 kA steep current impulse (1/20µs) kV          | 183        |            |
|                      | c) Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude: |            |            |
|                      | • 5 kA kV  | xxxxxxxxxx |            |
|                      | • 10 kA kV   | 165        |            |
|                      | • 20 kA kV   | xxxxxxxxxx |            |
|                      | d) Maximum residual voltage for a 500 A switching current impulse kV               | xxxxxxxxxx |            |
|                      |  |            |            |
| <b>5.2.3</b>         | <b>17. LONG DURATION CURRENT IMPULSE WITHSTAND TEST</b>                            |            |            |
|                      | a) Reference number of test report   | xxxxxxxxxx |            |
|                      | b) Charging voltage pu of $U_r$  | 3,2        |            |
|                      | or   |            |            |
|                      | • charging current A   | xxxxxxxxxx |            |
|                      | c) Virtual duration of peak µs   | 2000       |            |
|                      | d) Number of discharge operations  | 18         |            |
|                      | e) Number of grouped operations  | 6          |            |
|                      | f) Operations per group  | 3          |            |
|                      | g) Maximum interval between operations s   | 60         |            |

| Sub clause of 34-419 | Description  |              | Schedule A      | Schedule B |
|----------------------|--|--------------|-----------------|------------|
|                      | h) Interval between groups   |              | Cool to ambient |            |
|                      | i) Maximum permitted change in residual voltage after long duration current impulse withstand test | %            | 5               |            |
| <b>5.2.4</b>         | <b>18. OPERATING DUTY TEST</b>   |              |                 |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx      |            |
|                      | <b>Conditioning part 1:</b>  |              |                 |            |
|                      | b) 10 kA current impulse (8/20 $\mu$ s), energized at 1,2 x MCOV                                   | kV           | 58              |            |
|                      | c) Number of discharge operations  |              | 20              |            |
|                      | d) Number of grouped operations  |              | 4               |            |
|                      | e) Operations per group  |              | 5               |            |
|                      | f) Interval between operations   | s            | 60              |            |
|                      | g) Intervals between groups  | min          | 30              |            |
|                      | <b>Conditioning part 2:</b>  |              |                 |            |
|                      | h) High current impulse (4/10 $\mu$ s)   | kA           | 100             |            |
|                      | i) Number of applications  |              | 2               |            |
|                      | <b>Conditions for switching surge test:</b>  |              |                 |            |
|                      | j) Charging voltage  | pu of $U_r$  | 3.2             |            |
|                      | or   |              |                 |            |
|                      | • charging current   | A            | xxxxxxxxxx      |            |
|                      | k) Virtual duration of peak  | $\mu$ s      | 2000            |            |
|                      | l) Number of discharge operations  |              | 2               |            |
|                      | m) Interval between operations   | s            | 60              |            |
|                      | n) Starting temperature for first impulse  | $^{\circ}$ C | 60              |            |
|                      | o) Energy dissipated during second impulse   | kJ           | xxxxxxxxxx      |            |
|                      | <b>Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:</b>            |              |                 |            |
|                      | p) Interval between last long duration current impulse and power                                   | ms           | 100             |            |



| Sub clause of 34-419 | Description  |              | Schedule A | Schedule B |
|----------------------|--|--------------|------------|------------|
|                      | frequency test   |              |            |            |
|                      | q) Elevated rated voltage (Ur*) applied for 10 s   | kV           | xxxxxxxxxx |            |
|                      | r) Elevated continuous operating voltage (Uc*) applied for 30 min                                  | kV           | xxxxxxxxxx |            |
|                      | s) Maximum permitted change in residual voltage after long duration current impulse withstand test | %            | 5          |            |
| <b>5.2.5</b>         | <b>19. POWER FREQUENCY VOLTAGE VERSUS TIME CHARACTERISTIC</b>                                      |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
| <b>5.2.6</b>         | <b>20. SHORT-CIRCUIT TEST</b>  |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
|                      | b) High current  | kA<br>r.m.s. | 40         |            |
|                      | c) Low current   | kA<br>r.m.s. | 0,6 ± 0,2  |            |
| <b>5.2.7</b>         | <b>21. NATURAL AGEING AND POLLUTION PERFORMANCE TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
| <b>5.2.8</b>         | <b>22. INTERNAL PARTIAL DISCHARGE TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
|                      | b) Power frequency voltage applied [1,05 x MCOV]   | kV           | 50.5       |            |
|                      | c) Maximum partial discharge   | pC           | 10         |            |
| <b>5.2.9</b>         | <b>23. MOISTURE INGRESS TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
| <b>5.2.10</b>        | <b>24. BENDING MOMENT TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |

**5. TECHNICAL A & B DEVIATION SCHEDULE – 66 kV SURGE ARRESTER****Table 4: Deviation Schedule - 66 kV Surge Arrester**

| Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification. |            |                    |
|---|------------|--------------------|
| Item  | Sub-clause | Proposed deviation |
|   |            |                    |

SIGNED ON BEHALF OF TENDERER : .....

COMPANY NAME : .....

NAME IN BLOCK LETTERS : .....

DATE : .....

## 6. TECHNICAL A & B SCHEDULE – 132 kV SURGE ARRESTER

Schedule A: Purchaser's specific requirements

Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

Table 5: Technical Schedule – 132 kV Surge Arresters

| Sub clause of 34-419 | Description                                       | Schedule A      | Schedule B |
|----------------------|---|-----------------|------------|
|                      | <b>1. SURGE ARRESTER IDENTIFICATION</b>           |                 |            |
|                      | a) Supplier                                       | xxxxxxxxxx      |            |
|                      | b) Manufacturer                                   | xxxxxxxxxx      |            |
|                      | c) MOV block manufacturer                         | xxxxxxxxxx      |            |
|                      | d) Product code: Item 11(Coastal)                 | xxxxxxxxxx      |            |
|                      | • Item 12 (Inland)                                | xxxxxxxxxx      |            |
| <b>4.1</b>           | <b>2. OPERATING CONDITIONS</b>                    |                 |            |
|                      | a) Altitude m                                     | up to 1800      | xxxxxxxxxx |
|                      | b) Average humidity %                             | 30 to 90        | xxxxxxxxxx |
|                      | c) Minimum ambient temperature °C                 | -10             | xxxxxxxxxx |
|                      | • Maximum ambient temperature °C                  | 40              | xxxxxxxxxx |
|                      | • Maximum diurnal variation °C                    | 30              | xxxxxxxxxx |
|                      | d) Intensity of solar radiation kW/m <sup>2</sup> | 1,1             | xxxxxxxxxx |
|                      | e) IEC pollution level: Item 11 (Coastal)         | HVH             | xxxxxxxxxx |
|                      | • Item 12 (Inland)                                | LM              | xxxxxxxxxx |
|                      | f) Lightning activity                             | High            | xxxxxxxxxx |
|                      | g) System earthing                                | Effective       | xxxxxxxxxx |
|                      | h) System configuration                           | 3-phase, 3-wire | xxxxxxxxxx |
|                      | i) Nominal system voltage (Un) kV                 | 132             | xxxxxxxxxx |
|                      | j) Maximum system voltage (Um) kV                 | 145             | xxxxxxxxxx |
|                      | k) Supply frequency Hz                            | 50              | xxxxxxxxxx |
|                      | l) BIL of equipment to be protected kV peak       | 550             | xxxxxxxxxx |

| Sub clause of 34-419 | Description   | Schedule A    | Schedule B |
|----------------------|---|---------------|------------|
| <b>4.3</b>           | <b>3. ELECTRICAL CHARACTERISTICS OF ARRESTER</b>  |               |            |
|                      | a) Arrester classification  | Station class |            |
|                      | b) IEC line discharge class   | 2             |            |
|                      | c) Nominal lightning discharge current (8/20 $\mu$ s) kA  | 10            |            |
|                      | d) Minimum energy absorption capability for a single high current impulse, 100kA 4/10 $\mu$ s in per unit of MCOV kJ/kV | 3,4           |            |
|                      | e) Arrester rated voltage (Ur) kV   | xxxxxxxxxx    |            |
|                      | f) MCOV (Uc) kV   | 84            |            |
|                      | g) Maximum residual voltage (Ures) at 10kA (8/20 $\mu$ s ) kV   | 300           |            |
| <b>4.4</b>           | <b>4. ARRESTER HOUSING</b>  |               |            |
|                      | a) Housing material Item 11 (Coastal)   | xxxxxxxxxx    |            |
|                      | • Item 12 (Inland)  | xxxxxxxxxx    |            |
|                      | b) Minimum external creepage distance:  |               |            |
|                      | • Item 11 (Coastal) [Um x 31 mm/kV] mm  | 4495          |            |
|                      | • Item 12 (Inland) [Um x 20 mm/kV] mm   | 2900          |            |
| <b>4.4.3</b>         | <b>5. ARRESTER HOUSING PROFILE DESIGN</b>   |               |            |
|                      | IEC 60815 annex D parameters:   |               |            |
|                      | a) c  | $\geq 20$     |            |
|                      | b) s/p  | $\geq 0,65$   |            |
|                      | c) Ld/d   | $\leq 5$      |            |
|                      | d) P1 – P2  | $\geq 15$     |            |
|                      | e) CF   | $\leq 3,5$    |            |
|                      | f) PF   | $\geq 0,7$    |            |
| <b>4.5</b>           | <b>6. ARRESTER MOUNTING DETAILS</b>   |               |            |
|                      | a) Orientation  | Vertical      | xxxxxxxxxx |
|                      | b) Method of mounting   | Tripod base   | xxxxxxxxxx |

| Sub clause of 34-419 | Description   | Schedule A       | Schedule B |
|----------------------|---|------------------|------------|
|                      | c) Diameter of mounting holes in base mm  | xxxxxxxxxx       |            |
|                      | d) PCD (see Figure 1 of SCSSCAA00) mm   | 110 - 255        |            |
|                      | e) Supplied with: 3 bolts, 3 nuts, 3 tapered washers and 6 flat washers.                                  | Yes              |            |
|                      | f) Reference number of drawing showing mounting details   | xxxxxxxxxx       |            |
| <b>4.6.1</b>         | <b>7. ARRESTER LINE TERMINAL</b>  |                  |            |
|                      | g) Type   | Stem             |            |
|                      | h) Diameter   | 26               |            |
|                      | i) Minimum length mm  | 100              |            |
|                      | j) Orientation  | Vertical         |            |
|                      | k) Material   | xxxxxxxxxx       |            |
|                      | l) Reference number of drawing showing details of line terminal   | xxxxxxxxxx       |            |
| <b>4.6.2</b>         | <b>8. ARRESTER EARTH TERMINAL</b>   |                  |            |
|                      | Earth terminal to be provided with clamping arrangement suitable for clamping of the following conductor: |                  |            |
|                      | a) Conductor material   | Copper           |            |
|                      | b) Conductor type   | Strap            |            |
|                      | c) Conductor dimensions mm  | 50 x 3           |            |
|                      | d) Material used for clamping arrangement   | xxxxxxxxxx       |            |
|                      | e) If dissimilar metals are used for clamping arrangement, state types                                    | xxxxxxxxxx       |            |
|                      | f) Reference number of drawing showing details of earth terminal  | xxxxxxxxxx       |            |
| <b>4.7.1</b>         | <b>9. DRAWINGS TO BE SUBMITTED WITH TENDER</b>  |                  |            |
|                      | Single copies of drawings shall be submitted as part of the original tender showing the following detail: |                  |            |
|                      | a) Outline dimensions of arrester, fit as for service   | Reference number |            |
|                      | b) Mounting details   | Reference number |            |
|                      | c) Line and earth terminal, conductor clamping arrangement  | Reference number |            |

| Sub clause of 34-419 | Description   | Schedule A        | Schedule B |
|----------------------|---|-------------------|------------|
|                      | d) Details of grading rings   | Reference number  |            |
| <b>4.7.2</b>         | <b>10. ARRESTER CHARACTERISTIC DATA REQUIRED</b>  |                   |            |
|                      | a) V-I characteristic curve, AC   | Reference Number: |            |
|                      | b) V-I characteristic curve, DC   | Reference Number: |            |
|                      | c) Temporary overvoltage withstands capability curve in per unit of MCOV, with and with-out prior duty.                   | Reference Number: |            |
|                      | <b>11. ARRESTER TEMPORARY OVERVOLTAGE CAPABILITY, WITH PRIOR DUTY.</b><br>(prior duty as defined in annex D, IEC 60099-4) |                   |            |
|                      | a) Overvoltage applied for 1 s <span style="float: right;">pu of MCOV</span>  | xxxxxxxxx         |            |
|                      | b) Overvoltage applied for 5 s <span style="float: right;">pu of MCOV</span>  | xxxxxxxxx         |            |
|                      | c) Overvoltage applied for 10 s <span style="float: right;">pu of MCOV</span>   | xxxxxxxxx         |            |
|                      | <b>12. PHYSICAL DIMENSIONS OF ARRESTERS</b>   |                   |            |
|                      | a) Overall height of arrester <span style="float: right;">mm</span>   | xxxxxxxxx         |            |
|                      | b) Minimum external flashover distance <span style="float: right;">mm</span>  | 1 100             |            |
|                      | c) External diameter of arrester housing <span style="float: right;">mm</span>  | xxxxxxxxx         |            |
|                      | d) Diameter of voltage grading rings <span style="float: right;">mm</span>  | xxxxxxxxx         |            |
|                      | e) Distance of grading ring from top of arrester <span style="float: right;">mm</span>                                    | xxxxxxxxx         |            |
|                      | <b>13. MOV ELEMENTS</b>   |                   |            |
|                      | a) Diameter of elements <span style="float: right;">mm</span>   | xxxxxxxxx         |            |
|                      | b) Thickness of elements <span style="float: right;">mm</span>  | xxxxxxxxx         |            |
|                      | c) Number of elements per arrester  | xxxxxxxxx         |            |
| 4.2.2                | d) Number of stacks in parallel   | 0                 |            |
|                      | <b>14. MISCELLANEOUS</b>  |                   |            |
| 4.2.1                | a) Live spray washing (Yes/No)  | No                | xxxxxxxxx  |
|                      | b) Total mass of assembled unit <span style="float: right;">kg</span>   | xxxxxxxxx         |            |
|                      | c) Minimum expected life of arrester at 40 °C and MCOV <span style="float: right;">yrs</span>                             | 25                |            |

| Sub clause of 34-419 | Description  | Schedule A      | Schedule B |
|----------------------|--|-----------------|------------|
| 4.2.7                | d) Sample available for inspection   | Yes             |            |
| 5.2.10               | e) Declared specified long-term load kN  | xxxxxxxxxx      |            |
| <b>5.2.1</b>         | <b>15. INSULATION WITHSTAND TEST</b>   |                 |            |
|                      | a) Reference number of test report   | xxxxxxxxxx      |            |
|                      | b) Lightning impulse (1,2/50µs) withstand level kV<br>[(1,3/0,82) × Ures]          | 476             |            |
|                      | c) 60 s wet power frequency withstand r.m.s kV                                     | 230             |            |
| <b>5.2.2</b>         | <b>16. RESIDUAL VOLTAGE TEST</b>   |                 |            |
|                      | a) Reference number of test report   | xxxxxxxxxx      |            |
|                      | b) Maximum residual voltage for a 10 kA steep current impulse (1/20µs) kV          | 336             |            |
|                      | c) Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude: |                 |            |
|                      | • 5 kA kV  | xxxxxxxxxx      |            |
|                      | • 10 kA kV   | 300             |            |
|                      | • 20 kA kV   | xxxxxxxxxx      |            |
|                      | d) Maximum residual voltage for a 500 A switching current impulse kV               | xxxxxxxxxx      |            |
| <b>5.2.3</b>         | <b>17. LONG DURATION CURRENT IMPULSE WITHSTAND TEST</b>                            |                 |            |
|                      | a) Reference number of test report   | xxxxxxxxxx      |            |
|                      | b) Charging voltage pu of $U_r$  | 3,2             |            |
|                      | or   |                 |            |
|                      | • charging current A   | xxxxxxxxxx      |            |
|                      | c) Virtual duration of peak µs   | 2000            |            |
|                      | d) Number of discharge operations  | 18              |            |
|                      | e) Number of grouped operations  | 6               |            |
|                      | f) Operations per group  | 3               |            |
|                      | g) Maximum interval between operations s   | 60              |            |
|                      | h) Interval between groups   | Cool to ambient |            |

| Sub clause of 34-419 | Description  | Schedule A | Schedule B |
|----------------------|--|------------|------------|
|                      | i) Maximum permitted change in residual voltage after long duration current impulse withstand test % | 5          |            |
| <b>5.2.4</b>         | <b>18. OPERATING DUTY TEST</b>   |            |            |
|                      | a) Reference number of test report   | xxxxxxxxxx |            |
|                      | <b>Conditioning part 1:</b>  |            |            |
|                      | b) 10 kA current impulse (8/20 $\mu$ s), energized at 1,2 x MCOV kV                                  | 101        |            |
|                      | c) Number of discharge operations  | 20         |            |
|                      | d) Number of grouped operations  | 4          |            |
|                      | e) Operations per group  | 5          |            |
|                      | f) Interval between operations s   | 60         |            |
|                      | g) Intervals between groups min  | 30         |            |
|                      | <b>Conditioning part 2:</b>  |            |            |
|                      | h) High current impulse (4/10 $\mu$ s) kA  | 100        |            |
|                      | i) Number of applications  | 2          |            |
|                      | <b>Conditions for switching surge test:</b>  |            |            |
|                      | j) Charging voltage pu of $U_r$  | 3.2        |            |
|                      | or   |            |            |
|                      | • charging current A   | xxxxxxxxxx |            |
|                      | k) Virtual duration of peak $\mu$ s  | 2000       |            |
|                      | l) Number of discharge operations  | 2          |            |
|                      | m) Interval between operations s   | 60         |            |
|                      | n) Starting temperature for first impulse $^{\circ}$ C   | 60         |            |
|                      | o) Energy dissipated during second impulse kJ  | xxxxxxxxxx |            |
|                      | <b>Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:</b>              |            |            |
|                      | p) Interval between last long duration current impulse and power frequency test ms                   | 100        |            |
|                      | q) Elevated rated voltage ( $U_r^*$ ) applied for 10 s kV  | xxxxxxxxxx |            |



| Sub clause of 34-419 | Description  |              | Schedule A | Schedule B |
|----------------------|--|--------------|------------|------------|
|                      | r) Elevated continuous operating voltage (Uc*) applied for 30 min                                  | kV           | xxxxxxxxxx |            |
|                      | s) Maximum permitted change in residual voltage after long duration current impulse withstand test | %            | 5          |            |
| <b>5.2.5</b>         | <b>19. POWER FREQUENCY VOLTAGE VERSUS TIME CHARACTERISTIC</b>                                      |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
| <b>5.2.6</b>         | <b>20 Short-circuit test</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
|                      | b) High current  | kA<br>r.m.s. | 40         |            |
|                      | c) Low current   | kA<br>r.m.s. | 0,6 ± 0,2  |            |
| <b>5.2.7</b>         | <b>20. NATURAL AGEING AND POLLUTION PERFORMANCE TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
| <b>5.2.8</b>         | <b>21. INTERNAL PARTIAL DISCHARGE TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
|                      | b) Power frequency voltage applied [1,05 x MCOV]   | kV           | 89         |            |
|                      | c) Maximum partial discharge   | pC           | 10         |            |
| <b>5.2.9</b>         | <b>22. MOISTURE INGRESS TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |
| <b>5.2.10</b>        | <b>23. BENDING MOMENT TEST</b>   |              |            |            |
|                      | a) Reference number of test report   |              | xxxxxxxxxx |            |

**7. TECHNICAL A & B DEVIATION SCHEDULE – 88 kV SURGE ARRESTER****Table 6: Deviation Schedule - 88 kV Surge Arrester**

| Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification. |            |                    |
|---|------------|--------------------|
| Item  | Sub-clause | Proposed deviation |
|   |            |                    |

SIGNED ON BEHALF OF TENDERER : .....

COMPANY NAME : .....

NAME IN BLOCK LETTERS : .....

DATE : .....

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**



**THE CONTRACT PART 3: SCOPE OF THE WORK**

**C3.3: GENERAL SPECIFICATION**

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**



**THE CONTRACT PART 3: SCOPE OF THE WORK**

**C4: SITE INFORMATION**

# GSE11 – GENERAL SPECIFICATION ELECTRICAL

## SUBTRANSMISSION OVERHEAD LINES

## TABLE OF CONTENTS

|     |  |     |
|-----|--|-----|
| 1.  | GENERAL .....  | 5   |
| 2.  | NORMATIVE REFERENCES .....                               | 5   |
| 3.  | TEMPORARY WORKS .....                                    | 8   |
| 4.  | CONSTRUCTION SEQUENCE AND PROPOSED PLANNED OUTAGES ..... | 9   |
| 5.  | WORKS INFORMATION .....                                  | 9   |
| 6.  | ACTIVITY STAGE 1 .....                                   | 11  |
| 7.  | ACTIVITY STAGE 2 .....                                   | 16  |
| 8.  | ACTIVITY STAGE 3 .....                                   | 23  |
| 9.  | ACTIVITY STAGE 4 .....                                   | 25  |
| 10. | ACTIVITY STAGE 5 .....                                   | 25  |
| 11. | ACTIVITY STAGE 6 .....                                   | 40  |
| 12. | ACTIVITY STAGE 7 .....                                   | 47  |
| 13. | ACTIVITY STAGE 8 .....                                   | 52  |
| 14. | ACTIVITY STAGE 9 .....                                   | 77  |
| 15. | ACTIVITY STAGE 10 .....                                  | 91  |
| 16. | ACTIVITY STAGE 11 .....                                  | 93  |
| 17. | ACTIVITY STAGE 12 .....                                  | 94  |
| 18. | CONSTRUCTION GUIDELINES .....                            | 97  |
| 19. | CONCRETE MIX GUIDELINES .....                            | 102 |
| 20. | CONCRETE HAND MIX .....                                  | 102 |
| 21. | BASIC STRINGING PROCEDURE .....                          | 105 |
| 22. | AMBIENT TEMPERATURE MEASURING TECHNIQUE .....            | 108 |
| 23. | FOOTING RESISTANCE MEASUREMENT GUIDELINE .....           | 108 |

## TABLE OF TABLES

|  |    |
|--|----|
| Table 1: SANS specifications .....   | 5  |
| Table 2: Eskom specifications .....  | 5  |
| Table 2: Geotechnical design parameters for various soil types .....                 | 27 |
| Table 3: Standard Permanent Conventional Strain Structure Stay Assembly 115kN .....  | 53 |
| Table 4: Standard Permanent Conventional Strain Structure Stay Assembly 210 kN ..... | 54 |

|  |     |
|--|-----|
| Table 5: Standard Permanent Conventional Strain Structure Stay Assembly .....                      | 54  |
| Table 6: Phase Conductor single "I-String A" Suspension Assembly For Single "Conductor".....       | 58  |
| Table 7: Phase Conductor Twin "I-String A" Suspension Assembly for Twin "Conductor" .....          | 59  |
| Table 8: Option A: Phase Conductor Single Strain Assembly for Single "Conductor" .....             | 60  |
| Table 9: Option B: Phase Conductor Single Strain Assembly for Single "Conductor" .....             | 61  |
| Table 10: Option C: Phase Conductor Single Strain Assembly for Single "Conductor" .....            | 62  |
| Table 11: Option D: Phase Conductor Single Strain Assembly for Single "Conductor" .....            | 63  |
| Table 12: Phase Conductor Twin Strain Assembly for Twin "Conductor" .....                          | 64  |
| Table 13: Phase Conductor Single Angle Suspension Assembly for Single "Conductor" .....            | 65  |
| Table 14: Phase Conductor Braced Vertical Suspension Assembly for Twin "Conductor" .....           | 66  |
| Table 15: Phase Conductor Braced Horizontal Suspension Assembly for Twin "Conductor".....          | 67  |
| Table 16: Phase Conductor Braced Horizontal Suspension Assembly for Twin "Conductor".....          | 68  |
| Table 17: Horizontal Phase Conductor Twin Jumper Assembly for Twin "Conductor" .....               | 69  |
| Table 18: Phase Conductor Single Jumper Support Assembly for Single "Conductor" .....              | 70  |
| Table 19: (Insulated Option) S/W Sus. Ass. for Single "7/3,35 mm & 19/2.65" GS Shield ....         | 70  |
| Table 20: (Non-insulated Option) S/W Sus. Ass. for Single "7/3,35mm & 19/2.65" .....               | 71  |
| Table 21: (Insulated Option) Shield Wire Strain Assembly for Single "7/3,35mm & 19/2.65" ..        | 71  |
| Table 22: (Non-insulated Option) Shield Wire Strain Assembly for Single "7/3,35mm & 19/2.65" ..... | 72  |
| Table 23: (Insulated Option) Shield Wire Strain Assembly for Single "7/3,35mm & 19/2.65" ..        | 72  |
| Table 24: (Insulated Option) Shield Wire Strain Assembly for Single "7/3,35mm & 19/2.65" ..        | 73  |
| Table 25: (Non-Insulated Option) Shield Wire Strain Assembly for Single "Conductor" .....          | 73  |
| Table 26: (Insulated Option) Shield Wire Strain Assembly for Single "Conductor" .....              | 74  |
| Table 27: (Non-Insulated Option) Shield Wire Suspension Assembly for Single "Conductor".....       | 75  |
| Table 28: (Insulated Option) Shield Wire Suspension Assembly for Single "Conductor":.....          | 76  |
| Table 29: Conductor Properties.....  | 97  |
| Table 30: Standard Electrical Clearances .....   | 99  |
| Table 31: Power Line Servitudes and Building Restrictions .....                                    | 99  |
| Table 32: Standard Insulation Levels and Creepage Distances .....                                  | 100 |
| Table 33: Minimum Vertical Clearances of Power Lines at Maximum Sag and Swing .....                | 101 |
| Table 34: Earth Electrode Resistance -61.8% Method Measurement Results .....                       | 109 |
| Table 35: Earth Electrode Resistance -61.8% Method Calculated Results 2. Steel Poles ....          | 109 |

## TABLE OF FIGURES

|   |     |
|---|-----|
| Figure 1: Phase Conductor Single "I-String A" Suspension Assembly for Single "Conductor"    | 58  |
| Figure 2: Phase Conductor Twin "I-String A" Suspension Assembly for Twin "Conductor"        | 59  |
| Figure 3: Option A - Phase Conductor Single Strain Assembly for Single "Conductor"          | 60  |
| Figure 4: Option B: Phase Conductor Single Strain Assembly for Single "Conductor"           | 61  |
| Figure 5: Option C: Phase Conductor Single Strain Assembly for Single "Conductor"           | 62  |
| Figure 6: Option D: Phase Conductor Single Strain Assembly for Single "Conductor"           | 63  |
| Figure 7: Phase Conductor Twin Strain Assembly for Twin "Conductor"                         | 64  |
| Figure 8: Phase Conductor Single Angle Suspension Assembly for Single "Conductor"           | 65  |
| Figure 9: Phase Conductor Braced Vertical Suspension Assembly for Twin "Conductor"          | 66  |
| Figure 10: Phase Conductor Braced Horizontal Suspension Assembly for Twin "Conductor"       | 67  |
| Figure 11: Phase Conductor Braced Horizontal Suspension Assembly for Twin "Conductor"       | 68  |
| Figure 12: Horizontal Phase Conductor Twin Jumper Assembly for Twin "Conductor"             | 69  |
| Figure 13: Phase Conductor Single Jumper Support Assembly for Single "Conductor"            | 70  |
| Figure 14: (Insulated Option) Shield Wire Strain Assembly for Single "7/3,35mm & 19/2.65"   | 71  |
| Figure 15: (Insulated Option) Shield wire strain assembly for single "7/3,35mm & 19/2.65"   | 72  |
| Figure 16: (Insulated Option) Shield Wire Strain Assembly for Single "7/3,35mm & 19/2.65"   | 73  |
| Figure 17: (Insulated Option) Shield Wire Strain Assembly for Single "7/3,35mm & 19/2.65"   | 73  |
| Figure 18: (Non-Insulated Option) Shield Wire Strain Assembly for Single "conductor"        | 73  |
| Figure 19: (Insulated Option) Shield Wire Strain Assembly for Single "Conductor"            | 74  |
| Figure 20: (Non-Insulated Option) Shield Wire Suspension Assembly for Single "Conductor"    | 75  |
| Figure 21: (Insulated Option) Shield Wire Suspension Assembly for Single "Conductor"        | 76  |
| Figure 22: Tyco Flight Diverter   | 90  |
| Figure 23: Aircraft Warning Sphere  | 91  |
| Figure 24: Connections for Earth Electrode Resistance Measurements Fall-Of-Potential Method | 110 |



| Revisions  | Description  |
|------------|--|
| 2017-07-04 | Multi-frequency vibration dampers – use of bolted attachments on the Stockbridge type dampers prohibited. (Marnus) |

## 1. GENERAL

This general specification covers the general requirements for Sub-transmission overhead power lines up to 132 kV.

## 2. NORMATIVE REFERENCES

The following documents contain provisions that constitute requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

**Table 1: SANS specifications**

| Document     | Rev./issue | Title and Publisher   |
|--------------|------------|---|
| SANS 121     | Latest     | Hot Dip Galvanized Coatings On Fabricated Iron And Steel Articles – Specifications And Test Methods |
| SANS 1200 AA | Latest     | Standardized Specification For Civil Engineering Construction Section A: General (Small Works)      |
| SANS 1200 DA | Latest     | Standardized Specification For Civil Engineering Construction Section DA: Earthworks (Small Works)  |
| SANS 1200 GA | Latest     | Standardized Specification For Civil Engineering Construction Section GA: Concrete (Small Works)    |
| SANS 9001    | Latest     | Requirements For Quality Management Systems   |
| SANS 10280   | Latest     | Code Of Practice For Overhead Power Lines For Conditions Prevailing In South Africa                 |
| SANS 14001   | Latest     | Environmental Management Manual International Standards – EMS                                       |
| SANS 182-3   | Latest     | Conductors for overhead electrical transmission lines   |

In addition, the following Eskom specifications shall constitute requirements of this specification. All Eskom standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

**Table 2: Eskom specifications**

| Document  | Rev./issue | Title and Publisher  |
|---|------------|--|
| <b>1. TRANSMISSION GUIDELINES, PROCEDURES, SPECIFICATIONS &amp; STANDARDS</b> |            |  |
| TWN41-675   | 1          | Installation Of Guy Grips  |
| TRMSCAAC1   | 3          | Specification For Transmission Line Towers And Line Construction                           |
| TRMSCAAH2   | 5          | Specification For Suspension And Strain Assemblies And For Hardware For Transmission Lines |
| TRMSCABG8   | 0          | Corrosion Protection Of New And Weathered Steel Power Line Structures                      |

| Document  | Rev./issue | Title and Publisher   |
|---|------------|---|
| <b>2. DISTRIBUTION GUIDELINES, PROCEDURES, SPECIFICATIONS &amp; STANDARDS</b> |            |   |
| DST_34-146  | 1          | Authorisation Procedure For Operating On High Voltage Systems   |
| DST_34-962  | 1          | Management Of Certificates Of Compliance For Electrical Installations   |
| DST_34-1954   | 0          | Supervision Of People In Electrically Hazardous Locations   |
| DISSCABA5   | 2          | Specification For A Fall Arrest System  |
| DSP_34-1488   | 1          | Specification For Master Locks And Master Keys For Electrical And Related Equipment                             |
| DPC_34-908  | 0          | Procedure For Barricading   |
| EPC_32-846  | 0          | Operating Regulations For High-Voltage Systems  |
| DST_34-2052   | 0          | Power Lines, Buildings, Telecommunication Towers, Wind Turbines And Related Structures With Regards To Aviation |
| SCSASACF5   | 0          | Planning Of Power Lines In The Vicinity Of Rifle Ranges   |
| DPC_34-1812   | 0          | Statutory Approval Application To Rail Authorities  |
| SCSPVADG6   | 0          | Statutory Applications To Water Authorities   |
| SCSPVADA4   | 0          | Procedure: Statutory Approval Application To Rail Authorities   |
| SCSPVADO3   | 0          | Statutory Applications To Local Authorities   |
| DGL_34-600  | 0          | Building Line Restrictions, Servitude Widths, Line Separations And Clearances From Power Lines                  |
| EPL 32-727  | 0          | Safety, Health, Environment, And Quality (SHEQ) Policy  |
| EPL 32-97   | 0          | Land Management Policy  |
| DST_34-132  | 0          | Fire Risk Management  |
| ESKASABG3   | 0          | Standard For Bush Clearing And Maintenance Within Overhead Powerline Servitudes                                 |
| EPC_32-96   | 0          | Guidelines For The Rehabilitation And Vegetation Management Of Herbicides Treated Sites                         |
| DGL_34-190  | 0          | Access To Farms (Includes Strategy On Dealing With Game Farms)  |
| EPC 32-96   | 0          | Environmental Procedure: Environment Control Document   |
| EPC_32-245  | 0          | Environmental Procedure: Waste Procedure  |
| EPC_32-247  | 0          | Environmental Procedure: Bush Clearing  |
| EPC_32-248  | 0          | Environmental Procedure: EMP Guide  |
| DPC_34-350  | 0          | Procedure For The Reporting, Recording, Investigation, Costing And Follow-Up Of Incidents/Accidents             |
| SCSPVABP7   | 0          | Procedure For Environmental Assessment Of Reticulation And Sub Transmission Projects                            |
| DPC_34-333  | 1          | OHS Act Requirements To Be Met By Principal Contractors Employed By Eskom Distribution                          |

| Document    | Rev./issue | Title and Publisher  |
|-------------|------------|--|
| DGL_34-190  | 1          | Access To Farms (Includes Strategy On Dealing With Game Farms)   |
| DSP_34-1658 | 0          | Corrosion Protection Specification For New Indoor And Outdoor Distribution Equipment, Components, Materials And Structures Manufactured From Steel |
| DST_34-705  | 0          | Quality Requirements For Qualified Suppliers   |
| DSP_34-1667 | 0          | Hump Back Split Pins For New And Refurbished Power Lines Up To 132kV   |
| DSP_34-1681 | 0          | Standard For Aircraft Warning Devices Used On Overhead Transmission , Sub Transmission And Distribution Lines                                      |
| DSP_34-1657 | 0          | Specification For Conventional Stay Planting, Percussion Stay And Rock Anchor Installations And Compaction Testing                                 |
| DSP_34-377  | 1          | Specification For Phase Conductor For Distribution Lines And Substations   |
| DSP_34-194  | 1          | Specification For Helically Formed Line Hardware.  |
| DSP_34-329  | 1          | Colour Coding For Line Hardware, Including Helical, To Be Used On Conductors   |
| DSP_34-1681 | 0          | Specification For Aircraft Warning Devices Used On Overhead Sub Transmission And Distribution Lines  |
| DSP_34-433  | 1          | Requirements And Tests For Stockbridge Type Aeolian Vibration Dampers  |
| DSP_34-510  | 1          | Outdoor Post And Long Rod Insulators For New And Refurbished Power Lines For 66kv And 132kv  |
| DSP_34-1213 | 1          | Zinc-Coated Earth Conductor, Guy And Stay Wire For Distribution Lines  |
| DSP_34-1659 | 0          | Current-Carrying Compression Fittings For Overhead Sub-Transmission Systems  |
| DSP_34-1680 | 0          | Refurbishment Of Steel Power Line Structures   |
| DSP_34-1683 | 0          | Distribution Specification For Steel Mono-Pole Compact Line Towers For Sub Transmission Lines  |
| DSP_34-2051 | 1          | Design, Manufacturing And Testing Requirements For Fabricated Steel Overhead Line Structures And Components  |
| DST_34-1202 | 0          | Sub Transmission Lines Section 1: General  |
| DST_34-1207 | 2          | Conductors   |
| DISASABL1   | 2          | Insulators   |
| DST_34-1204 | 2          | Vibration Dampers  |
| ASABF9      | 0          | Earthing   |
| DST_34-1206 | 0          | Sub Transmission Lines Section 9: Steel Mono Pole 132kV Compact Line Tower Series  |

| Document    | Rev./issue | Title and Publisher  |
|-------------|------------|--|
| DST_34-1231 | 0          | Distribution Standard Part 6: Sub-Transmission Lines Section 9: Steel Mono-Pole 132kV Suspension Structures (Suspension Arm)       |
| DST_34-1230 | 0          | Distribution Standard Part 6: Sub-Transmission Lines Section 11: Steel Guyed Mono-Pole Suspension Structure 132kv (Suspension Arm) |
| DST_34-1228 | 0          | Sub-Transmission Lines Section 14: Assembly And Informative Drawings For 66kV And 132kV Lines                                      |
| DST_34-1235 | 0          | Sub Transmission Lines Section 15: Steel H-Structures For 132kv Lines  |
| 06TB-08     | 0          | Bifurcation (Splitting) Of Shield Wires  |
| 04TB-040    | 0          | Testing Of Compression Fitting Sample Assemblies   |
| 00TB-022    | 0          | Dead End Clamping Of Standard Greased Overhead Line Conductors.  |
| 13TB-015    | 0          | Standard Greases For Use On Overhead Conductors  |
| DST_34-1454 | 0          | Clearing And Maintenance Of Servitude Routes   |
| SCSASAAAX8  | 0          | Standard On The Implementation Of The Standardisation Of Disc Insulators To IEC 120 Standards                                      |
| 34-1439     | 0          | Standard For The Labelling Of High Voltage Equipment   |
| SCSASAAAY0  | 0          | Standard For Blasting Under Or Adjacent To Eskom Overhead Power lines and Substations  |
| DSP_34-254  | 1          | Manufacturing Specification for Distribution Equipment Labels  |
| DSP_32-1290 | 1          | OPGW Hardware and installation requirements for overhead lines   |
| DGL_34-550  | 0          | Guide For The Storage, Transport And Handling Of Composite Insulators.   |

### 3. TEMPORARY WORKS

All temporary construction roads shall be constructed by the **Contractor**, only if required for the successful execution of the construction activities or as instructed by the **Engineer**.

All temporary construction stays installed for the erection and securing of structures and for stringing purposes shall be completely removed after completion of these activities.

All temporary installations (Scaffolding, Goal posts, etc.) required for the crossing of roads, railway lines, power lines, telephone lines, etc. shall be completely removed after completion of the stringing activities.

Temporary By-passes shall be constructed for the duration of the complete construction of the new overhead line section where required and indicated on the project drawings.

At completion of construction at the new overhead power line section By-passes shall be disconnected and completely dismantled.

#### **4. CONSTRUCTION SEQUENCE AND PROPOSED PLANNED OUTAGES**

The *Contractor* for the *Works* has to make arrangements for pre-arranged outages to perform activities which need to be done under “de-energized” conditions. The outages are to be arranged to have the least impact on the relevant sub-transmission and distribution networks and shall take place as far as possible over weekends. The *Contractor* shall make provision for working during weekends in the construction programme and planning.

#### **5. WORKS INFORMATION**

##### **5.1.PLANT**

- a) The Employer will not supply any plant for the execution of the Works.
- b) All plant required for the successful completion of this project shall be provided by the Contractor.

##### **5.2.MATERIALS**

- a) For a detailed Detail Design Bill for Materials, refer to the Bill of Quantities and/or Bill of Materials which forms part of the tender/contract document.
- b) Apart from items specified in clauses below, the Contractor shall be responsible for the supply of all relevant construction material such as sand, stone, cement, reinforcing, concrete manhole sections, HD bolts, HD bolt top and bottom templates, shoring, steel shutters, temporary crossing installations and any miscellaneous items which might be required for the successful completion of the project.
- c) A Detail Design Bill of Materials, of all materials to be supplied to the Contractor, it will however remain the contractor’s responsibility to verify all quantities with the Engineer before any orders are placed. In some instances additional material are allowed for in the case of unforeseen circumstance, such equipment should not be ordered as part of the normal scope of works.
- d) The Contractor will supply the following:
  - All foundation material below ground, including stubs casted in foundations and concrete caps above ground level
  - Temporary stay material including stay wire;
  - (Note: Only the minimum amount of temporary stays required per structure will be specified by the Employer. The Contractor shall make provision for all additional temporary stays, which he thinks might be required for the safety of his workmen.)
  - All line designation, structure identification, phase colour disc and line crossing labels, complete with buckles and strapping;
  - All tower anti-climbing devices strain and razor wires.
- e) Suppliers samples and/or detail drawings of all line material, supplied by the Contractor shall be technically evaluated and approved by the Engineer prior to the purchasing thereof.

- f) If some materials are supplied by the Employer the following shall apply: Once any material delivered by the Employer to the Contractor's yard on site, the loading, transporting to the construction site, off-loading and safekeeping thereof becomes the responsibility of the Contractor. The Contractor must make the necessary arrangements for safe storage on site, offering adequate protection against theft, damage, wind and weather.
- g) The Contractor will be responsible for the insurance of materials against any form of damage or theft after delivery thereof.
- h) At all times it will be assumed that the Contractor has been ensured upon the acceptance of material supplied by the Employer, that no visible damage has occurred to it and that it also complies with the latest relevant Standard. In the case of damaged and/or unacceptable material, acceptance thereof must be refused.
- i) Should a dispute arises, with regards to the quality of any material delivered to site the assistance of the Engineer must be called upon for a decision.
- j) If any damaged material is found on site after delivery and acceptance thereof, it will be replaced at the cost of the Contractor and no extension of contract time will be granted for the extra delivery time.
- k) It is essential that a good "Record-keeping System" exist whereby control over quantities on site can be maintained. All new deliveries to the site-store and all materials and structures issued for construction must be recorded. At any time, it must be possible for the Engineer to establish from these records exactly what material or structures is kept in site store/yard or has been installed. These figures will regularly be compared to the actual quantities measured on site and the formal delivery notes.
- l) Liability for inherent defects in material issued by the Employer does not lie with the Contractor. If defects in material or in the Works, due to the use of patently defective material are discovered, new material will be replaced by the Supplier free of charge.
- m) If, however, it is established that defects in material or the Works were due to damage caused to material after issue, the Contractor will be held responsible for all replacement and repair costs to the material or the Works, as well as loss of time. The decision concerning the caused and responsibility of defects, as well as the extent of compensation (if any), rests with the Project Manager.

### **5.3.EQUIPMENT**

- a) No equipment will be supplied by the *Employer* for the completion of this project.
- b) All equipment required for the successful completion of this project shall be provided by the Contractor.

### **5.4.SITE SERVICES PROVIDED BY THE EMPLOYER**

- a) A new power line servitude, with limited and restricted access will be made available to the *Contractor* for the executing of the *Works* where applicable. No servitudes are required on the property of the power line owner (a servitude cannot be registered in favour of the owner over the owners own property)

- b) The line route, all structure and stay positions will be pegged by the Contractor's Surveyor. The Engineer shall supply the contractor with a staking report. Reinstating of any pegs removed during construction shall be the contractor's responsibility at no additional cost. After completion of excavation the staking reference pegs shall be available to confirm the support structures position – this shall be a holding point on the project programme.
- c) The contractor will be required to liaise with all Landowners.

## 6. ACTIVITY STAGE 1

### PRELIMINARY, GENERAL & SHEQ

- a) Preliminary and general costs include any other costs not required for site establishment, as specified below:
  - Contractual requirements i.e., insurance's, statutory contributions, etc.;
  - Material Surety Bond;
  - Contract Programming;
  - Off-site staff & overhead costs;
  - Additional provision to conduct a planned outage inclusive of all transport, labour and material (To be re-measured at completion);
  - Environmental requirements;
  - Health and Safety requirements.
- b) The **Contractor** is referred to the contract documents for the full intent and meaning of each clause or item and he shall allow opposite each clause or item herein contained whatever payments he may consider necessary for the carrying out and observance of such item.
- c) The Contractor shall price the Preliminaries and General Bill in respect of all payments required for any item of work, risk, contingency or obligation whatsoever that is not described in the Bills of Quantities and which is the responsibility of the Contractor under the contract.
- d) The Contractor shall, when requested by the Employer, make available the detailed breakdown of each priced.
- e) In the event of the Contractor not pricing the items of the Preliminaries and General Bill in sufficient detail, the Employer reserves the right to exercise his own discretion in the apportionment to individual items of the total Preliminary and General Prices within the contract documents.

### 6.1. ENVIRONMENTAL REQUIREMENTS

- a) The **Contractor** will see that the **Environmental Requirements** for this project is strictly adhered to.
- b) The Contractor shall:
  - Appoint his internal or external Environmental Control Officer to ensure proper implementation and day-to-day monitoring of the Environmental Requirements;
  - Demonstrate environmental competence by providing evidence of his / her companies' environmental policy;
  - Keep an Environmental Incident Register on site, which must be regularly updated by the Contractor throughout the entire construction period.
- c) Sanitary Facilities and Refuse Disposal:



- Temporary and/or mobile toilet facilities shall be provided at the Contractor's yard by the Contractor and removed on completion of the Works.
  - Under no circumstances shall the use of the veld be permitted. To prevent the occurrence of measles in cattle, Construction Employees may be required to be examined for tapeworm and treated or treated irrespective of whether they are infected or not. Proof of such treatment must be supplied to the Engineer. The drug "Niclosamide" (Yomesan, Bayer) is freely available and highly effective against tapeworms in humans.
  - The use of only chemical toilets as temporary facilities will be accepted. No other temporary system will be allowed on site.
  - The Contractor shall establish a refuse control system. All waste shall be collected and disposed of as required by the Landowner, Engineer and the Environmental Practitioner.
  - The Contractor shall make his own arrangements for the disposal of unsuitable excavated material, surplus material and construction waste resulting from the Works, to the Clerk of Works approval.
  - The Contractor shall furthermore ensure:
    - That waste is disposed of on a permitted waste site, for the applicable waste type, in terms of the Environment Conservation Act, 73 of 1989.
    - A disposal certificate is issued to the Employer prior to final payment, as proof of disposal.
    - That where appropriate, waste is being recycled or re-used.
- d) Vegetation Management:
- The Contractor shall ensure:
    - That all indigenous and protected trees (in terms of National and Provincial Legislation) are identified and permits obtained from the relevant authority prior to the cutting of such trees.
    - That written permission is obtained from the owner of protected trees prior to the cutting of such trees.
    - That permits be available on site where such trees are cut.
    - That the owner is consulted, and his/her consent being obtained, prior to the cutting of trees.
- e) Environmental Risks:
- The Contractor shall ensure:
    - That all environmental risks associated with the activity be assessed and documented prior to the execution of the activity.
    - Identified environmental risks must be avoided where possible and where it cannot be avoided, be remediated to the satisfaction of the Employer, the relevant Landowner, or any relevant Government Authority.
    - That all environmental incidents and complaints are reported to the Clerk of Works within 24 hours after the occurrence thereof.
- f) Other special environmental restrictions which must be adhered to and as stipulated in the Environmental Management Plan are:
- The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames which could result in veld fires or constitute a hazard.
  - Indiscriminate disposal of rubbish or rubble.
  - Deliberate littering of the site.
  - Spillage of potential pollutants, such as petroleum products.

- Lighting of fires for cooking, heating or other purposes, and failure to exterminate any fires.
- Use of any facility other than the chemical toilets provided.
- Burning of wastes and cleared vegetation under any circumstances.
- The use of rivers, streams, dams or any watercourses/surface water for washing purposes.
- Entering areas outside of the demarcated construction area.
- The presence of construction staff at the construction site outside of the designated construction times (06h00-18h00) i.e. no construction staff are allowed to overnight on site, outside of the demarcated construction camp.

## **6.2.HEALTH & SAFETY REQUIREMENTS**

- a) The Employer's Health and Safety Specifications and the Department of Labour's Construction Regulations for this project are specified in Combined Project Specific Policies, Guidelines & Standards.
- b) The Contractor shall:
  - Submit with this Tender, a complete Health and Safety Plan for this project, for the Employer's approval;
  - Comply in full with all the Employer's requirements for Security and Safety;
  - Maintain an active accident prevention program;
  - Appoint a responsible Health and Safety Officer and he is to co-operate fully with the Project Manager in all matters pertaining to accident prevention and safety on the construction site;
  - Hold safety meetings as required under the Occupational Health and Safety Act 85 of 1993, and shall submit copies of the minutes to the Project Manager no later than 2 days after the date of the meeting.
  - Provide first aid facilities as required by the Occupational Health and Safety Act, 85 of 1993.
  - Allow and ensure safe access for other Contractor's and the Employer's personnel when required.
  - Make provision for special transport of workers to, at and from site as per OHS Act/Construction Regulations requirements; i) Complete and submit an Expanded Public Works Programme report, prior to the commencements of any construction activities; j) Compile and submit for acceptance by the Employer "Detailed Construction Method Statements" for any test and construction activities to be executed on site;
  - Keep a Health and Safety Incident Register on site, which must be updated daily throughout the entire construction period.
- c) The Employer's Standard "Occupational Health and Safety Requirements" forms part of the Health and Safety Specification of this document and applies for the compilation of the 'Health & Safety Plan' for this project.
- d) The Contractor as well as the Clerk of Works shall ensure that the proper implementation, co-ordination and management of safety aspects during the project life cycle and that all statutory and supply authority Regulations are implemented and adhered to, as specified.

### **6.3. SITE ESTABLISHMENT**

- a) The Contractor will be responsible to locate a suitable site to establish a construction camp.
- b) Site establishment costs include any other costs not specified as preliminary and general costs, as stated below:
  - Establish, use and maintain notice boards and construction access road indicators. The notice boards and erection thereof shall comply with the advertising bylaw of the Local Authority;
  - Establish, use and maintain site office;
  - Establish, use and maintain site stores & construction camp;
  - Establish, use and maintain staff accommodation and sanitation;
  - Establish, use and maintain all telecomm and telephone installations and remove on completion, if required;
  - Establish, use and maintain Contractor's water supply, if required;
  - Establish, use and maintain Contractor's electricity supply, if required;
  - Establish, use and maintain Contractor's drainage and waste disposal at all camps;
  - Establish, use and maintain site toilet facilities;
  - Establish, use and maintain temporary works;
  - Establish, use and maintain all constructional plant.
  - The Contractor shall submit a Site Establishment application to the Building and Land Use Department.
- c) Erection of a site office & construction camp:
  - A fully equipped site office, suitable for regular site meetings must be erected, which must also serve as the office for the Contractor's Site Supervisor.
  - Adequate workspace must also be provided for the Clerk of Works, as well as a place of safekeeping of his site plans and documentation.
  - On completion of the project, all temporary structures and installations shall be removed from site and the site shall be re-instated to the satisfaction of the Project Manager.
  - For temporary installations, only chemical toilet facilities will be allowed at the construction office/camp for the use by construction workers and visitors to the construction camp.
  - The Contractor shall:
    - Ensure that the entire camp site(s) is fenced and gates locked after hours and over weekends.
    - Ensure that firebreaks are made along the inside perimeter of the fence (where appropriate).
    - Ensure that appropriate sanitation and cooking facilities are provided and maintained at all work sites.
    - Ensure that no open fires are permitted at the camp site(s). The establishment of fencing and firebreaks must be negotiated with the relevant Landowner(s).
- d) Erection of Stores for safekeeping of materials:
  - The responsibility for the safe storage of material on site as well as protection against damage due to wind or weather lies with the Contractor.

- The construction camp and material yard shall be properly fenced off and all access gates shall be kept locked during periods where no construction activities are taking place.
  - No conductor, shield wire, line hardware, insulators and steel structures shall be stockpiled directly on the ground.
  - The construction camp and material yard shall be maintained and kept in a clean and tidy condition, throughout the construction period and also to the satisfaction of the Engineer.
- e) Laboratory Facilities:
- The Contractor shall provide laboratory facilities for his own use on site to carry out all routine testing of materials and construction, as required by the specifications;
  - The Contractor may make use of approved commercial laboratories, if he so wishes.
- f) Telephone and Telecommunications:
- The Contractor shall be responsible for the supply, on site, of his own telephone or radio-telephone, if required.
- g) Accommodation of Employees:
- The Contractor shall make his own arrangements for the provision of married and single accommodation for his employees.
- h) Electrical Equipment/Appliances:
- Any electrical equipment or appliance used by the Contractor shall be maintained in safe and proper working conditions;
  - The Project Manager shall have the right to stop the Contractor's use of any electrical equipment or appliance, which, in his opinion, does not conform to the foregoing.
- i) Concrete Batching and Mixing Plant:
- The Contractor shall negotiate a proper site for the establishment of a batching plant with the Landowner;
  - The Contractor will be responsible for the proper management of the batching plant and it shall be dedicated solely to the Works;
  - Upon completion of the Works, the soil at the batching plant area shall be rehabilitated and the site cleaned and left in its original state or to the approval of the Clerk of Works and Landowner.
  - The use of local water for concrete mixing must first be negotiated with the relevant Landowner and/or appropriate authorities.
  - Such water shall be analysed for its suitability for the use in concrete. The water analyses shall be submitted to the Project Engineer for the approval thereof.
- j) Fuel depots:
- The Contractor shall when making use of bulk fuel tanks on site, shall have these fuel depot sites protected with under laying plastic sheeting with a trench and/or bund wall around it to avoid unnecessary soil pollution.
  - In cases of severe soil pollution at fuel depots a certified Contractor shall remove the polluted soil to an approved toxic dumping site or otherwise the soil must be treated chemically. In both cases a certificate for the removal and/or rehabilitation of the soil must be submitted to the Project Manager.
- k) Provision of Standard Specifications:
- Where any specification is listed and references are made to other published standards, or specifications of a similar nature, the Contractor shall arrange at

the inception of the contract, to make available at least one complete control set of the latest edition of all documents so referenced.

- The documents shall be kept in the Contractor's site office where they shall be made available for reference at all times by the Contractor's personnel or the Project Manager until completion of the Works.

## **7. ACTIVITY STAGE 2**

### **ESTABLISH CONSTRUCTION ACCESS**

#### **7.1.SUPPLY AND TRANSPORT OF NEW POWER LINE SERVITUDE GATES**

- a) The following Standards, Specifications, Guidelines and Drawings apply:
  - **TRMSCAAC1 Rev. 3 -Section 4.5** Transmission line tower and Line construction;
  - Fencing Act No. 31 of 1963
  - **DGL 34-190** Guideline for access to farms;
  - **DGL 34-600** Building line restrictions, servitude widths, line separations and clearances from power lines;
  - PLS Cadd design profile sheets.
- b) All new power line servitude and access required for this project shall be completely supplied and transported to site by the Contractor.
- c) Gate quantities measured on the Route Plan are subjected to re-measurement based on a proper site evaluation by the Contractor in conjunction with the Clerk of Works.
- d) Prior to the commencement of any other construction activities on this project, proper construction access on and to the line route/construction site shall be established.

#### **7.2.COMPLETE REFURBISHMENT OR REPLACEMENT OF EXISTING POWER LINE SERVITUDE AND ACCESS GATES**

- a) The Contractor in conjunction with the Clerk of Works shall do a proper assessment on the conditions of all existing gates along the line route.
- b) Existing farm gates situated near and/or in the power line servitude and which are required for access, but are unsuitable for construction-vehicle access must be thoroughly assessed and evaluated.
- c) All existing access/servitude gates shall be refurbished/replaced ensure proper construction access, as follow:
  - Existing gates in a still good workable condition shall be properly cleaned and repainted. All fencing wires shall be properly tightened.
  - Existing gates in a poor not workable condition shall be completely removed and replaced with new gates.
- d) Gates requiring refurbishment shall be:
  - Repaired to the satisfaction of the Clerk of Works;
  - Any parts, members, etc. to be replaced by the Contractor where required;
  - Fence wires to be re-tensioned and/or replaced where required;
  - Gate frame, posts and struts to be properly sanded and all severe corrosion and loose paint to be removed;

- Prepared gate frames, pots and struts to be painted.
- e) Gate refurbishment specification:
- Sand all paint surfaces properly and remove all loose paint, rust and foreign matter;
  - Apply one coat red lead primer to all surfaces;
  - Apply two final coats of aluminium based paint;
  - Allow sufficient time between coats to dry;
  - Apply two coats of bitumen coating around gate posts and struts entering the ground;
  - Cast concrete collars around gate posts and struts, only if there are no caps present and/or the existing caps are in a poor condition.
  - Concrete thresholds to be constructed at existing gates, only if required.
  - The existence of an earth bonding strap be gate posts must be investigate by the Clerk of Works and new earth bonding straps shall be installed where required.
- f) Existing access gates outside the power line servitude shall only be used after written approval is obtained from the relevant Landowner, for the use thereof.
- g) The Contractor shall temporarily remove the existing standard supply authority padlocks from existing gates and replace it with his own padlocks for the full duration of the construction period.

### **7.3.COMPLETE INSTALLATION OF NEW POWER LINE SERVITUDE GATES**

- a) New power line access/servitude gates shall be installed at all points where the power line crosses any fence in which there is no suitable gate within extend of the power line servitude, unless otherwise determined on site by the Clerk of Works.
- b) All construction vehicles shall pass through gates when crossing fences and the Contractor shall not be allowed to drop fences temporarily for the purpose of driving over it. No construction work shall be allowed to commence on any section of the power line, unless all gates in that line section have been installed.
- c) The Contractor in conjunction with the Clerk of Works shall do a proper assessment of all the marked fences for new gate installations to obtain proper access to the construction site.
- d) The Clerk of Works will be responsible to evaluate all marked fences and gates, prior to the installation of new power line servitude gates and/or replacement of existing gates.
- e) The Contractor's work comprises:
- Supply, safe handling, storage and transport to peg of all power line servitude gates, gate & fencing material and all other gate construction material;
  - Setting-out of gate & fence post and strut positions;
  - Evaluating sub-soil conditions for foundation nominations;
  - Drilling/excavating of holes for poles and struts;
  - Excavating of earth strap trenches;
  - Complete installation of all gate & fence posts and struts in 15MPa concrete footings;
  - Curing of concrete footings;
  - Install gate leafs and cut and re-tension existing fence wires;
  - Install earth straps, backfill and compact trenches;

- Treatment of all damaged sections on gate leaf frames, poles, struts, etc.
- f) The in-situ soil condition at each gate position will determine the type of gate post foundation to be installed.
- g) Power line servitude gates shall be erected with a gap not larger than 100mm between the bottom of the gate leaf and the natural ground level.
- h) Where gates are to be installed in jackal proof fences and game fences, a suitable concrete threshold as shown on the detail drawings shall be constructed at the gate opening. Gate leafs shall be covered with diamond mesh as specified on detail drawings.
- i) All gate and fence posts as well as post struts are to be installed in 15MPa concrete footings. The concrete footings must be properly cured, in the most suitable method, for at least 14 days prior to the tensioning of the fence wires.
- j) Earth strap trenches to backfilled slightly watered and thoroughly compacted in layers not exceeding 250mm in thickness.
- k) For soil formations with a very high resistivity the earth strap trenches to be backfilled with a 3:1 soil/agricultural gypsum mixture.
- l) The initial tensions to be maintained in all existing fence wires. Where required, the Contractor shall replace rusted or damaged wire strands on either side of the gate with similar new wiring to prevent the movement of livestock and other animals. The Clerk of Works will determine the extent of replacing fence wires and a written instruction shall be given accordingly.
- m) The Contractor shall supply and install all servitude gate numbering labels. Gate labels shall be installed on all access and servitude gates used for construction purposes.
- n) Gate labels specifications:
  - Labels shall be max. 150 x 150 mm with 15 mm radius rounded corners and 6 mm diameter holes drilled at each corner.
  - Labels shall be manufactured from a material equivalent to Mittal Steel Chroma prep (Z275) having a minimum thickness 1,0mm;
  - The primary colour of the label shall be powder coated with an exterior type powder coating according to SANS 1274 (Type 6) with a minimum thickness of 70µm. The primary colour needs to be on the same side of the substrate where the legend is going to be applied;
  - After the cast vinyl legend is positioned on the coloured substrate the label shall be powder coated on both sides of the label with an exterior type clear coat powder coating according to SANS 1274 (Type 6) with a minimum thickness of 70µm;
  - The font for label legend shall be Helvetica Medium, with a minimum height of 75 mm. The inscription shall be detailed in the Design Bill of Materials. All alphabetical inscriptions shall only be capital letters;
  - The legend shall be of cast vinyl having a guarantee of 7-10 years;
  - Label shall have Black Cast Vinyl lettering on Yellow background;
  - 2,5 mm galvanised binding wire to be used to tie the label to the top centre of the gate leaf.
- o) The Contractor shall provide padlocks for all servitude gates for the entire construction period, where after it will be replaced by the Employer with standard maintenance padlocks, on completion of the project.

- p) Landowners will be allowed to attach their personal padlocks in the lock chain, only after the approval of the Clerk of Works.
- q) Installation of gates in fences on National Road Reserves shall comply with the ordinances of the relevant Provincial Authority. No power line servitude gates shall be installed in Freeway servitude fences.
- r) No power line servitude gate shall be installed in the Spoornet Railway Servitude fences, unless otherwise negotiated and agreed upon with the relevant Transnet Authorities.

#### **7.4. COMPLETE ESTABLISHMENT OF PROPER CONSTRUCTION ACCESS**

- a) The Clerk of Works and the Contractor will see that the Landowner's Conditions stipulated during the negotiations for this project is strictly adhered to.
- b) No property will be entered by the Contractor or his employees, prior to an acceptable official notification to the specific Landowner.
- c) The Contractor shall only use the private farm roads with the necessary permission from the specific Landowner, use it with the necessary respect and maintain it throughout the construction period.
- d) The access to the site to be clearly marked by Contractor in the form of access road indicators. The Contractor shall also establish and maintain notice boards or sign posts at private roads used for construction purposes and special conditions clearly stipulated on these notice boards.
- e) Maximum use of both the existing servitudes and the existing roads shall be made. In situations where private roads must be used for construction purposes, the condition of the said roads must be recorded (e.g. Photographed) prior to the use thereof and be agreed upon by the Employer, the Landowner and the Contractor.
- f) All private roads used for access to the servitude shall be maintained by the Contractor and upon completion of the works, be left in at least the original condition.
- g) Access shall not necessarily be continuous along the line, and the Contractor must therefore acquaint himself with the physical access restrictions such as rivers, railways, motorways, mountains, etc. along the line. As far as possible, access roads shall follow the contour in hilly areas, as opposed to winding down steep slopes.
- h) Access is to be established by vehicles passing over the same track on natural ground, multiple tracks are not permitted. Access roads shall only be constructed where necessary at watercourses, on steep slopes or where boulders prohibit vehicular traffic.
- i) The Contractor is to inform the Clerk of Works before entering any of the following areas:
  - Naturally wetland areas, swamps, etc.
  - Any area after rain.
  - Any environmentally sensitive area.
- j) If access is across running water, the Contractor shall take precautions not to impede the natural flow of water. If instructed, the Contractor is to stone pitch the crossing point. There shall be no pollution of water. Access across running water and the method of crossing shall be at the approval of the Clerk of Works and the landowner.



- k) Where in the opinion of the Clerk of Works and/or Project Manager, inordinate and irreparable damage would result from the development of access roads, the Contractor shall use alternative construction methods compatible with the access and terrain, as agreed with the Project Manager.
- l) Existing water diversion berms are to be maintained during construction and upon completion be repaired as instructed by the Clerk of Works.
- m) Where access roads have crossed cultivated farmlands, the lands shall be rehabilitated by ripping to a minimum depth of 600mm.
- n) Construction of new roads:
  - Where construction of a new road has been agreed, the road width shall be determined by need, such as equipment size, and shall be no wider than necessary.
  - In areas over 4% side slope, roads may be constructed to a 4% out slope. The road shall be constructed so that material will not be accumulated in one pile or piles, but distributed as evenly as possible.
  - The material shall be side-cast as construction proceeds, and not overhang the road cut, and shall if necessary be trimmed back at an angle which would ensure stability of the slope for the duration of the works. The sides or shoulders of roads shall not act as a canal or watercourse.
  - Water diversion berms shall be built immediately after the opening of the new access road. In addition, water outlets shall be made at intervals where berms are installed, and suitably stone pitched if instructed by the Clerk of Works.
  - No cutting and filling shall be allowed in areas of 4% side slope and less.
  - Existing land contours shall not be crossed by vehicles and equipment unless agreed upon, in writing, by the Landowner and the Clerk of Works.
  - Existing drainage systems shall not be blocked or altered in any way.
- o) Closure of roads
  - Upon completion, only roads as indicated by the Clerk of Works shall be closed.
  - In areas where no cut or fill has been made, barriers of earth, rocks or other suitable material shall affect closure.
  - In areas 30% slope and less, the fill of the road shall be placed back into the roadway using equipment that does not work outside the road cut (e.g. back-hoe). In areas of greater than 30% slope, the equipment shall break the road shoulder down so that the slope nearly approximates to the original slope of the ground. The cut banks shall be pushed down into the road, and a near normal side slope shall be re-established and re-vegetated.
  - Replacement of earth shall be at slopes less than the normal angle of repose for the soil type involved.
- p) Construction of water diversion berms
  - Water diversion berms shall be spaced according to the ground slope and actual soil conditions, but no greater than the following:
    - Where the track has a slope of less than **2%: 50m** apart;
    - Where the track has a slope of **2%-10%: 25m** apart;
    - Where the track has a slope of **10%-15%: 20m** apart;
    - Where the track has a slope of more than **15%: 10m** apart.
  - Berms shall be suitably compacted to a minimum height of 350mm.
  - The breadth of the water diversion berm shall be 4m at the base, and extend beyond the width of the road for 2,0m on the outlet side to prevent water flowing

back into the road. It shall be angled to a gradient of 1% to enable the water to drain off slowly.

- Berms to be constructed so that a canal is formed at the upslope side.
- Where the in-situ material is unsuitable for the construction of water diversion berms, alternative methods of construction must be investigated and proposed by the Contractor and submitted to the Project Manager for acceptance.
- Loose boulders which obstruct the construction access as well as for running out the conductors shall be removed from the power line servitude.

q) Borrow pits

- The Contractor's decision as to the location of borrow pits, shall be at the Clerk of Works acceptance.
- The Contractor shall be responsible for the rehabilitation and re-vegetation of the borrow pits. It is the Contractor's responsibility to negotiate the royalties for the borrow pits with the Landowner.

r) Levelling at structure/tower sites

- No levelling at tower sites shall be permitted unless approved by the Clerk of Works.
- The steep slopes formed by the cut-banks and respective fillings when building the structure/tower platforms are to be trimmed back to an angle that ensures stability of the slope. When the ground is loose, berms are to be built on the top of the slope, 2,0m long logs spaced evenly must be pegged across the down-slope, re-vegetated with appropriate local grass seeds together with fertiliser.

## 7.5. BUSH CLEARING AND CUTTING OF TREES

a) The following Standards, Specifications, Guidelines and Drawings apply:

- **TRMSCAAC1 Rev. 3 -Section 4** Transmission line tower and line construction;
- Environmental Conservation Act No. 73 of 1989
- Conservation of Agricultural Resources Act No. 43 of 1983;
- Environmental Management Plan
- **EPC 32-96** Guidelines for the rehabilitation and vegetation management of herbicides treated sites;
- **ESKASABG** Standards and Specifications for the control and cutting of trees and bush within overhead line servitudes;

b) Trees and bush to be cut and/or trimmed on a careful and selective basis to ensure the required electrical clearances from all conductive equipment and to ensure the safety of the power line structures.

c) All equipment required for bush clearing shall be supplied by the Contractor.

d) All approved herbicides required for the prohibiting of re-growth of trees and bush to be supplied by the Contractor.

e) All actual bush clearing areas and quantities of trees cut by the Contractor shall be measured and recorded by the Clerk of Works. Actual measured bush clearing records shall be submitted to the Employer for acceptance.

f) Minimum One Week written notice must be given to the Employer's Environmental Practitioner before commencement with bush clearing activities.

- g) The Contractor shall use only well trained approved and/or accredited weed killer applicators.
- h) The Contractor will not be allowed to cut and/or trim any endangered trees or shrubs in the servitude, unless written prove of the required permits, obtained by the Contractor, is submitted to the Clerk of Works.
- i) Any endangered trees or shrubs to be cut shall be identified and marked by the Contractor in conjunction with the Environmental Control Officer and Clerk of Works.
- j) The use of existing gates and private roads in or outside the power line servitude for bush clearing purposes must be discussed with and accepted by the relevant Landowner, prior to the use thereof.
- k) All vehicles used for bush clearing shall pass through gates when crossing fences and the Contractor shall not be allowed to drop fences temporarily for the purpose of driving over it.
- l) A minimum 5,0m wide strip on the centre of the power line servitude all trees, bush and shrubs shall be cut at ground level to ensure proper access for construction purposes along the line.
- m) Additional maximum 5,0m wide strips on either side of the mentioned 5,0m centre strip all trees, bush and shrubs shall be cut at maximum 150mm above ground level to ensure no interference with construction activities along the power line.
- n) All trees, bush and shrubs shall be cut at ground level for 15,0m radius circles construction working areas at all guyed intermediate suspension and in-line strain structure sites.
- o) All trees bush and shrubs shall be cut at ground level for 25,0m radius circles construction working areas at all guyed angle strain structure sites.
- p) All wood from the cut trees, bush and shrubs shall be removed from the power line servitude to ensure proper construction access.
- q) Where tall trees are to be cut in the power line servitude, the total width of the servitude must be cleared, as well as the selective trimming of trees outside the servitude to ensure the safety of the overhead conductors and power line structures. The Clerk of Works will give the Contractor a written instruction for any trees to be trimmed outside the power line servitude.
- r) Trees that are felled shall be cut within 150mm above ground level, with the exception of a five meter (5,0m) wide access down the centre of the power line servitude in which the trees shall be cut as close as possible to ground level. Stumps need not to be removed, unless conflict with a structure, guy anchor or access is involved, or if requested by the Clerk of Works.
- s) All stumps from trees, bush and shrubs shall be chemically treated immediately after cutting, to prevent any re-growth thereof. The chemical treatment must be approved by the Employer's Environmental Practitioner prior to the purchasing and application thereof.
- t) All felled trees shall be cut into short manageable logs maximum 3,0m in length, unless otherwise required by the relevant Landowner.
- u) Where no trees, bush or shrubs are present the clearing of access shall be done by crushing of small brush rather than the uprooting thereof. Scalping of the earth, or any unnecessary disturbance, will not be allowed as any means of clearing the servitude, except on steep side slopes where cuts and fills are required.
- v) Between structures, where no traffic is required, there shall be no removal of grasses except as required for stringing of the power line. Access for the stringing of the power line shall be limited to one single track for all pulls.

- w) No cutting of bush and shrubs will be permitted across bush filled ravines or gullies where the bush will not interfere with the strung conductor. Alternative means shall be used to string the power line conductors.
- x) All chopped trees and bush will remain the property of the relevant Landowners, unless otherwise negotiated with the Clerk of Works.

## **8. ACTIVITY STAGE 3**

### **SURVEY ACTIVITIES**

#### **8.1.PEGGING OF LINE ROUTE, STRUCTURE SETTING-OUT & STAYS POSITIONS**

- a) The following Standards, Specifications, Guidelines and Drawings apply:
  - **TRMSCAAC1 Rev. 3 -Section 5** Transmission line tower and Line construction;
  - Provide pegging data and reference
- b) Setting Out of the Works:
  - The Contractor will be responsible to set out the works as per the staking table provided by the Engineer.
  - The bends will be pegged with dia 20mm steel pegs, protected with medium sized stone piles and clearly marked with "White Wash".
  - These bend pegs will be officially handed over to the Contractor at pre-arranged dates prior to the commencement of any construction activities.
  - The contractor will also be responsible for the pegging and marking of all intermediate suspension and angle strain structure positions, as well as the setting-out of all structure stay positions, temporary stay positions and structure line pegs and determining of structure off-set distances (if required), according to the line profile drawings and within the tolerances stated in TRMSCAAC1, Sections 5.5.3 & 6.2.4.3 (a). Unless otherwise specified in this contract.
  - All material required for the detail pegging of the line will be supplied by the Employer.
  - Other reference pegs (Line pegs and bi-sector line pegs) required for construction purposes will be provided and set out by the Employer.
  - Line pegs and flags at max. 1 500m intervals along the centre line of the power line servitude will be provided and pegged by the Employer, only on special written request from the Contractor.
  - A completed list of scaled co-ordinates for all structure, stay, line peg and bi-sector line peg positions will be submitted by the Project Engineer, for the use by the Employer's Surveyor and the Contractor.
  - All "As-staked" structure and structure stay positions, to be checked and verified by the Contractor prior to the commencement of any construction activities. The Contractor must immediately report any discrepancies between the "As-staked" and "Design" information to the Clerk of Works or Project Engineer.
  - All other detailed setting-out of the works will be the Contractor's responsibility.
  - The Contractor will be responsible for the securing of the Employer Servitude Pegs, by casting a concrete collar with minimum dimensions of 300mm x 300mm x 300mm deep at the line bend positions, see TRMSCAAC1, Section 5.3.

- c) Standard setting-out, structure and stay peg colour codes:
- Terminal and bend position -20mm x 1,0m long steel rod;
  - In-line strain position -10mm x 300mm long steel rod;
  - Mono-pole structure centre position -RED wooden peg;
  - H-pole structure centre position -WHITE wooden peg;
  - 2-Pole structure centre position -WHITE wooden peg;
  - Lattice tower centre position -WHITE wooden peg; H-pole structure leg positions -RED wooden pegs;
  - 2-Pole structure leg positions -RED wooden pegs;
  - Lattice tower leg positions -RED wooden pegs;
  - Permanent stay position -BLUE wooden peg;
  - Construction/Temporary stay position -BLUE/WHITE wooden peg;
  - Bi-sector setting-out line -WHITE wooden pegs;
  - Line peg position -WHITE wooden peg.
- d) Structure position labelling:
- Every structure position (RED or WHITE peg) to be marked with a steel, wooden, PVC tubing or steel dropper  $\pm 1,5$ m long and painted RED/WHITE or with a RED/WHITE fabric attached to it. Each rods shall carry a tag, with a structure identification description similar to the structure identifications on the applicable PLS Cadd Profile Design Sheets.
  - The structure number, structure type and pole length shall be clearly legible on the identification tag
  - Each peg shall be left in its position until the structure is assembled and approval is given by the Clerk of Works for the erection thereof.
- e) Marking of power line route for bush clearing purposes
- The power line route shall be clearly marked by the Employer's Surveyor for bush clearing purposes, measured as part of the Bush Clearing Activities.
  - At dense bush terrain, the centre of the power line route shall be marked entering the bush as well as at the exit of the bush.
  - At scattered bush terrain, the centre of the power line route shall be marked at max. 250m intervals.
  - At tall tree plantations, trees to be cut only within the power line servitude shall be marked for clear identification by the Contractor.

## **8.2.MARKING OF SERVITUDE AND ACCESS GATES**

- a) All fences in which servitude gates are to be installed, at the point where the fence intersects with the centre of the power line servitude, shall be marked by the *Employer's* Surveyor.
- b) In situations where a structure position is close to the fence in which a power line servitude gate needs to be installed, the gate position must be marked off-line in such a position that the structure and/or structure stays will not obstructed the access through the gate along the line.
- c) All fences in which servitude gates are to be installed, shall be marked as follow:
- A Red coloured fabric strip will be tied onto the fence wire, inside the power line servitude, at positions where servitude gate centre must to be installed;

- A Red & White coloured fabric strip will be tied onto the gate frame, inside or outside the power line servitude, at positions where existing farm gates are to be refurbished and/or replaced with new access/servitude gates.
  - A White coloured fabric strip will be tied onto the gate frames, outside the power line servitude, at positions where existing farm gates can be used by the Contractor, for construction purposes only.
- d) Permission and written approval for the use and/or replacement of private access gates inside and outside the power line servitude must first be obtained from the relevant Landowners, prior to the use and/or replacement thereof.

### **8.3.MEASURING OF ALL OVER AND UNDER CROSSING CLEARANCES**

- a) The Employer's Surveyor will also be responsible for the measuring and recording of all over and under crossing clearances, after the completion of the stringing activities on the line and prior to the commissioning of the line.
- b) Ambient temperature measurements shall be taken and recorded by the Surveyor in conjunction with the clearance measurements. The complete set of 'Clearance & Ambient Temperature Records' shall be submitted to the Project Engineer for evaluation and acceptance thereof.

## **9. ACTIVITY STAGE 4**

### **COMPLETE CONSTRUCTION OF TEMPORARY BY-PASS LINES**

For complete installation and dressing of By-pass structures, refer to **Activity Stages**.

- a) Supply and transport of By-pass connecting hardware.
- b) All connecting clamps required for the by-pass connections shall be transported to site by the **Contractor**.
- c) Complete installation and removal of temporary bypass lines
- d) The temporary by-passes lines -Include the detail and references of the by-pass lines to be constructed.
- e) After the complete construction of the following new line sections by-pass line shall be connected to the existing lines at allocated positions to minimize the duration of the temporary use of the name inter-connector line:
- Provide detail of by-pass
- f) At completion of construction at the mentioned new overhead power line section the by-pass lines name shall be disconnected and completely dismantled.
- g) Both sets of temporary by-pass structures including stay assemblies shall be completely dismantled.
- h) All dismantled material and structures from the temporary By-passes shall be loaded, transported to the Employers Works and off-loaded by the Contractor.
- i) The sites of the dismantled by-pass lines shall be properly re-instated to the satisfaction of the Clerk of Work and Environmental Control Official.

## **10. ACTIVITY STAGE 5**

### **FOUNDATIONS – GEOTECHNICAL INVESTIGATION, FOUNDATION DESIGN OR VERIFICATION, EXCAVATING OF HOLES AND INSTALLATION OF STRUCTURE FOUNDATIONS AND STAYS**

## 10.1. GEOTECHNICAL INVESTIGATION AND SOIL/FOUNDATION TYPE NOMINATIONS

- a) The following Standards, Specifications, Guidelines and Drawings apply:
  - TRMSCAAC1 Rev. 3 -Section 6 Transmission line tower and Line construction;
  - SANS 1200 D -1988 Earthworks;
  - Relevant foundation drawings;
  - Relevant support structure drawings;
  - Line Route Plan;
  - PLSCADD design profile sheets.
- b) Prior to the commencement of any drilling/excavation activities, the Contractor's shall do proper investigations of the sub-soil conditions at all structure positions, in the presence of the Clerk of Works and/or Project Engineer.
- c) The Contractor shall appoint his own professional Civil Engineer/Civil Technologist to do the sub soil geotechnical survey and nomination of the specific soil types at each structure position.
- d) Proper profile test holes to be excavated to the maximum founding depth of each structure, where possible, with a TLB back-actor. Any other method proposed for the sub-soil investigations and soil nominations must be approved by the Project Engineer, prior to the implementation thereof.
- e) A soil profile with identified material layers and depths, including a photograph thereof, as well as the nominated foundation type schedule to be submitted to the Project Engineer for acceptance, prior to the commencement of the foundation excavations.
- f) If any dispute with regards to the nominated foundations types arises between the Contractor and the Employer, the assistance of an independent professional Civil and/or Geotechnical Engineer shall be called upon.
- g) Standard soil classifications:
  - **"Type 1" soils:** Competent soil with equal or better consistency (strength or toughness) than one would encounter in stiff cohesive soils or dense cohesion less soils above the water table. This soil must have a broad balanced texture (constituent particle sizes) with high average combinations of un-drained shear strength and internal angle of friction, with minimum values of  $80\text{kN/m}^2$  and  $30^\circ$  respectively. The minimum natural specific weight shall not be less than  $18\text{kN/m}^3$ . Maximum soil bearing pressure  $300\text{kPa}$ .
  - **"Type 2" soils:** A less competent soil than "Type 1", with equal or weaker consistency than one would encounter in firm to stiff swelling cohesive soils, or dry poorly graded loose to medium dense cohesion less soils above the water table. The minimum un-drained shear strength shall be  $40\text{kN/m}^2$ , and the minimum natural specific weight shall not be less than  $16\text{kN/m}^3$ . Maximum soil bearing pressure  $150\text{kPa}$ .
  - **"Type 3" soils:** Dry loose cohesion less soil or very soft to soft cohesive soil. Maximum soil bearing pressure  $100\text{kPa}$ .
  - **"Type 4" soils:** Submerged cohesion less and cohesive soils. This includes all soils below the permanent water table, including soils below a re-occurring perched water table, or permeable soil in low-lying areas subjected to confirmed seasonal flooding. Maximum soil bearing pressure  $50\text{kPa}$ .
- h) Standard rock classifications:

- **“Type A” hard rock:** Hard to very hard solid or moderately fractured continuous rock, and including hard to very hard rock of any other description which meets the strength requirements. The maximum bearing or toe pressure at foundation depth shall be 2 000kPa.
  - **“Type B” soft rock:** Weathered or decomposed very soft to soft continuous rock, and including **rock** of any other description which does not satisfy the requirements for classification under clause 5.1.8 a). The maximum bearing or toe pressure at foundation depth shall be 800kPa.
- i) Standard boulder classifications:
- **“Class A”** Boulder excavation shall be excavations in material containing more than 40% by volume of boulders of size in the range 0,03m<sup>3</sup>-20m<sup>3</sup> in a matrix of soft material or smaller boulders; Excavations in dolomite formations other than solid dolomite will be classed as boulder excavations “Class A” if the formation contains more than 40% by volume of lumps of hard dolomite of size in the range 0,03m<sup>3</sup>-20m<sup>3</sup> in a matrix of soft material or smaller lumps of hard dolomite; Excavations of solid boulders or lumps of size exceeding 20m<sup>3</sup> will be classed as hard rock excavations; Excavations of fissured or fractured rock will not be classed as boulder excavations but as hard rock or intermediate excavations, according to the nature of the material.
  - **“Class B”** Boulder excavation shall be excavations in material containing less than 40% by volume of boulders of size in the range 0,03m<sup>3</sup>-20m<sup>3</sup> in a matrix of soft material or smaller boulders and which require individual drilling and blasting in order to be loaded by a track type front-end loader or back-acting excavator; The excavation of the rest of the material shall be classed as soft or intermediate excavations, according to the nature of the material.
- j) Geotechnical design parameters for various soil types:

**Table 3: Geotechnical design parameters for various soil types**

|                                     | <b>“Type 1”</b> | <b>“Type 2”</b> | <b>“Type 3”</b> | <b>“Type 4”</b> |
|-------------------------------------|-----------------|-----------------|-----------------|-----------------|
| Maximum soil bearing pressure (kPa) | 300             | 150             | 100             | 50              |
| Maximum toe bearing pressure (kPa)  | 375             | 200             | 125             | 65              |
| Frustum angle degrees               | 30              | 20              | 0               | 0               |

- k) For maximum soil bearing pressure and maximum toe bearing pressure, use the tabled pressure or 80% of the ultimate tested bearing pressure determined from appropriate tests.
- l) The soil profile excavations shall be suitably backfilled immediately after the relevant inspections and tests have been completed.
- m) Where site conditions, such as difficult access or environmentally sensitive areas, etc. preclude the excavation of a soil profile hole, alternative soils identification procedures shall be proposed by the Contractor and acceptance obtained from the Project Engineer.
- n) Should the foundation conditions at the actual foundation location be found to differ from those identified at the corresponding soil profile, the Contractor shall immediately inform the Clerk of Works and a revised assessment shall be made.



- o) Foundation type excavation quantities measured in the Volume 3 Part 1 are based on assumptions and will be subjected to final re-measurement based on the detail sub-soil geotechnical investigation and soil nominations at each structure and stay position.

## **10.2. STRUCTURE FOUNDATIONS DESIGN OR VERIFICATION**

- a) The appointment of a professional civil engineer will be the responsibility of the contractor and will be paid by the contractor -costs must be included in the tender. Foundation designs are provided for all possible soil types but needs to be verified and approved by a Prof Civil Engineer for each installation. Should the contractor wish to construct a foundation of a different design, all design drawings will be submitted to the Engineer for acceptance. The contractor will accept full responsibility for these designs. The Employer will not pay for these designs. This decision will be taken by the Engineer. Foundation designs for all structures shall be in accordance with **0501KR-01 rev 1, 240-47172520 (TRMSCAAC5) and SCSASABK8** by a registered professional in each type of soil (type 1, 2, 3, 4 soft rock and hard rock).

## **10.3. FOUNDATION INSTALLATION**

### **10.3.1. Detail setting-out of structure foundation excavations**

- a) After acceptance of the geotechnical survey and the foundation nominations by the Project Engineer and prior to the commencement of any drilling/excavation activities the Contractor's shall do the following preparations:
- Check and verify all structure pole and stay anchor positions, as per design and detail drawings and within the tolerances specified in **TRMSCAAC1 Section 6.2.4.3**;
  - Set-out of all nominated foundation details as per Employers Standard foundation design details for each structure.
  - All stay excavation positions to be marked  $\pm 1,48\text{m}$  in-line and backwards from the pegged stay positions.

### **10.3.2. Drilling/excavating of holes for structure foundations**

- a) All loose top soil containing grass, plants and /or plant roots whatsoever, shall be removed and temporary stockpiled for re-use at the structure site re-instatement. None of these materials are to be re-used for backfilling in structure foundations.
- b) Drill and/or excavate of holes for structure foundations/poles, as specified in TRMSCAAC1 Section 6.2, as per detail designs or as agreed upon with the Project Engineer for alternative methods suitable for site conditions.
- c) At each structure position, the Contractor shall excavate the appropriate foundation. Excavations in this instance shall be the removal of soil/rock by any accepted means for the purpose of constructing a particular foundation system.
- d) No excavation work, other than for soil investigation, shall be commenced on a section of line until the following conditions have been met:

- The Contractor has submitted the proposed foundation and soil type schedule to the Project Manager;
  - If drilled cast-in-situ piles or rock anchors are proposed, soil samples and pile/anchor tests have been conducted, if so instructed by the Project Manager.
- e) Excavations shall be made to the full dimensions required and shall be finished to the prescribed lines and levels. The bottom or sides of excavations upon or against which concrete is to be poured shall be undisturbed. If, at any point in excavation, the natural material is disturbed or loosened, it shall be filled with 10MPa concrete, including the application of a blinding layer at the base of foundations where these eventualities are likely to occur during the construction process. Soil backfilling will not be accepted.
  - f) In soil type which is incapable of withstanding the design loads which will be imposed upon it by a pad foundation, the Contractor shall propose a method of increasing the effective bearing area of the foundation. This may entail the installation of a foundation with a larger pad or other suitable solutions proposed by the Contractor. Any such proposal shall be submitted to the Project Manager for acceptance prior to excavation.
  - g) When the material at foundation depth is found to be partly rock or incompressible material, and partly a soil or material that is compressible, all compressible material shall be removed for an additional depth of 200mm and filled with 10MPa concrete.
  - h) Excavations for cast-in-situ concrete, including pile caps cast against earth, shall be concreted within seventy-two hours after beginning the excavations. In addition to this general requirement, pile and/or anchor holes that are not adequately protected against the elements to the satisfaction of the Clerk of Works, shall be cast on the same day that drilling/excavation has taken place.
  - i) Excavations that remain not concreted longer than seventy-two hours may, at the option of the Clerk of Works, be required to be enlarged by 150mm in all dimensions.
  - j) The Contractor shall notify the Clerk of Works upon completion of the excavation for the foundations. No concrete is to be placed until the excavation finishes, shuttering and reinforcing steel has been inspected and accepted in writing by the Clerk of Works.
  - k) Structure foundation excavation side walls and edges shall be smooth and square.
  - l) Excavations shall be properly cleaned, all loose sand; stones, vegetation, etc. shall be removed from the excavations prior to the casting of concrete and/or backfilling of excavations.
  - m) All excavated material suitable for backfilling and compaction of structure foundations to be kept clean and free from any vegetation and/or plant roots.
  - n) All unsuitable backfill material, such as soft clay and loose non-compactable sand shall be spoiled and dumped at a suitable dumping site or re-used for structure site re-instatement

### **10.3.3. Excavation shoring**

- a) The Contractor shall supply and install temporary shoring for securing of all structure foundations excavation side walls in collapsible **“Type 3 & 4” soils**.
- b) Shoring shall only be installed for the first two thirds (2/3) of the excavation depth, unless otherwise instructed by the Clerk of Works.

- c) Temporary shoring shall only be removed immediately before the backfilling of excavation commences.
- d) The Contractor shall ensure that excavation shoring strictly conforms to the Occupational Health and Safety Act 85 of 1993 – Construction Regulations Section 11 "Excavations"

#### **10.3.4. Supply of all foundations material and complete construction of all structure foundations**

- a) The following foundation material to be supplied by the Contractor:
  - Excavation shoring, where required;
  - Foundation formwork required for all specified foundation types;
  - Concrete material such as, sand, stone, cement and water, if concrete is batched on site;
  - Ready Mix concrete as per specification, if concrete is delivered to site;
  - All reinforcing required for concrete foundations;
  - Galvanized HD Bolts as specified for base plate structures;
  - Cement required for planted structure backfilling stabilization;
  - Imported soil required for planted structure backfilling stabilization, where specified only;
  - I.D. 1,2m "Rocla" pre-cast concrete manhole sections or alternatively purpose manufactured steel rings;
  - Any other material and/or equipment for the proper construction of the structure foundations.
- b) Structure foundations shall be proof load tested as per specification TRMSCAAC1 Rev 3 Section 6.2.5.2. The Contractor shall provide equipment on site during the construction of the pole foundation capable of loading the pole foundation to two-thirds of the maximum design moment. Where instructed by the Clerk of Works, the Contractor shall apply a construction proof load test of two-thirds the maximum design moment to the completed pole.
- c) As part of Activity Stage 5.1 the soil types for foundation installation will be identified by means of a Geotechnical sub-soil investigation done by a Civil Engineer/Technologist appointed by the Contractor. The foundation types will be nominated and recorded accordingly. Nominated foundation type records shall be submitted to the Employer for acceptance.
- d) Foundation excavation side walls and edges shall be smooth and square. Foundation excavations shall be clean prior to the casting of concrete and/or backfilling of excavations. All loose sand, stones, vegetation, etc. shall be removed from the excavations prior to the casting of concrete and/or backfilling of excavations.
- e) Concrete caps as per detail D-DT-7857 at all planted structures only to be constructed after the complete installation and testing of standard and/or additional structure earthing systems.
- f) Concrete mix designs shall be proportioned to obtain a minimum required strength of 25MPa at 28 days, and a target strength of 35MPa, with a maximum water/cement ratio of 0,59. No individual 28 day concrete test cube result shall fall below 85% of the specified strength.
- g) In the absence of any previous statistical data, the mix designs shall be proportioned to attain a characteristic strength of 33MPa at 28 days.

Notwithstanding the above requirements, the minimum cement content shall be 340 kg/m<sup>3</sup>.

- h) Grout mix designs for rock anchors shall be proportioned to attain a minimum strength of 35MPa at 28 days with any expansive additives included. The use of epoxy grouts is to be used only with the Project Engineer's approval.
- i) Water for the use in concrete shall be clean and free from all earthy, vegetable or organic matter, acids or alkaline substances in solution or suspension.
- j) Prior to any concrete placement the Contractor shall submit the trial mix designs and results of seven and twenty-eight day test cube strengths to the Employer for acceptance.
- k) If ready-mixed concrete is to be used, the Contractor shall obtain, from the ready-mix supplier, aggregate test reports and mix designs that satisfy the requirements. "7-Day" Test cube strength reports of all mix designs and submit to the Employer for acceptance prior to placement of any concrete.
- l) Foundation construction tolerances
  - The intent of this paragraph is to establish tolerances that are consistent with construction practice and the effect that permissible deviations will have upon the structural action or operational function of the structure.
  - Where tolerances are not stated for any individual structure or feature, permissible deviations will be interpreted in conformity with the provisions of this paragraph.
  - The Contractor shall be responsible for setting out and maintaining concrete excavations, shuttering and structural steelwork within the tolerance limits so as to ensure completed work within the specified tolerances.
  - Concrete work, that exceeds the tolerance limits specified shall be remedied, or removed and replaced.
  - Variation in structure location:
    - Transverse to centre-line: Less than 50mm
    - Longitudinal displacement: Less than 300mm
  - Variation in relative vertical elevation of structural steelwork (one leg to another)
    - Less than 5mm
  - Variation in horizontal distance between structural steelwork from that computed
    - Adjacent legs: Less than 5mm
    - Diagonal legs: Less than 7mm
  - Rotation -maximum deviation of transverse axis of structure from bisector of interior line angle
    - Less than 0°12'
  - Elevation -variation of tower base from centre-line peg
    - Minus 150mm
    - Plus 1 000mm
  - Height of concrete foundations above ground level
    - Minimum 150mm
    - Maximum 550mm
  - Variation in relative placement of foundation components from those indicated on drawings, including piles, shuttering and structural steelwork
    - Less than 50mm
  - Tolerances for placing reinforcing steel
    - Variation of protective cover: 5mm

- Variation from indicated spacing: 25mm m)
- Tolerances for guy anchors Guy anchors shall be installed such that the attachment point of the anchor is within 250mm of the correct calculated position.
- The attachment point shall be a minimum of 150mm and a maximum of 650mm above the ground level.
- Guy anchors designed for use with anchor rods extending below ground level shall have the anchor rod installed in line with the guy wire slope, within 5% or such lesser tolerance as required by the design.
- Tolerances for pole foundations.
- Pole foundations shall be constructed such that the pole, and the associated foundation works are within 50mm of the correct calculated position.

m) Workmanship

- Concrete shall be proportioned, mixed, placed and finished in such a manner as to be free of honeycomb, segregation and other defects of workmanship.

n) Formwork

- Forms shall be of wood, metal or other suitable material.
- The forms shall be mortar-tight and shall be designed, constructed, braced and maintained such that the finished concrete will be to true line and elevation, and will conform to the required dimensions and contours.
- Formwork shall be designed to withstand the pressure of concrete, the effect of vibration as the concrete is being placed and all loads incidental to the construction operations without distortion or displacement.
- Where the bottom of the form is inaccessible, provision shall be made for cleaning out extraneous material immediately before placing the concrete.
- All exposed corners of the concrete shall be chamfered approximately 25mm. A suitable nosing tool may be used for horizontal chamfers only if approved by the Clerk of Works.
- All formwork dimensions shall be checked, and if necessary, corrected before any concrete is placed.
- All forms shall be treated with a form-release agent accepted by the Clerk of Works before concrete is placed.
- Any material, which will adhere to, discolour or be deleterious to the concrete, shall not be used.

o) Proportioning of concrete

- The concrete mix shall consist of ordinary Portland cement, fine aggregate, coarse aggregate and water proportioned in accordance with the mix design accepted by Project Engineer.
- Adjustments in these proportions may be directed at any time when found necessary as a result of field tests of the concrete. No change in proportioning shall be made unless instructed by the Clerk of Works.
- As an alternative to the use of ordinary Portland cement, the Project Engineer may consider the use of other approved types of cement or blends thereof.
- No change in the source, character or gradation of materials shall be made without notice to the Clerk of Works and without a revised proportioning mix design being prepared and accepted by the Project Engineer prior to use of the materials.
- During the concrete operations, the concrete mixture shall be tested for each batch by the Contractor to determine the slump of the fresh concrete in

accordance with SANS Method 862. Records of slump tests shall be supplied to the Clerk of Works.

- Test cubes shall be prepared, in accordance with SANS Method 863 at the initiation of concrete placement of each mix design and every day that concrete is batched thereafter.
- Test cubes shall only be made out of a concrete batch at the point of discharge.
- If the Contractor does not make use of independent facilities for the crushing of test cubes and the reporting there-on, then suitable on-site facilities for the crushing of test cubes must be provided by the Contractor, and the Clerk of Works shall witness such tests.
- Additional test cube sets shall be prepared and crushed as requested by the Clerk of Works. Each set of test cubes shall consist of four cubes.
- One to be crushed at seven days, two to be crushed at twenty eight days and one to be held as a spare in the event of a suspect result from one of the other three cubes. The written results of the test cube strength tests shall be immediately forwarded to the Project Engineer upon receipt.
- All cement shall be batched by mass. Cement shall be measured to within 2% accuracy.
- Aggregates may be batched by mass or by volume, provided that volumetric batching equipment is calibrated at the start of concrete operations by weighing a typical discharge.
- The quantities of aggregate batched shall be measured within 3% accuracy. Adjustments of fine aggregate volumes due to "bulking" shall be accounted for in batching.
- The amount of moisture in the aggregates shall be determined daily by a method accepted by the Clerk of Works and the water requirements as per the mix design altered accordingly.
- Water quantities, including aggregate moisture allowances, shall be determined within 2% accuracy. The use of water meters for dispensing water shall be subject to the Clerk of Works acceptance.

p) Mixing of concrete

- Concrete shall be mixed sufficiently to ensure that the various sizes of aggregate are uniformly distributed throughout the mass and each particle of aggregate is adequately coated with cement paste of uniform consistency.
- Concrete delivered to site that lacks homogeneity should be mixed for a longer time or discarded, as directed by the Clerk of Works.
- For mixers of one cubic metre or less, the mixing time shall be not less than ninety seconds after all ingredients have been charged in the mixer.
- For mixers of larger capacities, minimum-mixing times shall be increased by fifteen seconds for each additional half cubic metre of mixer capacity, or fraction thereof.
- Concrete delivered to the construction site shall be mixed en-route. Mixing shall be rigorously controlled for agitating time, mixing time and overall time upon arrival at the foundation site. Concrete discharge shall be completed within one and one-half hours after introduction of the water to the cement and aggregate.
- In exceptional cases only, the Contractor may at his own risk add water to a concrete mix at the point of delivery.
- The maximum amount of water that may be added at site is three litres per cubic metre of concrete.

- At no time shall the water/cement ratio of 0.59 be increased.
  - Non-shrink grout shall be mixed in a suitable mechanical grout mixer/pump accepted by the Clerk of Works.
- q) Placement of reinforcing steel
- After acceptance of the excavation by the Clerk of Works, the Contractor shall install all the reinforcing steel required for foundations.
  - Reinforcing steel shall be fabricated and bent in strict accordance with the drawings and SABS 82.
  - Reinforcing steel, before being positioned, shall be thoroughly cleaned of mill scale and any coatings that will destroy or reduce bond.
  - Reinforcing steel shall be accurately positioned and secured against displacement during placing and vibrating of concrete.
  - Reinforcing bars shall be tied at all intersections with no less than No.18 gauge annealed wire.
  - Reinforcing bars shall be lapped forty-five diameters at all splices, unless shown otherwise on the detail drawings.
  - Reinforcing steel shall be provided and placed as detailed on the detail drawings. h) Unless otherwise shown on the detail drawings, the minimum cover to the main reinforcing bars in a slab, pile cap, chimney, pile or anchor, shall be 50mm.
  - Use of suitable accepted spacers or supports shall be made, to ensure that the minimum concrete cover to the reinforcement is maintained during the placement of concrete.
- r) Placement of embedded items
- The Contractor shall install all required embedded items shown on the detail drawings, prior to placing of concrete.
  - Structural steelwork or holding down bolts shall be accurately positioned and securely held in place during the placement of concrete.
  - The minimum cover to all embedded items, but excluding angle stubs, shall be 150mm.
  - The minimum cover to angle stubs and cleats shall be 75mm unless otherwise shown on the detail drawings.
  - Angle stubs may be supported on the bottom of excavations by either pre-cast concrete slabs set at the correct level by placing suitable grout or concrete underneath it, or on a previously placed binding layer installed up to the correct level.
  - The pre-cast slab shall be square in plan with a side dimension of 300mm and a depth of 75mm and shall be constructed using reinforced concrete with a minimum characteristic strength of 25MPa. g) The placing of loose rubble, stones, bricks, etc. under the pre-cast slab will not be acceptable. h) Structural steelwork or anchor bolts shall be embedded such that the top of the concrete of the foundation correctly coincides with the designed level.
- s) Placement of concrete
- No concrete for foundations shall be placed until each foundation has been inspected and accepted by the Clerk of Works.
  - The foundation at the time of this inspection shall be ready for concrete placement including reinforcing steel, embedded items and any necessary shuttering.

- All surfaces of the foundation upon or against which concrete is to be placed shall be free from mud and/or loose or disturbed material.
- A blinding layer of 10MPa concrete not less than 50mm thick is to be installed on all bottom surfaces of a "Type 3" or "Type 4" foundations.
- The surfaces of dry absorptive materials, against which concrete is to be placed, shall be moistened prior to the placing of concrete to prevent moisture being drawn from the fresh concrete.
- At least two suitable concrete vibrators shall be ready for operation at the site prior to placement of concrete.
- Freshly mixed concrete shall be handled, transported and deposited in such a manner as to prevent segregation or loss of material.
- When discharging by chute, the slope of the chute shall be uniform throughout its length and shall not be flatter than 1 in 3 or steeper than 1 in 2.
- Baffles shall be provided at the end of the chute to ensure a vertical discharge into the foundation.
- The maximum discharge height shall be 3,0m and for heights in excess of this, a tremie pipe shall be used.
- Placement of concrete shall not commence when the air temperature is below 2°C and rising, or below 5°C and dropping.
- The temperature of the concrete mixture immediately before placement shall not exceed 32°C.
- Concrete exceeding this temperature shall be discarded. During hot weather concreting operations, the Contractor shall take the temperature of each batch of concrete.
- No concrete shall be placed which has taken its initial set, regardless of whether the specified one and one-half hour period has elapsed or not.
- If a retarder, accepted by the Project Engineer, has been used, the one and one-half hour period may be exceeded provided the concrete has not taken its initial set.
- The Contractor must dispose of waste concrete in a place acceptable to the Clerk of Works.
- If concrete must be placed under water, a suitable watertight tremie pipe, accepted by the Clerk of Works, of sufficient length to reach the bottom of the excavation shall be used. The tremie pipe shall be free of water when filled with concrete to the bottom of the excavation. The tremie pipe shall be kept full of concrete during the entire placing operation. The discharge end of the tremie pipe must not be lifted out of the freshly placed mass of concrete until placement has been completed.
- Concrete shall be thoroughly settled and compacted into a dense homogeneous mass throughout the whole depth of each layer being consolidated, using internal vibrators.
- Excessive vibration, causing segregation, is to be avoided. Concrete vibrators shall not be used to move concrete.
- The concrete in cast-in-situ piles must be vibrated from the bottom upwards.
- Unless authorised by the Clerk of Works, the Contractor shall not place concrete, unless the Clerk of Works is present during the entire placement operation. v) When alternative foundations consisting of multiple cast-in-situ piles and pile caps are utilised, the Contractor shall at approximately one tower



in twenty, open up on two sides of the completed foundation of one leg, the pile cap and top 500mm of the piles, if so instructed by the Clerk of Works.

- If the foundation is rejected for any reason, the Contractor shall open up as many additional foundations as determined by the Clerk of Works, as is necessary to fully assess the problem.
- Foundations accepted are to be backfilled using 10MPa concrete up to a level at least 150mm above the base of the pile cap.

t) Construction joints

- In general, foundations shall be placed monolithically. Construction joints are to be avoided. If construction joints cannot be avoided and are accepted by the Clerk of Works, the Contractor may be permitted to make a construction joint if the following criteria are met:
  - The concrete is reinforced and the reinforcing steel will develop full bond strength both sides of the construction joint.
  - No construction joints will be allowed in un-reinforced concrete.
  - In single cast-in-situ piles, the construction joint is located one third the depth of the excavation,  $\pm 300\text{mm}$  and at least 150mm below the bottom of the structural steelwork or anchor bolts.
  - In multiple cast-in-situ piles, the construction joint is to be 75mm, and in rock anchors 100mm, above either the base of the pile cap excavation or the top of blinding level.
  - If the piles are constructed after the excavation for the pile cap has taken place, suitable ring shutters of the same diameter of the piles shall be used to construct the above mentioned pile/anchor projections.

u) No construction joints will be allowed in pile caps.

v) At all construction joints, the surfaces of the previously placed and hardened concrete shall be thoroughly cleaned of all foreign matter and primed with a 15mm thick layer of a wet mix of cement and sand in equal proportions, in the presence of the Clerk of Works before new concrete is placed. The grout coating shall be brushed over the concrete surface to ensure thorough coverage, particularly between the reinforcing bars. The new concrete shall be placed before the grout coating has taken its initial set.

w) Concrete finish

- The top surface of the foundation shall be at least a wood float finish and shall be contoured to shed water.
- All concrete placed against shuttering shall be free from irregularities, fins, rock pockets or other imperfections.
- Any rock pockets, porous or defective concrete shall be removed to the extent instructed by the Clerk of Works and repaired by filling with concrete, cement mortar or dry packed, as instructed by the Clerk of Works.
- All exposed concrete shall be shuttered to a minimum of 200mm below ground level.
- All exposed concrete edges shall be 25mm chamfered at 45°.

x) Concrete curing

- The Contractor shall provide means of maintaining concrete in a moist condition for at least seven days after the placement of concrete.
- Exposed surfaces shall be kept thoroughly wet 24 hours a day for this period.
- At the Contractor's option, concrete may be cured either by retaining shuttering in place and applying a liquid curing compound which forms a moisture

retaining membrane on un-shuttered concrete surface, or by removing shuttering and applying a curing compound as described to all exposed concrete surfaces.

- Curing compounds utilised shall be of a type accepted by the Project Engineer.
- Notwithstanding these requirements, formwork shall not be removed until at least 36 hours after the final placement of the concrete against such formwork. The Contractor shall remove formwork in such a way that shock and damage to the concrete is avoided.

y) Steelwork

- All galvanised structural steel at the steel/concrete interface shall be cleaned with a suitable cleaner before painting with two protective coats of paint acceptable to Project Engineer.
- This protection shall extend 500mm above and 400mm below the top surface level of the protruding foundation blocks.
- In the case of concrete foundations, no part of the structural steelwork of the tower shall be buried or come into contact with the soil.
- Anchors utilising steel extending below ground line shall be galvanised and then painted with two coats of an accepted bituminous paint, or be encased in concrete with at least 50mm cover. In addition to this requirement, the hot dip galvanised steel guy anchor link plate or bar utilised for the "Deadman" type of anchor foundation, shall be epoxy coated from 300mm below top of concrete level to the top end of the link above ground level.
- Apply in accordance with the manufacturer's specifications one coat of galvanising epoxy primer followed by one coat of aluminium filled epoxy paint.

z) Pole foundations

- The Contractor shall provide equipment on site during the construction of the pole foundation capable of loading the pole foundation to two-thirds of the maximum design moment.
- Where instructed by the Clerk of Works, the Contractor shall apply a construction proof load test of two-thirds the maximum design moment to the completed pole.
- The pole foundation shall be loaded in increments of 50%, 75%, 90% and 100% and then unloaded 50% in 3 cycles of 50% to 100% of the proof test.
- If creep exceeds 1mm/minute at ground level, additional load shall be applied until the creep is less than the stated limit.
- The three 50% loads and three 100% loads shall each be maintained on the pole for 5 minutes.
- If the creep is less than 1mm/minute, the final creep measurements shall be taken after each holding period.
- The pole foundation shall be considered acceptable if the total ground level creep from 50% to 100% load over 3 cycles is less than 30mm. If the creep exceeds 30mm, the foundation shall be modified or replaced by the Contractor and re-tested.
- All pole foundation tests shall be conducted in the presence of the Clerk of Works.

aa) Material mixture for structure backfilling shall consist of:

- 8 Parts of good, clean compactable excavated or imported soil;

- 1 Part of ordinary Portland cement.
- bb) Backfilling material shall be well mixed, slightly watered and thoroughly compacted in layers not exceeding 250mm in thickness.
- cc) Planted guyed and self-supporting structure foundations and backfilling to be constructed as follows:
- All backfilling and compacting of pole excavations to be done in strict accordance with the relevant detail drawings;
  - The excavated material from suitable soil types must be properly cleaned from vegetation and plant roots, etc.
  - After cleaning the excavated material must be mixed with cement in the relation 1 part of cement to 10 parts of soil, prior to the backfilling thereof;
  - Unsuitable excavated material, such as vegetation contaminated topsoil, soft clay or very loose sand, must be spoiled and a good compactable type of material such as natural gravel shall be imported and used for backfilling, as described in (c), above;
  - The stabilized soil must be backfilled, slightly watered and thoroughly compacted in layers not exceeding 250mm in thickness;
  - Proper Dynamic Cone Penetrometer (DCP) compaction tests, as specified in TMH6 Method ST6, to be executed during the backfilling and compaction of each pole foundation;
  - Random backfilling compaction tests as instructed by the Clerk of Works shall be done by the Contractor;
  - A copy of all compaction test records taken must be submitted to the Project Engineer for approval and the approved copies must be kept on file for future references;
  - A section of the pole 300mm above and 500mm below natural ground level shall be properly treated with at least two coats of an approved corrosion protection coating, prior to the casting of the concrete caps.
  - Weathered and/or damaged factory applied bitumen coatings shall be re-treated prior to the casting of the concrete caps.
  - All required standard and/or additional structure earthing systems shall be completely installed, prior to the construction of the concrete caps.
  - I.D. 1,2m x 0,25m-1,0m high "Rocla" pre-cast manhole sections must be installed in pole excavations where poor, collapsible and sandy soil conditions are present;
  - A 25MPa reinforced concrete cap, 1,2 x 1,2 x 0,5m deep as per drawing D-DT-7857 must be cast around all planted structure legs.
  - Alternatively a dia 1,2m x 500mm deep mass concrete cap can be cast around planted structure legs, using a I.D. 1,2m x 500mm high "Rocla" pre-cast manhole section as permanent formwork, with levels as per detail drawing, unless otherwise specified by the Project Engineer;
  - All over-excavations outside manhole rings and also deeper as required holes shall be backfilled and compacted as specified in (b) and (c) above, at the Contractor's own cost;
  - All excess excavated and/or spoiled material not required for backfilling must be removed from site and dumped at a suitable dumping site, unless otherwise specified by the Clerk of Works;

- All concrete spatter around the structure base must be properly cleaned from the structure prior to the hardening thereof.

dd) Supply anti-theft compound and treatment of lattice steel tower members and stay assemblies

ee) The following Standards and Specifications apply:

**TSP\_474-285** Specification for anti-theft measures;

**12TI-013** Technical instruction for the implementation of member anti

theft strategies.

ff) The Contractor shall supply all bitumastic paint and tile cement/glue required for the anti-theft treatment of lattice tower members and adjustable stay assemblies.

gg) After the complete construction of the entire new line, the bottom part members of all lattice towers (Foundation top level to and including anti-climbing device level) shall be thoroughly treated with minimum 2 coats of a bitumastic paint/tile glue 1:2 ratio mixture as per Technical Instruction 12TI-013.

hh) After the complete installation and tensioning of all permanent stays, the Contractor shall thoroughly treat the bottom part (150mm below ground level to  $\pm 1,5$ m above ground level) of all permanent stay assemblies with minimum 2 coats of a bitumastic paint/tile glue 1:2 ratio mixture as per Technical Instruction 12TI013.

#### **10.3.5. Barricading/protecting of all open excavations**

- a) All excavated/drilled holes for poles and stays shall be kept covered, protected and/or barricaded in a manner acceptable for the Clerk of Works and also to prevent any possible injuries to pedestrians, livestock, game and smaller wild animals and rodents.
- b) Failure to maintain proper protection of excavated holes by the Contractor shall result in the suspension of all excavation/drilling activities until proper protection has been restored.
- c) The Contractor shall ensure that excavation barricading/protection strictly conforms to the Occupational Health and Safety Act 85 of 1993 – Construction Regulations Section 11 "Excavations"

#### **10.4. STAY ROD & FOUNDATIONS DESIGN OR VERIFICATION**

- a) The appointment of a professional civil engineer will be the responsibility of the contractor and will be paid by the contractor -costs must be included in the tender. Foundation designs are provided for all possible soil types but needs to be verified and approved by a Prof Civil Engineer for each installation. Should the contractor wish to construct a foundation of a different design, all design drawings will be submitted to Eskom for acceptance. The contractor will accept full responsibility for these designs. Eskom will not pay for these designs unless the submitted Eskom designs cannot be used due to prevailing site conditions. This decision will be taken by the Engineer. Foundation designs for all structures shall be in accordance with 0501KR-01 rev 1, 240-47172520 (TRMSCAAC5) and SCSASABK8 by a registered professional in each type of soil (type 1, 2, 3, 4 soft rock and hard rock).

## **10.5. STAY ROD AND FOUNDATION INSTALLATION**

### **10.5.1. Drilling/excavating of holes for permanent and temporary structure stays**

- a) Drill and/or excavate maximum 1,75m deep holes for conventional stay installations, complete with a 45°-55°x max. 80mm wide stay slot for the stay rod, or as agreed upon with the / for alternative methods suitable for site conditions.
- b) The stay installation angles to be between 45°-35° with the vertical, unless otherwise specified by the Project Engineer.
- c) At site conditions where solid rock/granite is present at very shallow levels, alternative methods for structure and stay anchor installations will be evaluated and considered as a cost saving measure, only. The Project Engineer shall evaluate and approve the Contractor's proposal for such rock anchor installations.
- d) Rock anchors shall be installed at the specified angles between 45°-35° with the vertical.

## **10.6. BARRICADING/PROTECTING OF ALL OPEN EXCAVATIONS**

- a) All excavated/drilled holes for poles and stays shall be kept covered, protected and/or barricaded in a manner acceptable for the Clerk of Works and also to prevent any possible injuries to pedestrians, livestock, game and smaller wild animals and rodents.
- b) Failure to maintain proper protection of excavated holes by the Contractor shall result in the suspension of all excavation/drilling activities until proper protection has been restored.
- c) The Contractor shall ensure that excavation barricading/protection strictly conforms to the Occupational Health and Safety Act 85 of 1993 – Construction Regulations Section 11 “Excavations”

## **11. ACTIVITY STAGE 6**

### **INSTALLATION OF POWER LINE STRUCTURES**

#### **11.1. SAFE STOCK-PILING/STORAGE, HANDLING AND TRANSPORT OF STRUCTURES AND STRUCTURE MATERIAL AND STAYS**

- a) The Employer shall transport all steel mono-pole, H-pole structures and steel lattice towers required for this project. The structure segments and tower members will be delivered to a pre-determined bulk stockpiling site/s.
- b) The Contractor will be responsible for the proper and safe stockpiling of the structure segments and tower members as well as the safe handling and delivery to peg thereof. Refer to Volume 3 Part 1 section 6.1 of this document for all structure quantities and details to be supplied by the Employer for this project.
- c) The “Type 247A” double circuit intermediate suspension tower (Twin Bear, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor.

Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.

- d) The "Type 247B" 0°-40° double circuit angle strain tower (Twin Bear, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- e) The "Type 247C" 40°-90° double circuit angle strain tower (Twin Bear, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- f) The "Type 247C" 0°-40° double circuit terminal tower (Twin Bear, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- g) The "Type 248A" single circuit horizontal intermediate suspension tower (Single Zebra, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- h) The "Type 248B" 0°-40° single circuit angle strain tower (single Zebra, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- i) The "Type 248C" 40°-90° single circuit angle strain tower (Single Zebra, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- j) The "Type 248C" 0°-45° single circuit terminal tower (single Zebra, 2 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor.

Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.

- k) The "Type 255A" single circuit intermediate suspension tower (single Wolf, 1 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 13.1m, 16.1m and 19.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- l) The "Type 255B" 0°-10° single circuit angle strain tower (single Wolf, 1 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 12.1m, 13.1m, 14.1m, 15.1m, 16.1m and 17.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- m) The "Type 255C" 10°-45° single circuit angle strain tower (single Wolf, 1 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 12.1m, 13.1m, 14.1m, 15.1m, 16.1m and 17.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- n) The "Type 255C" 0° single circuit terminal tower (single Wolf, 1 x single 7x3.35 earth wires) shall have body extensions according to the conductor attachment heights CAH requirements of 14.1m, 15.1m, 16.1m, 17.1m, 19.1m and 20.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- o) The "Type 255D" 10°-90° single circuit angle strain tower (single Wolf, 1 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 12.1m, 13.1m, 14.1m, 15.1m, 16.1m and 17.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- p) The "Type 255D" 0°-30° single circuit terminal tower (single Wolf, 1 x single 7x3.35 earth wires) shall have body extensions according to the bottom conductor attachment heights CAH requirements of 12.1m, 13.1m, 14.1m, 15.1m, 16.1m and 17.1m. Structure and position specific leg extensions as determined by soil topography will be ordered by the contractor after verification by the contractor. Foundation stubs are part of the foundation and will be supplied by the contractor based on the soil condition requirements.
- q) The "258C" Intermediate Two-pole Braced Double Circuit Structures shall be flange bolted jointed steel pole self-supporting structures. Back to back angle-ion braces will join the poles with bolted connections to the poles. A braced insulator arrangement will be used to attach the phase conductors.

- r) The "2-ET/15049" Intermediate Double Circuit Structures shall be a telescopically jointed mono-pole. A 1290mm double earth wire bracket for twin suspension earth wires shall be supplied as part of the structure
- s) All "2-WT/1294" Twin Kingbird/Bersfort single circuit intermediate suspension structures shall be a planted telescopically jointed steel mono-pole self-supporting structures. It will be equipped with bird perching brackets as per detail drawing D-DT-7347. A double earth wire bracket for an earth wire and OPGW suspension shall be supplied with the structures.
- t) The "2-WT/1295" Twin Kingbird/Bersfort single circuit strain structures shall be a telescopically jointed, planted steel mono-pole guyed structure. Phase conductor and stay position arrangements will be designed to suit application conditions.
- u) The "2-WT/1296" Twin Kingbird/Bersfort single circuit, strain 3-pole structure is a planted steel mono-pole guyed structure. The poles are telescopically jointed and one phase of the circuit is attached per pole. Earth wires will be strung on the outside poles of the structure. The stay position arrangements will be designed to suit application conditions.
- v) The "2-WT/1297" Twin Kingbird/Bersfort single circuit, terminal 3-pole structure is a planted steel mono-pole, guyed structure. The poles are telescopically jointed and one phase of the circuit is attached per pole. Earth wires will be strung on the outside poles of the structure. The stay position arrangements will be designed to suit application conditions.
- w) All "2-WT/1281" Bersfort single circuit intermediate suspension structures shall be a telescopically jointed steel mono-pole guyed structure. A braced insulator arrangement will be used to attach the phase conductors. It will be equipped with bird perching brackets as per detail drawing D-DT-7347. A double earth wire bracket for an earth wire and OPGW suspension shall be supplied with the structures.
- x) The "2-WT/1284" Bersfort single circuit strain structures shall be a telescopically jointed, steel mono-pole guyed structure. Phase conductor and stay position arrangements will be designed to suit application conditions.
- y) The "2-WT/1285" Bersfort single circuit, inline strain 3-pole structure is a guyed steel mono-pole structure. The poles are telescopically jointed and one phase of the circuit is attached per pole. Earth wires will be strung on the outside poles of the structure. The stay position arrangements will be designed to suit application conditions.
- z) The "2-WT/1286" Bersfort angle strain single circuit, terminal 3-pole structure is a guyed steel mono-pole structure. The poles are telescopically jointed and one phase of the circuit is attached per pole. Earth wires will be strung on the outside poles of the structure. The stay position arrangements will be designed to suit application conditions.
- aa) The "Type 7611" single circuit intermediate suspension structures shall be telescopically jointed steel mono-pole self-supporting structures having a minimum tip load of 23kN and shall be equipped with bird perching brackets as per detail drawing D-DT-7347. Special designed OPGW suspension brackets shall be supplied with the structures.
- bb) The "Type 7615" angle strain structures shall be telescopically jointed, planted steel mono-pole guyed structures having a minimum tip load of 23kN. The stay position arrangements will be designed to suit application conditions.
- cc) The "Type 7618" angle strain 3-pole structure is a guyed steel mono-pole structure. The poles are telescopically jointed and one phase of the circuit is attached per



- pole. Earth wires will be strung on the outside poles of the structure. The stay position arrangements will be designed to suit application conditions
- dd) The "2-WT-1213" terminal 3-pole structure is a guyed steel mono-pole structure. The poles are telescopically jointed and one phase of the circuit is attached per pole. Earth wires will be strung on the outside poles of the structure. The stay position arrangements will be designed to suit application conditions
  - ee) All "Type 7649" single circuit intermediate suspension structures shall be telescopically jointed steel mono-pole self-supporting structures with "Raptor Friendly" suspension arms having a minimum tip load of 23kN and shall be equipped with bird perching brackets as per detail drawing D-DT-7347. Special designed OPGW suspension brackets shall be supplied with the structures.
  - ff) All "Type 7621" double circuit steel mono-pole intermediate structures shall be telescopically jointed steel mono-pole self-supporting structures with a minimum tip load of 37kN and shall be equipped with bird perching brackets as per detail drawing D-DT-7347. Special designed OPGW suspension brackets shall be supplied with the structures.
  - gg) All "Type 7649DC" double circuit steel mono-pole intermediate suspension structures shall be telescopically jointed steel mono-pole self-supporting structures with "Raptor Friendly" suspension arms having a minimum tip load of 37kN and shall be equipped with bird perching brackets as per detail drawing D-DT-7347. OPGW suspension brackets shall be supplied with the structures.
  - hh) All "Type 7800" single circuit intermediate suspension structure legs shall be flange jointed steel H-pole self-supporting structures, having minimum diameter 324mm legs with a 8,2m specially designed cross-arm and shall be equipped with bird perching brackets for each leg as per detail drawing D-DT-7347. Special designed OPGW suspension brackets shall be supplied with the structures.
  - ii) All "Type 7801" in-line strain structures shall be flange jointed steel H-pole guyed structures having leg diameters of 219mm-324mm and shall have a 8,2m x 70kN cross braced cross-arm as per structure detail.
  - jj) All "Type 7802" in-line strain structures shall be flange jointed steel H-pole guyed structures having leg diameters of 219mm-324mm and shall have a 8,2m x 120kN cross braced cross-arm as per structure detail.
  - kk) All "Type 7807" terminal structures shall be flange jointed steel H-pole guyed structures having a leg diameters of 219mm and shall have a 8,2m x 70kN cross braced cross-arm as per structure detail.
  - ll) All "Type 7808" terminal structures shall be flange jointed steel H-pole guyed structures having leg diameters of 219mm-324mm and shall have a 8,2m x 120kN cross braced cross-arm as per structure detail.
  - mm) All "Type 7810" single circuit intermediate suspension structure legs shall be flange jointed steel H-pole self-supporting structures, having minimum diameter 324mm legs with a 10,2m specially designed cross-arm and shall be equipped with bird perching brackets for each leg as per detail drawing D-DT-7347. Special designed OPGW suspension brackets shall be supplied with the structures.
  - nn) All "Type 7811" in-line strain structures shall be flange jointed steel H-pole guyed structures having a leg diameters of 219mm and shall have a 10,2m x 70kN cross braced cross-arm as per structure detail.
  - oo) All "Type 7812" in-line strain structures shall be flange jointed steel H-pole guyed structures having leg diameters of 219mm-324mm and shall have a 10,2m x 120kN cross braced cross-arm as per structure detail.

- pp) All "Type 7817" terminal structures shall be flange jointed steel H-pole guyed structures having a leg diameters of 219mm and shall have a 10,2m x 70kN cross braced cross-arm as per structure detail.
- qq) All "Type 7818" terminal structures shall be flange jointed steel H-pole guyed structures having leg diameters of 219mm-324mm and shall have a 10,2m x 120kN cross braced cross-arm as per structure detail.
- rr) All "Type 7645" in-line and angle strain structures shall be telescopically jointed steel mono-pole guyed structures having a minimum tip load of 23kN and shall be equipped with dia 12mm x 450mm long steel rod spikes as per structure detail.
- ss) All "Type 7645" double circuit in-line and angle strain structures shall be telescopically jointed cross braced steel 2-pole guyed structures having a minimum tip load of min. 23kN/pole and shall be equipped with dia 12mm x 450mm long steel rod spikes for each pole as per structure detail.
- tt) All "Custom" or "site specific" structure may be complete new structure designs or revisions of existing structure designs to the specific site conditions. For these type of structures the Engineer will provide the wire load on the structure. The contractor shall allow for a detail structure and foundation design by the manufactures, the wind load on the structure must be included by the manufacturers Engineer.
- uu) Flange mounted poles shall preferably be telescopic steel monolithic self-supporting structures. All HD bolts, top and bottom templates shall be included by the contractor into the priced material rate. The contractor shall allow for raking of all flange mounted structures.
- vv) All mono-pole structures shall be provided with 2 x "Earth lugs", One lug on each transversal side of the structure at natural ground level for all planted poles.
- ww) All H-pole and 2-pole structures shall be provided with 2 x "Earth lugs", One lug per structure leg at natural ground level for all planted poles.
- xx) All 3-pole structures shall be provided with 3 x "Earth lugs", One lug per structure leg at natural ground level for all planted poles.
- yy) All structure shafts to be provided with cleats for removable steps, installed at 8,0m from natural ground level to maximum level of 1,0m from the structure top.
- zz) Complete set removable steps will be supplied by the Employer for this project. The removable steps shall be used by the Contractor for construction purposes only and will be handed over to the local Field Services Department for future maintenance use.
- aaa) All structural steel shall be Grade S355JR steel to SANS 1431 and hot dipped galvanised to SANS 121. Structure bolts shall be Grade 4.6 ordinary bolts, nuts and washers to be shall be hot dipped galvanized to SANS 121.
- bbb) The appointed Structure/Tower Manufacturers and Project Engineer shall meet to discuss all non-standard requirements on all for the structures and towers for this project, prior to the manufacturing thereof.
- ccc) All structure segments and tower members shall bear a legible permanent identification mark, which must be easily visible after completion of the assembling and erection of the structures. Except for the Manufacturer's own identification marks, the following information shall be included on the identification label, name:
- ddd) Structure type (PLSCADD design code);
- eee) The actual structure length;
- fff) Examples: "247C -17.1m"; "7615 -23kN -21,0m"; "7611 -23kN -24,0m "

ggg) One complete set of the Manufacturer's detail structure/tower assembly drawings shall be submitted by the Structure Manufacturer to the Project Engineer for final approval prior to the manufacturing thereof.

hhh) The following care shall be taken by the Manufacturer's transport contractor and Contractor during the handling and transport of the structure segments and tower members:

- Method statements shall be compiled by the relevant manufacturer for the proper and safe handling and transport of all structure segments and tower members;
- Tower members shall be securely bundled and each bundle shall be clearly marked for identification;
- Structure segments and tower members shall be properly loaded with wooden spacers between segments, when transported;
- Structure segments and tower members shall not be dropped from transporting vehicles, but shall be carefully off-loaded and stacked on the wooden block spacers; e) Structure segments and tower members shall be handled with nylon or fabric slings. The use of unprotected wire rope slings or chains will not be allowed;
- Structure segments and tower members, when off-loaded at peg, shall be off-loaded onto wooden blocks in the veld and not left lying in direct contact with the ground;
- Structure segments and tower members, when layout at peg, must be off-loaded in the correct proportions to avoid dragging of the sections on the ground and/or unnecessary double handling.

iii) Any damages caused to the structure segments due to careless and reckless handling by the Contractor shall be rectified by the Contractor at his own cost and to the approval of the Clerk of Works/Project Engineer.

jjj) Assembly and erection of structures

- The telescopic jointed structure segments shall be fitted and compressed on the ground to obtain the nominal length of the structure as specified on the Manufacturer's detail drawings.
- The telescopic jointed structure segments shall be fitted and compressed on the ground to obtain the nominal length of the structure as specified on the Manufacturer's detail drawings.
- Tools and equipment used by the Contractor for the assembly of structures shall not scar or deform the steel material, nor damage the protective coating on the steel and must be approved by the Clerk of Works, prior to the use thereof.
- Suspension arms, bird perching brackets, shield wire and OPGW suspension brackets and suspension assemblies shall be fitted to all "Types 7611, 7612 & 7649 & 7649DC" structures, prior to the erection thereof.
- The threads of all torqued structure bolts shall be properly punched at minimum three positions at the "nut-neck" and completely covered with at least one coat of a "Carboline Rustbond Penetrating Sealer ZA", "Exotropic Etch coat" or similar product approved by the Project Engineer.
- No structure shall be erected by the Contractor prior to the complete installation of permanent and temporary underground stay assemblies, the approval of the pole excavations as well as foundation base construction and curing by the Clerk of Works.

- The erection of H-pole and mono-pole structures shall be subjected to the following criteria:
  - All structures shall be erected vertically within 2mm in 1,0m in both transversal and longitudinal directions. For the correct structure orientations in relation to the line direction refer to layout drawings;
  - During the structure erection the tension in all stays shall be 10%
- All structures shall be properly cleaned prior to the erection thereof. Sand, mud and other dirt must be thoroughly cleaned with nylon brushes.
- The planting depths of the supporting intermediate suspension structures vary and are specified on according to each structure length. For structure foundation backfilling specifications refer to structure foundation detail drawings.
- The guyed in-line and angle strain structures shall be planted max. 2,0m deep. Variations on the planting depth will be indicated in the design document and as a comment on the PLSCADD drawings. For structure foundation backfilling specifications refer to structure foundation detail drawings.
- The "Type 7801, 7802, 7807, 7808, 7811, 7812, 7817 & 7818" guyed H-pole strain and terminal structure legs to be planted max. 2,0m deep with the assemble cross-arm to be 100% level as specified on detail drawings. For structure foundation backfilling specifications refer to structure foundation detail drawings D-DT-7851. The "Type 7800 and 7810" structures have planting depths according to the pole length as indicated on the structure and foundation drawings.
- The bottom parts of all lattice steel towers including the anti-climbing device clamps shall be assembled with swaged bolts as per Specification TSP 474-285 and treated with an anti-theft compound as per Technical Instruction 12TI-013.

## **12. ACTIVITY STAGE 7**

### **TRANSPORT AND INSTALLATION OF POWER LINE STRUCTURE EARTHING**

#### **12.1. TRANSPORT AND INSTALLATION OF POWER LINE STRUCTURE EARTHING**

##### **12.1.1. Transport of power line structure earthing material**

- a) The following Standards, Specifications, Guidelines and Drawings apply:
  - SCSASABF9 Sub-transmission line Earthing Specification;
  - Project File PLSCADD design profile sheets;
  - Project File PLSCADD design staking table;
  - Design Bill of Material.
- b) The Contractor shall deliver to site all earthing material required for the power line structure earthing, as well as Agricultural Gypsum required for earth trench backfilling.
- c) The Employer supply and deliver to site all flat copper earth bonding straps required for underground substation bonding.

## 12.2. COMPLETE INSTALLATION OF POWER LINE STRUCTURE EARTHING

All power line structures shall be earthed to the required earth resistance.

### 12.2.1. Standard structure earthing

- a) A 3 point star earth electrode (D-DT-0640) consists of:
- x dia 16mm x 1.5m long copper clad high tensile steel earth rod, with 4 x earth rod clamps to connect 16mm<sup>2</sup> 7/1.63 bare annealed copper conductor.
  - x 7/1.63 bare annealed copper conductor lengths are connected with a 4 x 16SQ line tap.
  - x 6m lengths of the above bare copper are connected to the earth rods.
  - 1 x 1m lengths of the bare copper are connected to the fourth earth rod
  - 1 x 6m length of the bare copper are bolted to the pole's 50mm x 50mm x 8mm thick earth pad with a 16.0 SQ M12 crimp lug.
- b) Installation: A 3 point star earth electrode (D-DT-0640) shall be installed as follows:
- The electrode layout is in the shape of a crow foot as indicated on D-DT-0640
  - A min. 300mm wide earth rod trench shall be excavated to a depth of 1m in the layout shape.
  - The 4 earth rods will be vertically installed at the ends of the trenches.
  - The bottom ±150mm of the earth trenches shall be backfilled with a well mixed 3:1 clean top soil/agricultural gypsum mixture, after installation of the earth rods.;
  - The contact surfaces between the structure and the earth rod shall be clean and treated with a thick application of contact grease to ensure a proper conductive connection, prior to the bolt connection;
  - Backfill and thoroughly compact earth trenches.
  - At planted structure or structure legs, the standard and additional earthing systems shall be completely installed flat next to the structure/leg surface, prior to the construction of the concrete cap.
- c) An alternative earthing system for high theft areas consists of:
- 1 x dia 16mm x 3,6m long copper coated high tensile steel earth rod, with and 50 x 50 x 8mm thick mild steel earth lug factory welded to one end. Earth to have a dia 18,0mm hole drilled in the centre of the lug.
  - Earth rod to be bent to suit site conditions. Minimum bend radii to be 100mm.
  - One x M16 x 40mm long Grade 4.8 hexagon bolt nut and two x M16 flat round washers.
  - The earth rod shall be bolt jointed to the structure earth lug.
- d) Installation: The alternative systems for all structures shall be installed as follows:
- All steel pole structures shall be provided with Two 50mm x 50mm x 8mm thick earth pads welded to the structure base and/or leg;
  - The copper coated earth rod shall be bent and installed in alternating diagonal directions with the power-line direction;
  - The earth rod shall be smoothly bent with an approved rod-bender at min. 100mm radii. No sharp and/or kinked bends shall be allowed in the earth rods;

- The one end of the earth rod shall bolt jointed to the structure at the allocated earth pad;
  - The opposite end of the earth rod shall be installed in a min. dia 100mm x max. 1,5m deep vertically drilled earth rod hole;
  - The earth rod hole shall be drilled  $\pm 1,5\text{m}$  deep at positions  $\pm 2,0\text{m}$  away from the structure in alternating diagonal directions with the power-line direction;
  - A min. 300mm wide earth rod trench shall be excavated in the alternating diagonal directions min. 550mm deep, between the structure or structure leg to the drilled earth rod hole;
  - The total earth rod hole as well as the bottom  $\pm 150\text{mm}$  of the earth trenches to be backfilled with a well mixed 3:1 clean top soil/agricultural gypsum mixture, after installation of the earth rods;
  - A section of the earth rod (From and including the structure connection point to  $\pm 500\text{mm}$  below natural ground level) must be properly treated with at least two coats of an approved Bitumen or Aluminium based coating;
  - The contact surfaces between the structure and the earth rod shall be clean and treated with a thick application of contact grease to ensure a proper conductive connection, prior to the bolt connection;
  - Backfill and thoroughly compact earth trenches.
  - As a rule each line terminal structure shall be provided with two standard structure earthing systems, unless otherwise specified.
  - At planted structure or structure legs, the standard and additional earthing systems shall be completely installed flat next to the structure/leg surface, prior to the construction of the concrete cap.
- e) Counterpoise earthing installed for lattice towers consist of:
- Install a 40 x 3 mm galvanized steel strap within each lattice tower foundation to connect the steel stub to the foundation reinforcement
  - Install 10mm copper clad steel at each tower leg until the footing resistance of  $20\Omega$  are reached or
  - Install 15m lengths of  $25\text{mm}^2$  bare copper at each tower leg until the footing resistance of  $20\Omega$  are reached
- f) Installation: Counterpoise earthing
- The electrode layout is radially away from the tower legs.
  - A min. 300mm wide earth rod trench shall be excavated to a depth of 1m according to the layout.
  - The bottom  $\pm 150\text{mm}$  of the earth trenches shall be backfilled with a well mixed 3:1 clean top soil/agricultural gypsum mixture, after installation of the earth rods.;
  - The contact surfaces between the structure and the earth rod shall be clean and treated with a thick application of contact grease to ensure a proper conductive connection, prior to the bolt connection;
  - Backfill and thoroughly compact earth trenches.
  - At planted structure or structure legs, the standard and additional earthing systems shall be completely installed flat next to the structure/leg surface, prior to the construction of the concrete cap.
- g) Bonding of 3-Pole structures and the bonding of terminal structures to the substation earth mat:
- Bond the terminal structures to the substation earth mat by using 50 x 3mm flat Cu strap or 2 x parallel lengths of 10mm copper clad steel,

- Bond the 3 poles of 3-Pole structures to each other by using 50 x 3mm flat Cu strap or or 2 x parallel lengths of 10mm copper clad steel.
- h) Installation: Bonding of 3-Pole structures and the bonding of terminal structures to the substation earth mat
- Install the bonding electrodes at a depth of 1m.
  - A min. 300mm wide earth rod trench shall be excavated to a depth of 1m according to the layout.
  - The bottom  $\pm 150$ mm of the earth trenches shall be backfilled with a well mixed 3:1 clean top soil/agricultural gypsum mixture, after installation of the earth rods.;
  - The contact surfaces between the structure and the earth rod shall be clean and treated with a thick application of contact grease to ensure a proper conductive connection, prior to the bolt connection;
  - Backfill and thoroughly compact earth trenches.
- i) After the complete installation of the standard structure earthing systems all structure footing resistances shall be measured by the Contractor in the presence of the Clerk of Works and results shall be recorded. Structure footing resistance records shall be submitted to the Project Engineer for evaluation.
- j) All structure footing resistances on 33-132kV lines shall be less than 20 Ohm, except for the terminal structure footing resistances which must be less than 10 Ohm and bonded to the substation main earth mat.
- k) Structure footing resistance measurements of each structure shall be taken by the Contractor immediately after installation of the standard structure earthing system, prior to the installation and connection of the overhead shield wire onto the structures and the construction of the concrete caps.
- l) The 61.8% Method shall be used to do the structure footing resistance measurements. Refer to Distribution Standard SCSASABF9 Section 4.13 for recommended structure footing resistance measurement methods.
- m) The HW2A high frequency instrument shall be treated as any other meter requiring the Project Engineer's approval. The meter shall be calibrated to match the surge impedance of the line, otherwise the impact of the other associated towers connected to the shielding wire, will not be excluded from the result.
- n) Should the Contractor wish to use another type of instrument, the details of its intended application and test methodology shall be submitted to the Project Engineer for acceptance.
- o) In situations where the required structure footing resistances cannot be obtained with the installed standard earthing systems, due to soils with a very high resistivity, the methods for additional and/or counterpoise earthing must be clarified with the Project Engineer, see paragraphs below.

### **12.2.2. Additional structure earthing**

- a) After the complete installation of a standard structure earthing system at all structures, the footing resistances shall be measured by the Contractor and in situations where the measured structure footing resistance doesn't comply with the required 20 Ohm-specification, additional earthing systems shall be installed until the required footing resistance are met or otherwise instructed by the Project Engineer.

- b) After the complete installation of the additional earthing systems the relevant structure footing resistances shall be re-measured by the Contractor in the presence of the Clerk of Works and results shall be recorded at each measuring attempt. Structure footing resistance records shall be submitted to the Project Engineer for acceptance.
- c) Additional/counterpoise earthing system methods:
- Soil resistivity tests shall be done by the Project Engineer at structures with high footing resistances, to determine the correct method for the installation of additional/counterpoise earthing;
  - The basic methods for the installation of additional/counterpoise earthing must be done in the following sequence:

**STEP 1:**

- Drill a **min. dia 100mm x ±1,5m deep hole, ±2,0m** away and in the opposite diagonal direction as the standard earthing system, from the structure or structure leg.
- Excavate a min. 300mm wide x ±0,55m deep trench between the drilled hole and the structure or structure leg;
- Install 1 x dia 16mm x 3,6m long copper coated earth rod in the trench and drilled hole from the structure or structure leg;
- The one end of the earth rod, must be bolt jointed to the structure or structure leg at the earth pad;
- The earth rod hole as well as the bottom ±150mm of the earth trenches to be backfilled with a well mixed 3:1 clean top soil/agricultural gypsum mixture, after installation of the earth rods;
- A section of the earth rod (From and including the connection point up to ±500mm below natural ground level) must be properly treated with at least two coats of an approved Bitumen or Aluminium based coating;
- The contact surfaces between the structure and the earth rod shall be clean and treated with a thick application of contact grease to ensure a proper conductive connection, prior to the bolt connection;
- For the backfilling of earth trenches refer to paragraph 7.2.3, below.
- The structure footing resistance measurement of the structure shall be taken by the Contractor immediately after installation of the additional structure earthing system, prior to the installation and connection of the overhead shield wire onto the structures.
- In situations where the required 20 Ohm structure footing resistance specification cannot be obtained after the installation of the STEP 1 additional earthing system installation, STEPS 2 & 3 additional earthing systems might be required, only after instructed by the Project Engineer.
- STEPS 2 & 3 additional earthing system installations shall be similar to the STEP 1 installation, but in opposite diagonal directions.

**12.2.3. Backfilling of earth trenches**

- a) Drilled earth spike holes:
- The complete drilled hole to be backfilled with 1 part of Agricultural Gypsum properly mixed with 3 parts of clean topsoil free from vegetation and plant roots.



- The well mixed backfill material for the drilled holes shall be wetted to form a stiff paste and poured into the holes. The backfill shall be thoroughly compacted inside the drilled hole;
  - The earth rod shall be installed in the hole immediately after compaction of the backfilling.
- b) Earth trenches:
- The first 150mm thick backfill layer in the earth trenches to consist of 1 part of Agricultural Gypsum properly mixed with 3 parts of clean imported topsoil.
  - The backfilling to be slightly watered and thoroughly compacted in layers not exceeding 150mm in thickness;
  - The final backfill layers to consist of clean excavated material from the earth trenches. The backfilled material to be slightly watered and thoroughly compacted in layers not exceeding 250mm in thickness.
- c) For earth trenches in rocky-terrain where the required earth trench depths can't be reached:
- The backfilling of earth strap trenches in rocky areas where no proper trenching can be done, a conductive mixture of carbonaceous aggregate (e.g. graphite, bentonite or any other approved conductive mixture shall be used.
  - A 3:1 sand/conductive cement (D-DT-3205) mixture shall be used;
  - The trenches shall be backfilled completely and immediately after the installation of the earth rods/straps.

### **13. ACTIVITY STAGE 8**

#### **DRESSING OF ALL STRUCTURES**

##### **13.1. SAFE STORAGE OF ALL PHASE CONDUCTOR AND SHIELD WIRE LINE HARDWARE AND INSULATORS**

- a) The following Standards, Specifications, Guidelines and Drawings apply:
- TRMSCAAC1 Rev. 3 -Section 8.2 Transmission line tower and Line construction;
  - BOM, Project File, Project design bill of materials;
  - Project File PLSCADD design profile sheets.
- b) The quantities for the supply and transport of insulators and fittings shall be in strict accordance with the Design Bill of Materials for each structure.
- c) All insulators, hardware for all suspension and strain assemblies supplied for the project shall comply with the relevant items specified in the Eskom Distribution Standards Part 9 -Buyer's Guide unless otherwise specified. For bundled and heavy conductors 7.3kN MDCL post insulators shall be used if intermediate standoff post insulators aren't braced.
- d) All insulators and line hardware fittings supplied for the project, shall be technically evaluated and approved by the Engineer prior to the installation thereof.

##### **13.2. SAFE STORAGE, HANDLING AND TRANSPORT TO PEG OF LINE HARDWARE AND INSULATORS**

- a) The Contractor will be responsible for the safe storage, handling and transport to peg of insulators and fittings.

- b) Special care and precautions shall be taken by the Contractor not to cause any damage and/or deformation what so ever to the suspension, strain and horizontal stand-off insulators, in the storage, handling, transportation thereof.
- c) Insulators with defects shall be brought to the attention of Clerk of Works, who will determine the extent of the damage for possible use thereof.
- d) Any damage and/or deformation caused to any insulator, due to negligence by the Contractor will be replaced by the Contractor at his own costs.

### **13.3. ASSEMBLY AND INSTALLATION OF STAY ASSEMBLIES**

#### **13.3.1. Safe stock-piling/storage, handling and transport of all stay assembly material**

- a) The Contractor shall transport all stay assembly material and deliver it to a pre-determined bulk stockpiling site/s.
- b) The Contractor will be responsible for the proper and safe stockpiling of the stay assembly material as well as the safe handling and delivery to peg thereof. Refer to the BoQ / BoM for all stay quantities and details.
- c) The following Standards, Specifications, Guidelines and Drawings apply:
  - TRMSCAAC1 Rev. 3 -Section 6 Transmission line tower and Line construction;
  - D-DT-7325 Transmission line tower and Line construction;
  - 2-WT/1288 16mm 1400MPa Steel Rope 210kN Stay assembly;
  - 2-WT/1299 19mm 1400MPa Steel Rope 272kN Stay assembly;
- d) All permanent and temporary stay material and stay wire shall be safely handled and transported to peg by the Contractor for the complete installation thereof.
- e) The Contractor shall transport all permanent and temporary stay material and stay wire as specified.
- f) The quantities specified for temporary stays are the minimum required to keep the structures as plumb as possible during stringing activities. The Contractor shall add to these quantities to ensure the safety of his workmen during stringing activities.
- g) All construction/temporary stays will remain the Contractor's assets and shall be removed from site at completion of the clamping of the phase conductors, shield wire and OPGW, unless otherwise agreed by the engineer and instructed by the Clerk of Works.

#### **13.3.2. Installation of permanent and temporary stay assemblies**

- a) All underground stay assembly types as well as soil types in which permanent stays are to be installed shall be recorded by the Clerk of Works and records shall be submitted to the Employer for acceptance
- b) All underground stay assembly types as well as soil types in which permanent stays are to be installed shall be recorded by the Clerk of Works and records shall be submitted to the Employer for acceptance.
- c) Permanent stay arrangements for guyed structures are as follow, unless otherwise specified by Project Engineer:
  - Standard permanent conventional strain structure stay-assembly 115kN

**Table 4: Standard Permanent Conventional Strain Structure Stay Assembly 115kN**

|   |  |   |
|---|--|---|
| 1 | 120kN Straight standard shackle – to drawing: D-DT-7017 Rev. 5 | 1 |
|---|--|---|

|   |   |        |
|---|---|--------|
| 2 | Thimble; 16mm wire rope – to drawing: D-DT-3026 Rev. 16                       | 1      |
| 3 | 19/2,65mm -Galvanized steel preformed guy grip – to drawing: D-DT-7035 Rev. 2 | 1      |
| 4 | 19/2,65mm Galvanized steel stay wire 1100MPa – to drawing: D-DT-7036 Rev. 4   | Varies |
| 5 | 19/2,65mm -Galvanized steel preformed guy grip – to drawing: D-DT-7035 Rev. 2 | 1      |
| 6 | Thimble; 16mm wire rope – to drawing: D-DT-3026 Rev. 16                       | 1      |
| 7 | M24 x 2,4m long adjustable stay assembly -drawing: D-DT-7023 Rev. 13          | 1      |
| 8 | 600 x 600 x 6mm thick stay plate -drawing: D-DT-3172 Rev. 3                   | 1      |

- Standard permanent conventional strain structure stay-assembly 210kN

**Table 5: Standard Permanent Conventional Strain Structure Stay Assembly 210 kN**

|   |   |        |
|---|---|--------|
| 1 | 120kN Straight standard shackle – to drawing: D-DT-7017 Rev. 5                | 1      |
| 2 | Thimble; 16mm wire rope – to drawing: D-DT-3026 Rev. 16                       | 1      |
| 3 | 19/2,65mm -Galvanized steel preformed guy grip – to drawing: D-DT-7035 Rev. 2 | 1      |
| 4 | 19/2,65mm Galvanized steel stay wire 1100MPa – to drawing: D-DT-7036 Rev. 4   | Varies |
| 5 | 19/2,65mm -Galvanized steel preformed guy grip – to drawing: D-DT-7035 Rev. 2 | 1      |
| 6 | Thimble; 16mm wire rope – to drawing: D-DT-3026 Rev. 16                       | 1      |
| 7 | M24 x 2,4m long adjustable stay assembly -drawing: D-DT-7023 Rev. 13          | 1      |
| 8 | 600 x 600 x 6mm thick stay plate -drawing: D-DT-3172 Rev. 3                   | 1      |

- Standard permanent conventional strain structure stay-assembly 296kN

**Table 6: Standard Permanent Conventional Strain Structure Stay Assembly**

|   |  |        |
|---|--|--------|
| 1 | 300kN Straight standard shackle                      | 1      |
| 2 | Eye Bolt crimp fitting to fit 19mm 1400MPa Wire Rope | 1      |
| 3 | 19mm (19/3.81) 1400MPa Wire Rope                     | Varies |
| 4 | Eye Bolt crimp fitting to fit 19mm 1400MPa Wire Rope | 1      |
| 5 | Anchor -dead man                                     | 1      |

- For the complete installation of underground permanent stay assemblies, the Contractor's work comprises:
  - Install all permanent 115kN M24 x 2,4m adjustable stay assemblies at structure specified guyed angle suspension, in-line & angle strain and terminal structures, complete with 600 x600 x 6mm stay plates and 150 x 150 x 6mm backing washers, angles between 45°and 35° with the vertical, unless otherwise specified by the Project Engineer;
  - Install all permanent 215kN dead man adjustable stay assemblies at structure specified guyed angle suspension, in-line & angle strain and terminal structures, complete with dead man anchor, angles between 45°and 35° with the vertical, unless otherwise specified by the Project Engineer;
  - Install all permanent 296kN dead man adjustable stay assemblies at structure specified guyed angle suspension, in-line & angle strain and terminal

structures, complete with dead man anchor, angles between 45° and 35° with the vertical, unless otherwise specified by the Project Engineer;

- Rock anchors shall be installed to prescribed stay angles into solid rock formations only, as per manufacturer's specification.
  - For conventional stays installations the stay plates shall be positioned as firm as possible against the virgin soil inside the excavation;
  - A maximum 80mm wide stay rod slot shall be cut into the stay excavation side wall at the prescribed stay angles;
  - Stabilize backfill and compact stay excavation as specified below.
  - Proper Dynamic Cone Penetrometer (DCP) tests, as specified in TMH6 Method ST6, to be executed during the backfilling and compaction of each stay.
- d) All permanent stays shall be proof load tested. For the installation and testing of all conventional stays and rock anchors refer to documents TRMSCAAC1 Rev 3 Section 6.2.5.1 and Eskom Procedure DSP\_34-1657 for the conventional stay planting and compaction and rock anchor installation and testing.
- e) Bottom guy grips of all permanent adjustable stay assemblies shall be secured with guy grip crimp ferrules supplied and installed by the Contractor. Galvanized mild steel ferrules shall only be crimped after the complete installation and tensioning of the adjustable stay assemblies.
- f) A 2500 x 40mm OD HDPE UV stabilized Type 5 Class 6 pipes shall be supplied and installed with all permanent adjustable stay assemblies, by the Contractor.
- g) The Contractor shall provide equipment on site, during the installation of the guy anchors, capable of loading the anchor to a load equal to the un-factored foundation reaction for critical loading conditions.
- h) All rock anchor stay installations shall be proof load tested by the Contractor.
- i) All conventional installed stay anchors to be witnessed by the Clerk of Works, the Contractor shall apply a construction proof load test equal to the un-factored foundation reaction for critical loading conditions to the completed anchors. The method of the load application shall be subject to the Project Engineer's acceptance.
- j) All anchor tests shall be conducted in the presence of the Clerk of Works.
- One of the following proof load procedures will be accepted:**
- Test load of the installed stay anchor assembly should be not less than 10% above the stay wire working load. In absence of any specified value, the stay wire (used in the stay assembly) working load shall be taken as 40% of the wire Ultimate Tensile Strength (UTS). In that case the minimum test load is defined as 44% of the UTS. The stay anchor shall be marked in such a way that movement relative to the ground level can easily be detected. A tensile load of about 10% of the UTS of the stay wire shall be applied in the direction of the stay wire, normally at 45° to the ground level. For this load a creep / settling movement of the stay anchor amounting to approximately 15 mm will be acceptable. Position of the point corresponding to load of 10% UTS shall be marked. The load shall be steadily increased to 44% of the UTS and maintained for 2 minutes. There shall be no movement of the stay anchor assembly relative to the marked previously point, due to slip during this period of 2 minutes and no failure of the stay anchor.
  - The load shall be applied to the anchor in appropriate increments to 50%, 75%, 90% and 100% of the proof test load, and then unloaded to 50% and again loaded to **100%** of the proof test load, twice, i.e. during two further cycles of

loading. The *Contractor* shall monitor anchor movement along the guy slope. Successive load increments shall not be applied until the rate of creep is less than or equal to 0,5mm/minute. The **three cycles** of loading from **50% to 100%** shall each be of duration of not **less than 5 minutes**. The anchor shall be considered acceptable if the total creep from **50% to 100% load over 3 cycles** is **less than 15mm**. If the creep exceeds **15mm**, the anchor shall be modified or replaced by the *Contractor* and re-tested.

- k) Where stay excavations are done in very poor, loose sandy or soft clayey cohesion less soils, the first third of the backfill material to be imported. Imported material to consist of a clean and good compactable material such as natural gravels.
- l) Where stay excavations are done in cohesion less non-compactable material the first third of the backfilling to be stabilized. Vegetation and plant roots to be removed from excavated material, well mixed to a 1:8 cement/soil mixture, slightly watered, backfill and compacted.
- m) Backfill material to be slightly watered and thoroughly compacted in layers not exceeding 300mm in thickness to a height  $\pm 500$ mm above stay plate level as specified in the Eskom Procedure DSP\_34-1657. The remaining part of the stay excavation to be backfilled and thoroughly compacted excavated material.
- n) The Contractor shall make provision for the sufficient quantity of temporary stays at all in-line and angle strain structures, to ensure the stability and plumpness of the structures, as well as the safety of the Contractor's Workmen.
- o) All temporary stays shall remain intact and tensioned until completion of the stringing, regulating and clamping activities of the phase conductors, shield wires and OPGW.
- p) The Contractor can install temporary stays on the conventional method or alternatively pre-cast stay anchor blocks per phase can be used. For both situations all temporary installed stays and stay anchor blocks must be completely removed from site after completion of the stringing activities.
- q) All excavations left from the removed conventional installed stay assemblies must be properly backfilled, compacted and sites re-instated.
- r) A maximum 45° with the horizontal or flatter stay installation angle is required for temporary stays, under all circumstances.
- s) After the complete installation and tensioning of all permanent stays, the Contractor shall supply anti-theft compound and treat the bottom part (150mm below ground level to  $\pm 1,5$ m above ground level) of all permanent stay assemblies.

#### **13.4. SAFE HANDLING AND DRESSING OF STRUCTURE WITH LINE HARDWARE AND INSULATORS**

- a) The Contractor shall assemble all components used for attaching phase conductor and shield wires to the structures, and install the appropriate attachment points on the structures.
- b) Insulators shall be clean when hung by the Contractor. Clean rags, free from abrasive material, or other methods accepted by the Clerk of Works, shall be used to remove mud, grease, dirt and other foreign matter.
- c) Wire brushes shall not be used by the Contractor for the cleaning of any parts, metal surfaces shall be free from any noticeable contamination.
- d) The cleaning the insulators with a high-pressure water spray by the Contractor during structure erection will be permitted; only if done with a non-conductive degreasing solvent.

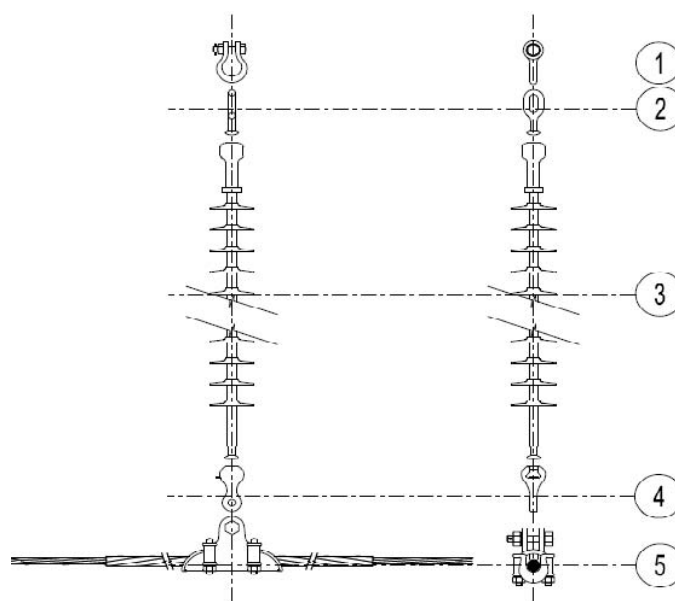
- e) Security clips shall be fully inserted in insulator caps. Insulator assemblies shall be lifted to the structure from one end of the assembly only. Bending of insulator strings to the point of bending ball pins, deforming security clips or damaging hardware is prohibited.
- f) The Contractor's Workmen shall not climb insulators after installation, nor shall such insulators be exposed to possible damage or contamination by any other means.
- g) During construction, loads shall not be imposed on insulator strings in excess of the Manufacturer's recommended safe working load. Any insulator that is exposed to such overload shall be rejected by the Clerk of Works, and shall be replaced at the Contractor's expense.
- h) Overall dimensions shown on drawings of insulator and hardware assemblies are approximate only. Assemblies shall be measured for accurate determination of jumper length and conductor cut-offs before installing dead-end accessories.
- i) Orientation of socket fittings:
  - All sockets fitted with "W" security clips. On single insulator strings the mouth of the socket must face the structure;
  - Sockets fitted with "P" security clips. On single insulator strings the eye of the "P" clip must face the structure.
- j) All split pins required on the hardware, when fitted, shall be split and bent back tightly around the bolt. The use of hump back split pins must be in strict accordance with the specifications DSP 34-1667.

## 13.5. PHASE CONDUCTOR ASSEMBLIES

- a) Phase conductor single “I-String A” suspension assembly for single “Conductor” ACSR intermediate suspension structures according to design BOM:

**Table 7: Phase Conductor single “I-String A” Suspension Assembly For Single “Conductor”**

|   |   |   |
|---|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5 (Tower shackle)  | 1 |
| 2 | 120kN Ball/Oval eye – to drawing: D-DT-7008 Rev. 4  | 1 |
| 3 | IEC 120; 132kV Composite suspension insulator; 120kN– to drawing: D-DT-7014 Rev. 9  |   |
| 4 | 120kN Socket/tongue -to drawing: D-DT-6061 Rev. 8   |   |
| 5 | A armor rod set; Aluminium alloy; suitable for “Conductor Specific according to design Bom” ACSR – to drawing: D-DT-7034 Rev. 2 |   |
| 6 | Pivoted suspension clamp; suitable “Conductor Specific according to design BOM” ACSR – to drawing: D-DT-7009 Rev. 7             |   |



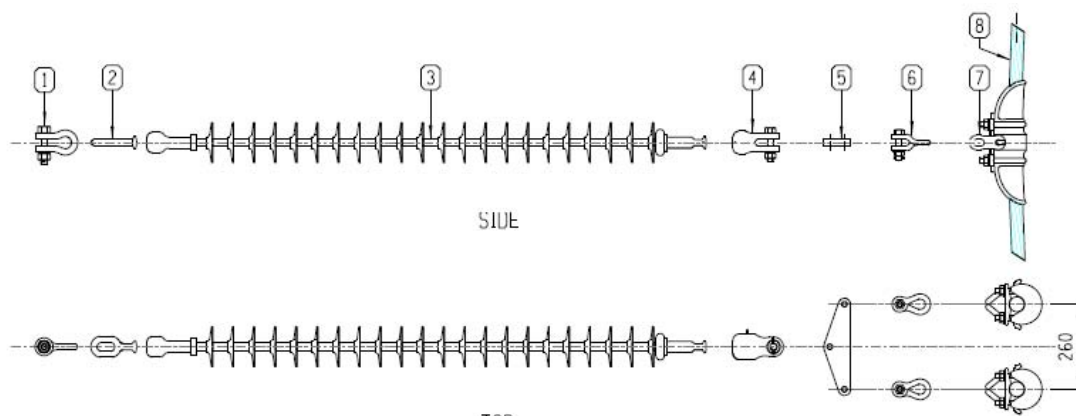
**Figure 1: Phase Conductor Single “I-String A” Suspension Assembly for Single “Conductor”**

Required:-Specified in Design BOM

**b) Phase conductor twin “I-String A” suspension assembly for twin “Conductor” ACSR intermediate suspension structures according to design BOM:**

**Table 8: Phase Conductor Twin “I-String A” Suspension Assembly for Twin “Conductor”**

|   |   |
|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5<br>(Tower shackle)   |
| 2 | 120kN Ball/Oval eye – to drawing: D-DT-7008 Rev. 4  |
| 3 | IEC 120; 132kV Composite suspension insulator; 120kN– to drawing: D-DT-7014 Rev. 9  |
| 4 | 120kN Socket/Clev 16mm -to drawing: D-DT-7021 Rev. 5  |
| 5 | Plate,Yoke Triang 260mm CRS 120kN 16mm Thick: : D-DT-7015 Rev. 7  |
| 6 | Shackle, twisted bolt type 120kN WITH 18mm Gap: D-DT-7019 Rev. 5  |
| 7 | Pivoted suspension clamp; suitable "Conductor Specific according to design BOM" ACSR – to drawing: D-DT-7009 Rev. 7           |
| 8 | Armor rod set; Aluminium alloy; suitable for "Conductor Specific according to design Bom" ACSR – to drawing: D-DT-7034 Rev. 2 |



**Figure 2: Phase Conductor Twin “I-String A” Suspension Assembly for Twin “Conductor”**

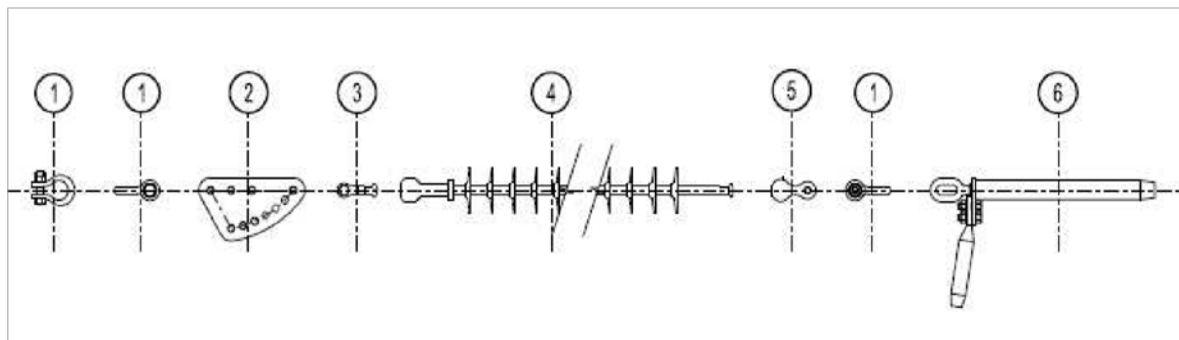
Required:-Specified in Design BOM



**c) OPTION A: Phase conductor single strain assembly for single “Conductor”  
ACSR for strain structures according to design BOM: strain towers:**

**Table 9: Option A: Phase Conductor Single Strain Assembly for Single “Conductor”**

|   |  |
|---|--|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5 (Tower shackle)   |
| 2 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5   |
| 3 | 120kN Sag adjustor – to drawing: D-DT-7042 Rev. 6  |
| 4 | 120kN Clevis/ball, bolt type, 100mm – to drawing: D-DT-6059 Rev. 9   |
| 5 | IEC 120; 132kV Composite strain insulator 120kN – to drawing: D-DT-7014 Rev. 9   |
| 6 | 120kN Socket/tongue - to drawing: D-DT-6061 Rev. 8   |
| 7 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5   |
| 8 | Compression dead-end assembly; Aluminium; suitable “Conductor Specific according to design BOM” – to drawing: D-DT-7000 Rev. 7 |



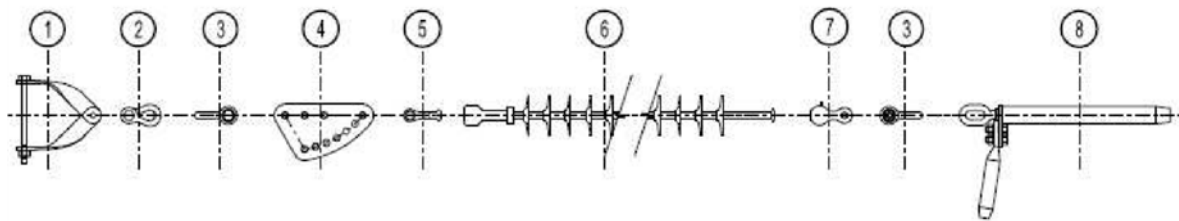
**Figure 3: Option A - Phase Conductor Single Strain Assembly for Single “Conductor”**

Required:-Specified in Design BOM

**e) OPTION B: Phase conductor single strain assembly for single “Conductor”  
ACSR conductor for H-pole in-line strain structures and H-pole terminal  
structures according to design BOM (Line side only):**

**Table 10: Option B: Phase Conductor Single Strain Assembly for Single “Conductor”**

|   |  |   |
|---|--|---|
| 1 | Shackle strap, M20 bolt type – to drawing: Component drawing   | 1 |
| 2 | 120kN Twisted shackle, bolt type – to drawing: D-DT-7019 Rev. 5 (Tower shackle)  | 1 |
| 3 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5   | 1 |
| 4 | 120kN Sag adjustor – to drawing: D-DT-7042 Rev. 6  | 1 |
| 5 | 120kN Clevis/ball, bolt type, 100mm – to drawing: D-DT-6059 Rev. 9   | 1 |
| 6 | IEC 120; 132kV Composite strain insulator 120kN – to drawing: D-DT-7014 Rev. 9   | 1 |
| 7 | 120kN Socket/tongue - to drawing: D-DT-6061 Rev. 8   | 1 |
| 8 | Compression dead-end assembly; Aluminium; suitable for “Conductor Specific according to design BOM” – to drawing: D-DT-7000 Rev. 7 | 1 |



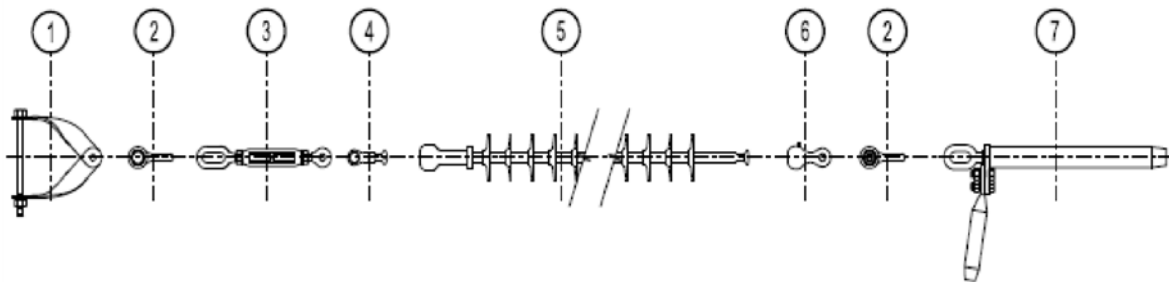
**Figure 4: Option B: Phase Conductor Single Strain Assembly for Single “Conductor”**

Required:-Specified in Design BOM

**f) OPTION C: Phase conductor single strain assembly for single “Conductor”  
ACSR conductor for 3-pole terminal structures, H-pole terminal structures  
(One side only) and H-pole terminal structures (Closing span side):**

**Table 11: Option C: Phase Conductor Single Strain Assembly for Single “Conductor”**

|   |   |   |
|---|---|---|
| 1 | Shackle strap, M20bolt type – to drawing: Component drawing<br>NB: Shackle strap not required for “Type 7618NS” structures        | 1 |
| 2 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017<br>Rev. 5 (Tower shackle)   | 1 |
| 3 | 120kN Oval eye/tongue turnbuckle – to drawing: D-DT-7007 Rev. 4   | 1 |
| 4 | 120kN Clevis/ball, bolt type, 80mm – to drawing: D-DT-6059 Rev. 9   | 1 |
| 5 | IEC 120; 132kV Composite strain insulator 120kN – to drawing: D-DT-7014 Rev. 9  | 1 |
| 6 | 120kN Socket/tongue - to drawing: D-DT-6061 Rev. 8  | 1 |
| 2 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5  | 1 |
| 7 | Compression dead-end assembly; Aluminium; suitable “Conductor<br>Specific according to design BOM” – to drawing: D-DT-7000 Rev. 7 | 1 |



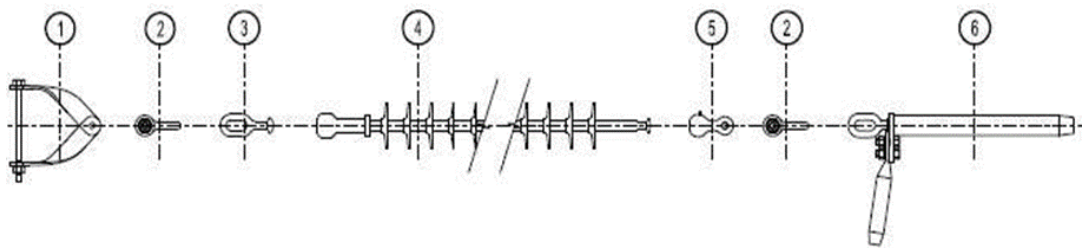
**Figure 5: Option C: Phase Conductor Single Strain Assembly for Single “Conductor”**

Required:-Specified in Design BOM

**g) OPTION D: Phase conductor single strain assembly for single “Conductor”  
ACSR conductor for “ H-pole structures and H-pole terminal structures (One  
side only):**

**Table 12: Option D: Phase Conductor Single Strain Assembly for Single “Conductor”**

|    |   |   |
|----|---|---|
| 1A | Shackle strap, M20 bolt type – to drawing: Component drawing  | 1 |
| 1B | Shackle strap, M20bolt type – to drawing: Component drawing   | 1 |
| 2  | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5 (Tower shackle)  | 1 |
| 3  | 120kN Ball/Oval eye – to drawing: D-DT-7008 Rev. 4  | 1 |
| 4  | IEC 120; 132kV Composite strain insulator 120kN – to drawing: D-DT-7014 Rev. 9  | 1 |
| 5  | 120kN Socket/tongue -to drawing: D-DT-6061 Rev. 8   |   |
| 2  | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5  |   |
| 6  | Compression dead-end assembly; Aluminium; suitable for “Conductor Specific according to design BOM”– to drawing: D-DT-7000 Rev. 7 |   |



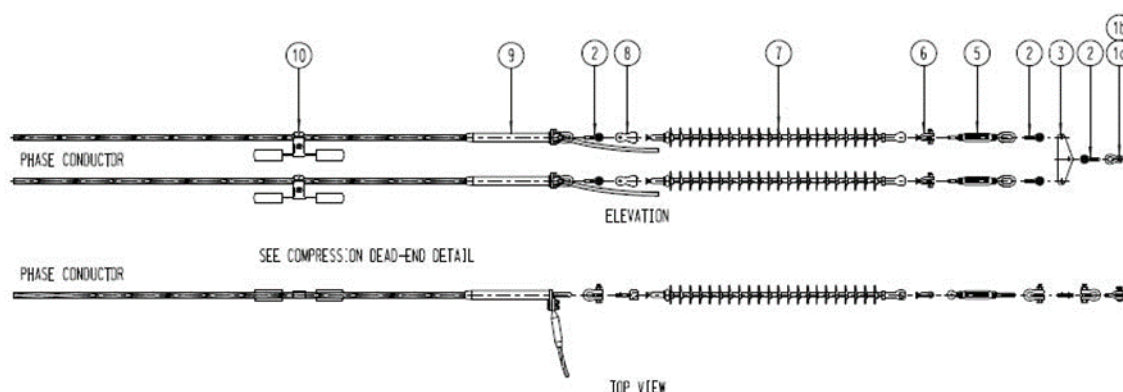
**Figure 6: Option D: Phase Conductor Single Strain Assembly for Single “Conductor”**

Required:-Specified in Design BOM

**h) Phase conductor twin strain assembly for twin “Conductor” ACSR angle, in-line strain and terminal structures according to design BOM (Line side only):**

**Table 13: Phase Conductor Twin Strain Assembly for Twin “Conductor”**

|    |  |   |
|----|--|---|
| 1a | Shackle twisted, bolt type 210kN 21.5mm Gap – to drawing: Supplier drawing   | 1 |
| 1b | Shackle Straight, bolt type 210kN 20mm Gap – to drawing: D-DT-7018 Rev. 5  | 1 |
| 2  | Shackle Straight, bolt type 210kN 20mm Gap – to drawing: D-DT-7018 Rev. 5  | 1 |
| 3  | Plate, Yoke Triangle 250mm CRS 210kN 18mm Thick: Supplier drawing  | 1 |
| 4  | Shackle Straight, bolt type 120kN 21.5mm Gap – to drawing: Supplier drawing  | 2 |
| 5  | Turnbuckle, eye tongue 120kN: D-DT-7007 Rev. 4   | 2 |
| 6  | Clevis/ball, bolt type, 16mm 16L 80CL 120kN – to drawing: D-DT-6059 Rev. 9   | 2 |
| 7  | IEC 120; 132kV Composite strain insulator 120kN – to drawing: D-DT-7014 Rev. 9   | 2 |
| 8  | Socket/tongue 16mm 120kN -to drawing: D-DT-6061 Rev. 8   | 2 |
| 4  | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5   | 2 |
| 9  | Compression dead-end assembly; Aluminium; suitable for “Conductor Specific according to design BOM” – to drawing: D-DT-7000 Rev. 7 | 1 |



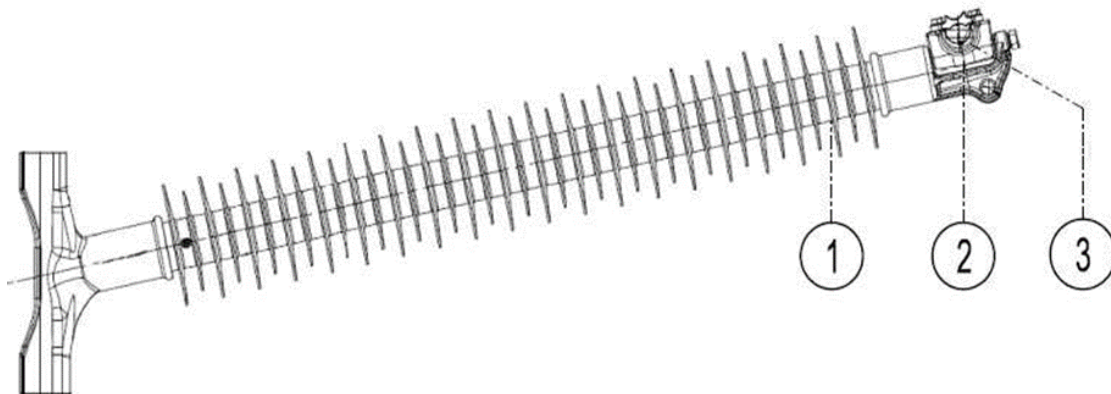
**Figure 7: Phase Conductor Twin Strain Assembly for Twin “Conductor”**

Required:-Specified in Design BOM

i) **Phase conductor single angle suspension assembly for single “Conductor” ACSR for angle suspension structures:**

**Table 14: Phase Conductor Single Angle Suspension Assembly for Single “Conductor”**

|   |  |
|---|--|
| 1 | 132kV Horizontal line post insulator 5.3kN Cast gain base- to drawing: D-DT-7013 Rev. 7  |
| 2 | Angle Trunnion clamp; Aluminium alloy; suitable for "Conductor Specific according to design Bom" ACSR – to drawing: D-DT-7011 Rev. 3 |
| 3 | Armor rod set; Aluminium alloy; suitable for "Conductor Specific according to design Bom" ACSR – to drawing: D-DT-7034 Rev. 2        |



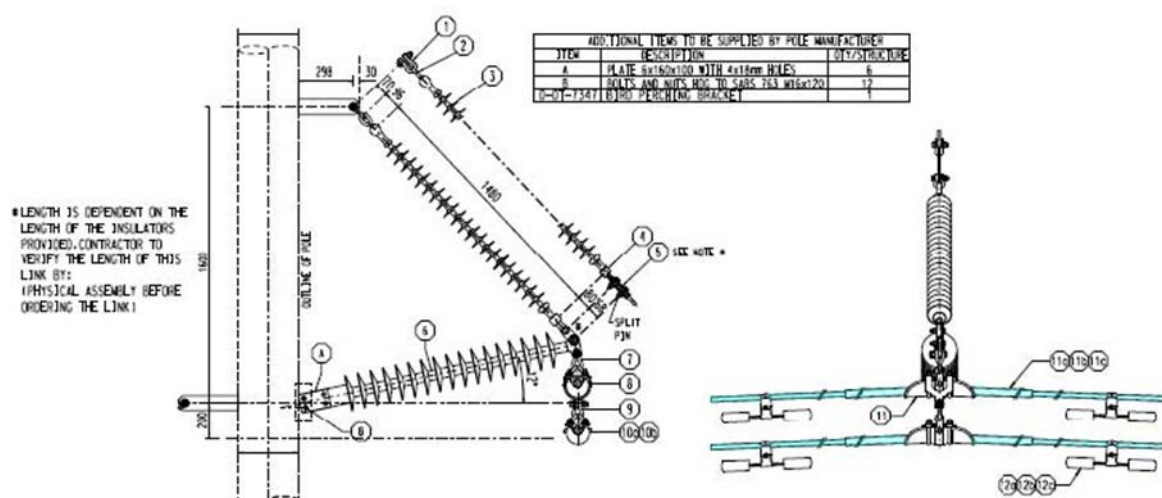
**Figure 8: Phase Conductor Single Angle Suspension Assembly for Single “Conductor”**

Required:-Specified in Design BOM.

j) **Phase conductor braced vertical suspension assembly for twin “Conductor” ACSR for twin conductor suspension structures:**

**Table 15: Phase Conductor Braced Vertical Suspension Assembly for Twin “Conductor”**

|    |   |   |
|----|---|---|
| 1  | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5  | 1 |
| 2  | 120kN Ball/Oval eye – to drawing: D-DT-7008 Rev. 4  | 1 |
| 3  | IEC 120; 132kV Composite strain insulator 120kN – to drawing: D-DT-7014 Rev. 9  | 1 |
| 4  | 120kN Socket/tongue -to drawing: D-DT-6061 Rev. 8   | 1 |
| 5  | Extension link 68mm 120kN incoming bolts nuts and split pins Supplier drawing   | 1 |
| 6  | 132kV Horizontal line post insulator 5.3kN D/E– to drawing: D-DT-7049 Rev. 1  |   |
| 7  | Shackle, twisted bolt type 120kN WITH 24mm Gap: Supplier drawing  | 2 |
| 8  | Clamp suspension pivoted eye clevis attachment “Conductor Specific according to design BOM” Supplier drawing                  | 1 |
| 9  | Shackle Straight, bolt type 120kN 26mm Gap – to drawing: Supplier drawing   | 1 |
| 10 | Pivoted suspension clamp; suitable “Conductor Specific according to design BOM” ACSR – to drawing: Supplier drawing           | 1 |
| 11 | Armor rod set; Aluminium alloy; suitable for “Conductor Specific according to design Bom” ACSR – to drawing: D-DT-7034 Rev. 2 | 1 |



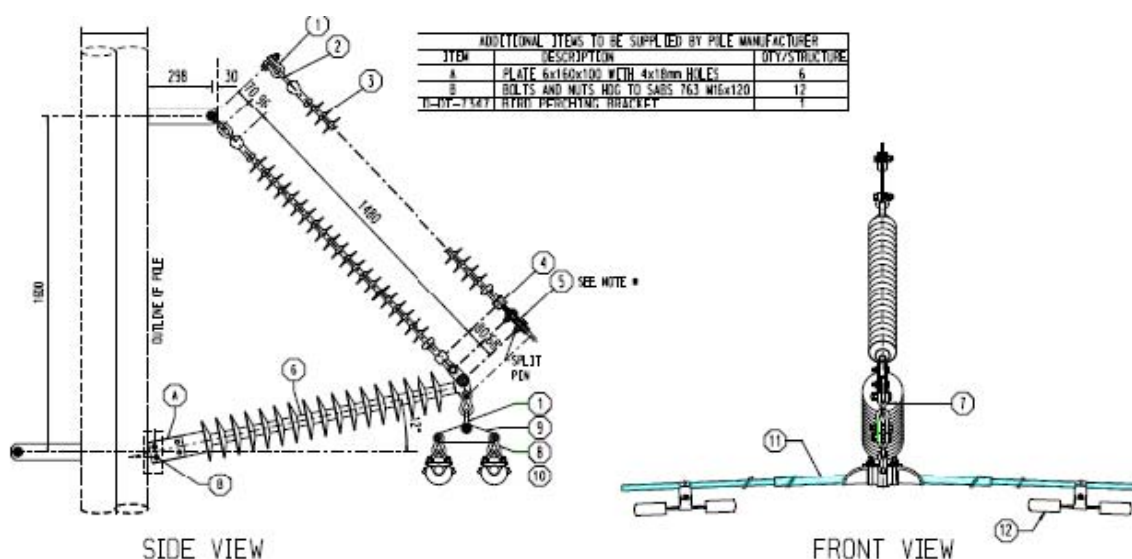
**Figure 9: Phase Conductor Braced Vertical Suspension Assembly for Twin “Conductor”**

Required:-Specified in Design BOM.

k) **Phase conductor braced horizontal suspension assembly for twin “Conductor” ACSR for twin conductor suspension structures:**

**Table 16: Phase Conductor Braced Horizontal Suspension Assembly for Twin “Conductor”**

|   |   |
|---|---|
| 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5  | 1 |
| 120kN Ball/Oval eye – to drawing: D-DT-7008 Rev. 4  | 1 |
| IEC 120; 132kV Composite strain insulator 120kN – to drawing: D-DT-7014 Rev. 9  | 1 |
| 120kN Socket/tongue -to drawing: D-DT-6061 Rev. 8   | 1 |
| Extension link Link 68mm 120kN incoming bolts nuts and split pins<br>Supplier drawing   | 1 |
| 132kV Horizontal line post insulator 5.3kN D/E– to drawing: D-DT-7049 Rev. 1  |   |
| Shackle, twisted bolt type 120kN WITH 24mm Gap: Supplier drawing  | 1 |
| Shackle, twisted bolt type 120kN WITH 18mm Gap: D-DT-7019 Rev. 5  | 2 |
| Plate,Yoke Triang 260mm CRS 120kN 16mm Thick : D-DT-7015 Rev. 7   | 1 |
| Pivoted suspension clamp; suitable “Conductor Specific according to design BOM” ACSR – to drawing: Supplier drawing           | 2 |
| Armor rod set; Aluminium alloy; suitable for “Conductor Specific according to design Bom” ACSR – to drawing: D-DT-7034 Rev. 2 | 1 |



**Figure 10: Phase Conductor Braced Horizontal Suspension Assembly for Twin “Conductor”**

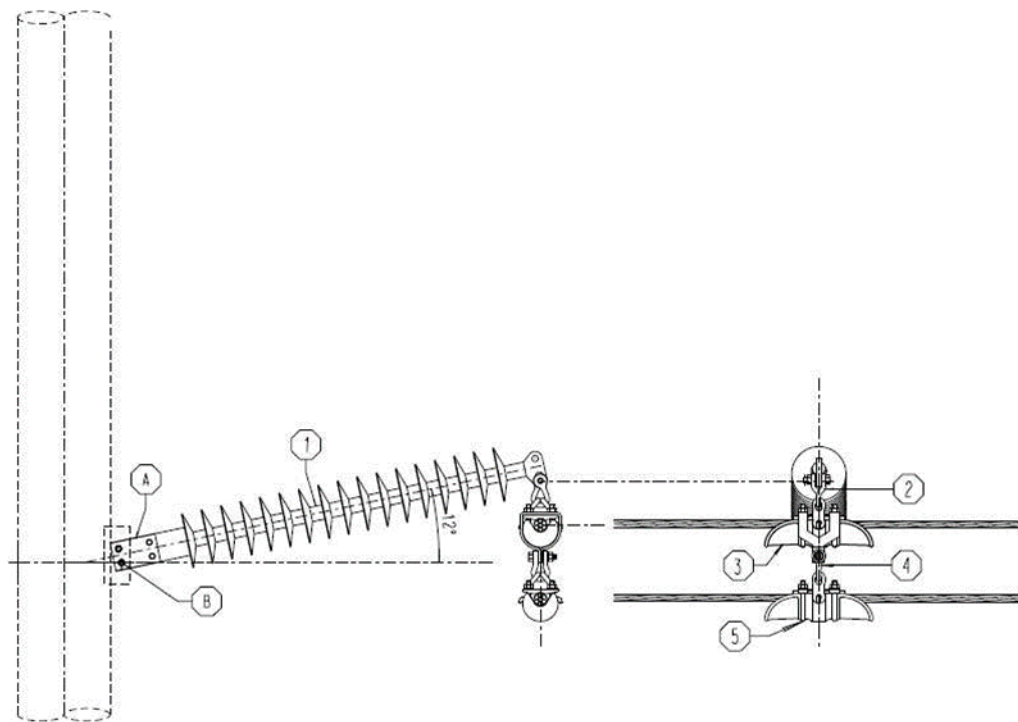
Required:-Specified in Design BOM.



**I) Vertical phase conductor twin jumper assembly for twin “Conductor” ACSR for angle strain structures:**

**Table 17: Phase Conductor Braced Horizontal Suspension Assembly for Twin “Conductor”**

|   |   |   |
|---|---|---|
| 1 | 132kV Horizontal line post insulator 5.3kN Cast gain base– to drawing: D-DT-7013 Rev. 7                             | 1 |
| 1 | 132kV Horizontal line post insulator 5.3kN D/E– to drawing: D-DT-7049 Rev. 1  | 1 |
| 2 | Shackle, twisted bolt type 120kN WITH 24mm Gap: Supplier drawing  | 1 |
| 3 | Clamp suspension pivoted eye clevis attachment “Conductor Specific according to design BOM” Supplier drawing        | 1 |
| 4 | Shackle Straight, bolt type 120kN 26mm Gap – to drawing: Supplier drawing   | 1 |
| 5 | Pivoted suspension clamp; suitable “Conductor Specific according to design BOM” ACSR – to drawing: Supplier drawing | 1 |
| 6 | Spacer Rigit “Conductor Specific according to design Bom” Supplier drawing  | 1 |



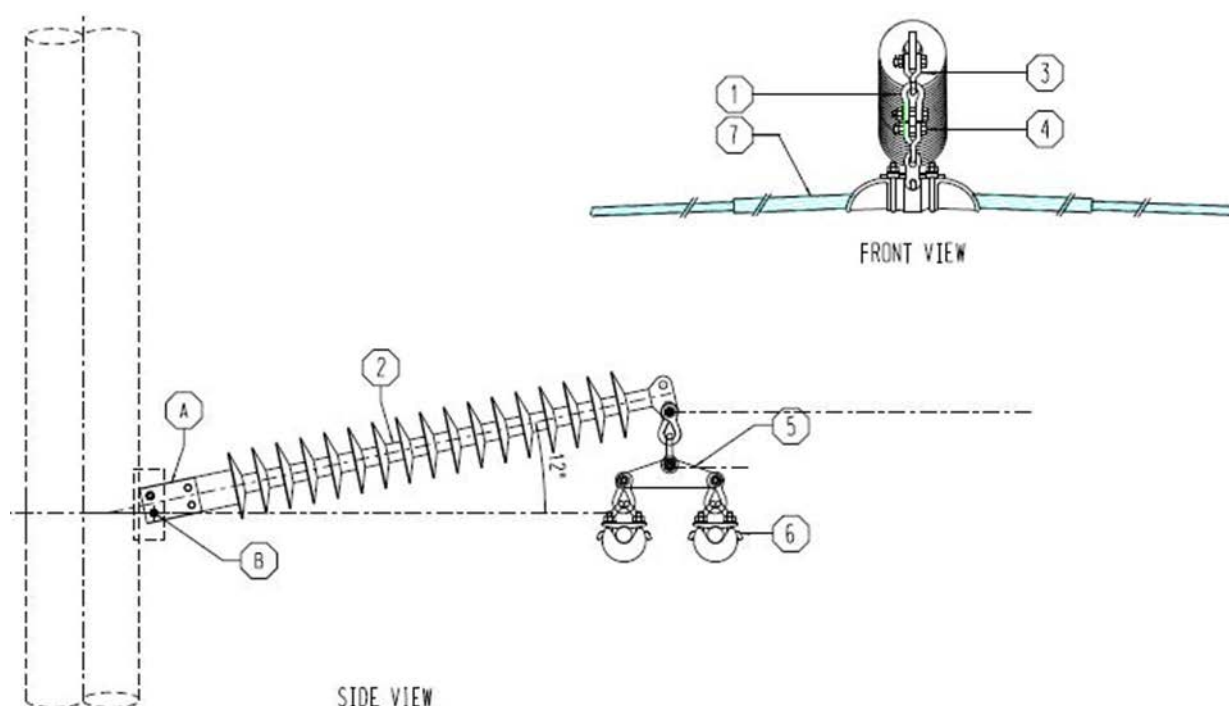
**Figure 11: Phase Conductor Braced Horizontal Suspension Assembly for Twin “Conductor”**

Required:-Specified in Design BOM.

**m) Horizontal phase conductor twin jumper assembly for twin “Conductor”  
ACSR for angle strain structures:**

**Table 18: Horizontal Phase Conductor Twin Jumper Assembly for Twin “Conductor”**

|   |   |   |
|---|---|---|
| 1 | 132kV Horizontal line post insulator 5.3kN Cast gain base- to drawing: D-DT-7013 Rev. 7                             | 1 |
| 1 | 132kV Horizontal line post insulator 5.3kN D/E- to drawing: D-DT-7049 Rev. 1  | 1 |
| 2 | Shackle, twisted bolt type 120kN WITH 24mm Gap: Supplier drawing  | 1 |
| 3 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5  | 1 |
| 4 | Plate,Yoke Triang 260mm CRS 120kN 16mm Thick: : D-DT-7015 Rev. 7  | 1 |
| 5 | Shackle, twisted bolt type 120kN WITH 18mm Gap: D-DT-7019 Rev. 5  | 2 |
| 6 | Pivoted suspension clamp; suitable “Conductor Specific according to design BOM” ACSR – to drawing: Supplier drawing | 2 |
| 7 | Spacer Rigit “Conductor Specific according to design Bom” Supplier drawing  | 1 |



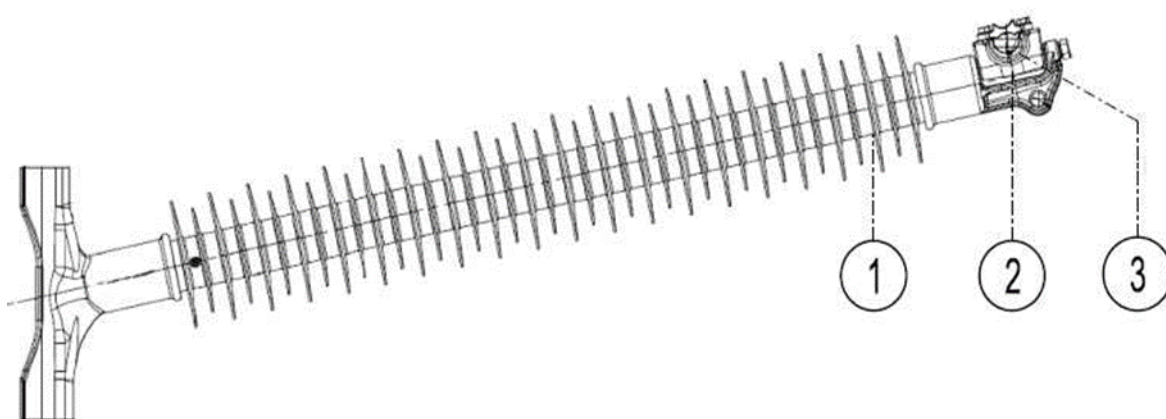
**Figure 12: Horizontal Phase Conductor Twin Jumper Assembly for Twin “Conductor”**

Required:-Specified in Design BOM.

**n) Phase conductor single jumper support assembly for single “Conductor” ACSR for strain structures:**

**Table 19: Phase Conductor Single Jumper Support Assembly for Single “Conductor”**

|   |   |   |
|---|---|---|
| 1 | 132kV Horizontal line post insulator 5.3kN Cast gain base– to drawing: D-DT-7013 Rev. 7   | 1 |
| 2 | 0°Trunnion suspension clamp; Aluminium alloy; suitable for “Conductor Specific according to design BOM” ACSR – to drawing: D-DT-7010 Rev. 2 | 1 |
| 3 | A armor rod set; Aluminium alloy; suitable for “Conductor Specific according to design Bom” ACSR – to drawing: D-DT-7034 Rev. 2             | 1 |



**Figure 13: Phase Conductor Single Jumper Support Assembly for Single “Conductor”**

Required:-Specified in Design BOM.

### 13.6. SHIELD WIRE ASSEMBLIES

**a) (Insulated Option) Shield wire suspension assembly for single “7/3,35mm & 19/2.65” GS shield - wire for intermediate suspension structures:**

**Table 20: (Insulated Option) S/W Sus. Ass. for Single "7/3,35 mm & 19/2.65" GS Shield**

|   |   |   |
|---|---|---|
| 1 | Earth wire clamp; galvanized mild steel – to drawing: D-DT-7003 Rev. 11 | 1 |
| 2 | Galvanized steel preformed armor rod set – to drawing: D-DT-7006 Rev. 2 | 1 |

Required:-Specified in Design BOM.

- b) **(Non-insulated Option) Shield wire suspension assembly for single “7/3,35mm & 19/2.65” GS shield wire for intermediate suspension structures:**

**Table 21: (Non-insulated Option) S/W Sus. Ass. for Single “7/3,35mm & 19/2.65”**

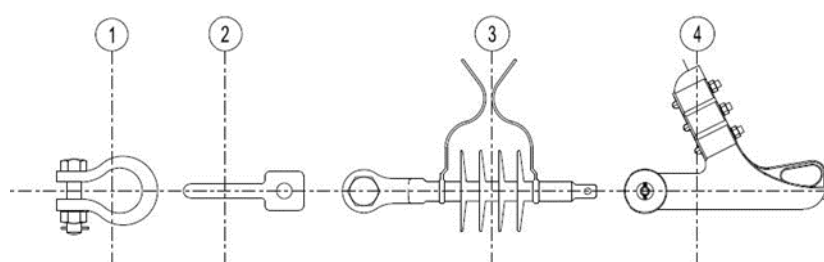
|   |   |   |
|---|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5                                      | 1 |
| 2 | 120kN Twisted tongue/oval eye – to McWade Productions (Pty) Ltd - Item no. B30572 or similar approved | 1 |
| 3 | Earth wire insulator, with arching horns – to drawing: D-DT-7012 Rev. 3                               | 1 |
| 4 | 70kN Pistol grip strain clamp, 3-bolt type -to drawing: D-DT-7022 Rev. 14                             | 1 |
| 5 | Crosby clamp; suitable for 12mm wire rope – to drawing: D-DT-7032 Rev. 7                              | 1 |

Required:-Specified in Design BOM.

- c) **(Insulated Option) Shield wire strain assembly for single “7/3,35mm & 19/2.65” GS shield wire for strain structures:**

**Table 22: (Insulated Option) Shield Wire Strain Assembly for Single “7/3,35mm & 19/2.65”**

|   |   |   |
|---|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5                                      | 1 |
| 2 | 120kN Twisted tongue/oval eye – to McWade Productions (Pty) Ltd - Item no. B30572 or similar approved | 1 |
| 3 | Earth wire insulator, with arching horns – to drawing: D-DT-7012 Rev. 3                               | 1 |
| 4 | 70kN Pistol grip strain clamp, 3-bolt type - to drawing: D-DT-7022 Rev. 14                            | 1 |
| 5 | Crosby clamp; suitable for 12mm wire rope – to drawing: D-DT-7032 Rev. 7                              | 1 |



**Figure 14: (Insulated Option) Shield Wire Strain Assembly for Single “7/3,35mm & 19/2.65”**

Required:-Specified in Design BOM.

**d) (Non-insulated Option) Shield wire strain assembly for single “7/3,35mm & 19/2.65” GS shield wire for strain structures:**

**Table 23: (Non-insulated Option) Shield Wire Strain Assembly for Single “7/3,35mm & 19/2.65”**

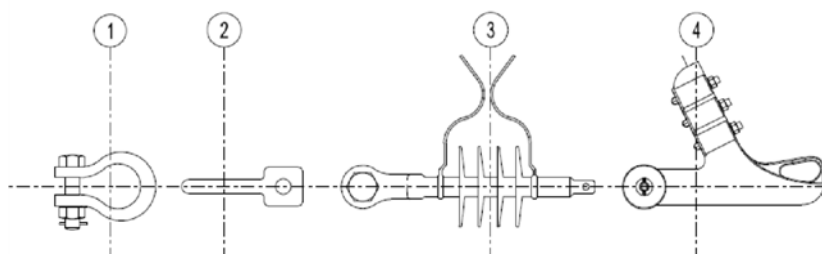
|   |   |   |
|---|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5                  | 1 |
| 2 | Thimble; galvanized mild steel; 16mm wire rope – to drawing: D-DT-3026 Rev. 16    | 1 |
| 3 | Galvanized steel preformed dead end – to drawing: D-DT-7035 Rev. 2                | 1 |
| 4 | Shield clamp; double groove; galvanized mild steel – to drawing: D-DT-7004 Rev. 5 | 1 |

Required:-Specified in Design BOM

**e) (Insulated Option) Shield wire strain assembly for single “7/3,35mm & 19/2.65” GS shield wire for terminal structures:**

**Table 24: (Insulated Option) Shield Wire Strain Assembly for Single “7/3,35mm & 19/2.65”**

|   |   |   |
|---|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5                                      | 1 |
| 2 | 120kN Twisted tongue/oval eye – to McWade Productions (Pty) Ltd - Item no. B30572 or similar approved | 1 |
| 3 | Earth wire insulator, with arching horns – to drawing: D-DT-7012 Rev. 3                               | 1 |
| 4 | 70kN Pistol grip strain clamp, 3-bolt type - to drawing: D-DT-7022 Rev. 14                            | 1 |



**Figure 15: (Insulated Option) Shield wire strain assembly for single “7/3,35mm & 19/2.65”**

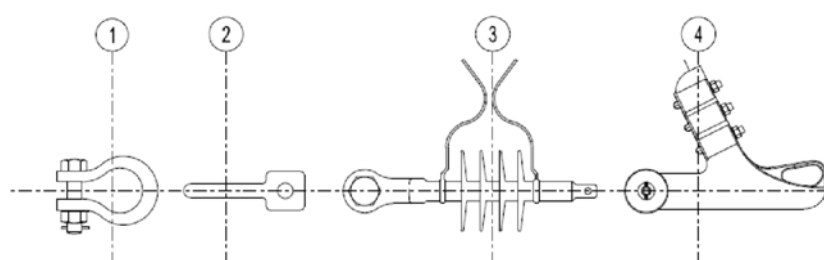
Required:-Specified in Design BOM

**f) (Insulated Option) Shield wire strain assembly for single “7/3,35mm & 19/2.65” GS shield wire for terminal structures:**

**Table 25: (Insulated Option) Shield Wire Strain Assembly for Single “7/3,35mm & 19/2.65”**

|   |   |   |
|---|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5                                      | 1 |
| 2 | 120kN Twisted tongue/oval eye – to McWade Productions (Pty) Ltd - Item no. B30572 or similar approved | 1 |
| 3 | Earth wire insulator, with arching horns – to drawing: D-DT-7012 Rev. 3                               | 1 |
| 4 | 70kN Pistol grip strain clamp, 3-bolt type - to drawing: D-DT-7022 Rev. 14                            | 1 |
| 5 | Crosby clamp; suitable for 12mm wire rope – to drawing: D-DT-7032 Rev. 7                              | 1 |

**Figure 16: (Insulated Option) Shield Wire Strain Assembly for Single “7/3,35mm & 19/2.65”**



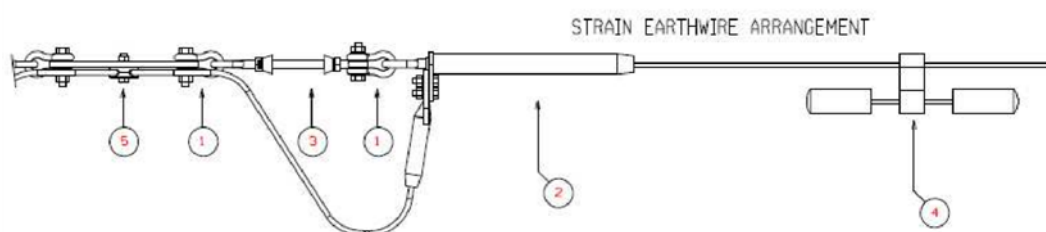
**Figure 17: (Insulated Option) Shield Wire Strain Assembly for Single “7/3,35mm & 19/2.65”**

Required:-Specified in Design BOM

**14.5.1 (Non-Insulated Option) Shield wire strain assembly for single “conductor” ACSR shield wire High fault currents:**

**Table 26: (Non-Insulated Option) Shield Wire Strain Assembly for Single “Conductor”**

|   |  |   |
|---|--|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5   | 2 |
| 2 | Compression dead-end assembly; Aluminium; suitable for “Conductor Specific according to design BOM” – to drawing: D-DT-7000 Rev. 7 | 1 |
| 3 | Turnbuckle, eye tongue 120kN: D-DT-7007 Rev. 4   | 1 |
| 5 | Shield clamp; double groove; galvanized mild steel – “Conductor Specific” as per to drawing: D-DT-7004 Rev. 5                      | 1 |



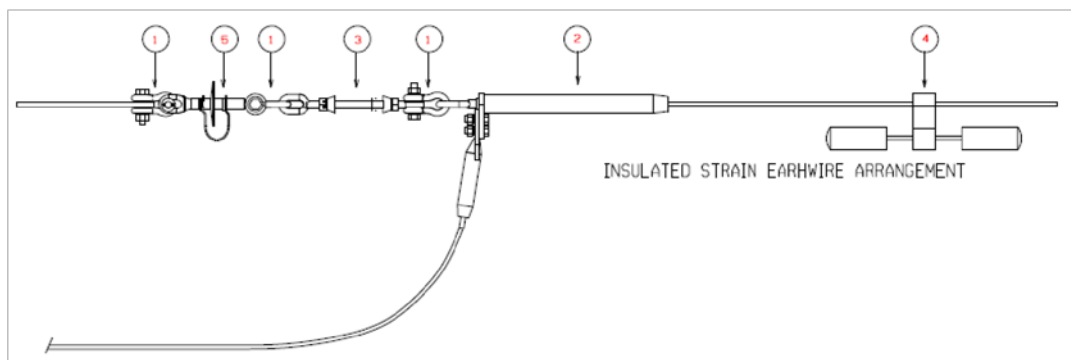
**Figure 18: (Non-Insulated Option) Shield Wire Strain Assembly for Single “conductor”**

Required:-Specified in Design BOM

**g) (Insulated Option) Shield wire strain assembly for single “conductor” ACSR shield wire High fault currents:**

**Table 27: (Insulated Option) Shield Wire Strain Assembly for Single “Conductor”**

|   |  |   |
|---|--|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5   | 3 |
| 2 | Compression dead-end assembly; Aluminium; suitable for “Conductor Specific according to design BOM” – to drawing: D-DT-7000 Rev. 7 | 1 |
| 3 | Turnbuckle, eye tongue 120kN: D-DT-7007 Rev. 4   | 1 |
| 5 | Earth wire insulator, with arching horns – to drawing: D-DT-7012 Rev. 3  | 1 |



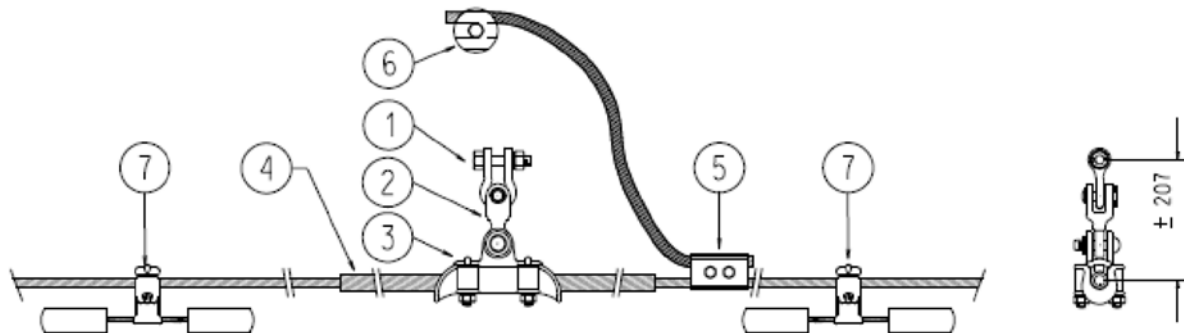
**Figure 19: (Insulated Option) Shield Wire Strain Assembly for Single “Conductor”**

Required:-Specified in Design BOM

**h) (Non-Insulated Option) Shield wire suspension assembly for single “conductor” ACSR shield wire High fault currents:**

**Table 28: (Non-Insulated Option) Shield Wire Suspension Assembly for Single “Conductor”**

|   |   |   |
|---|---|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5  | 2 |
| 2 | Clevis/tongue, bolt type, to McWade Productions (Pty) Ltd - Item no. B30442 or similar approved                                 | 1 |
| 3 | Clamp susp pivoted “Conductor Specific according to design BOM” ACSR – to drawing: D-DT-7009 Rev. 7                             | 1 |
| 4 | A armor rod set; Aluminium alloy; suitable for “Conductor Specific according to design BOM” ACSR – to drawing: D-DT-7034 Rev. 2 | 1 |
| 5 | Parallel grooved clamp extruded: “Conductor Specific according to design BOM”   | 1 |
| 6 | Shield clamp; double groove; galvanized mild steel – “Conductor Specific” as per to drawing: D-DT-7004 Rev. 5                   | 1 |



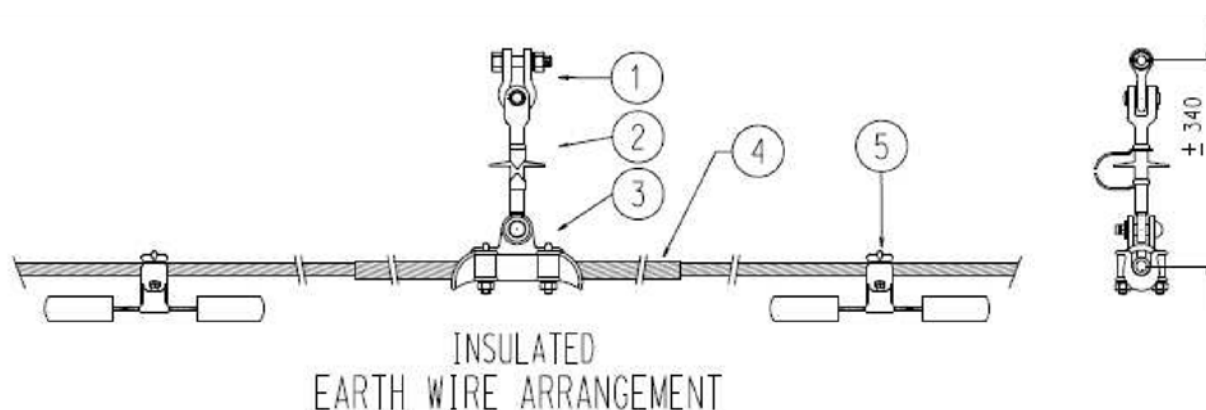
**Figure 20: (Non-Insulated Option) Shield Wire Suspension Assembly for Single “Conductor”**



- i) **(Insulated Option) Shield wire suspension assembly for single “conductor”**  
**ACSR shield wire High fault currents:**

**Table 29: (Insulated Option) Shield Wire Suspension Assembly for Single “Conductor”:**

|   |  |   |
|---|--|---|
| 1 | 120kN Straight shackle, bolt type – to drawing: D-DT-7017 Rev. 5   | 1 |
| 2 | Earth wire insulator, with arching horns – to drawing: D-DT-7012 Rev. 3  | 1 |
| 3 | Clamp susp pivoted “Conductor Specific according to design BOM”<br>ACSR – to drawing: D-DT-7009 Rev. 7                           | 1 |
| 4 | Armor rod set; Aluminium alloy; suitable for “Conductor Specific<br>according to design BOM” ACSR – to drawing: D-DT-7034 Rev. 2 | 3 |



**Figure 21: (Insulated Option) Shield Wire Suspension Assembly for Single “Conductor”**

### 13.7. CRITERIA FOR INSULATORS AND APPROVED INSULATORS AND INSULATOR SUPPLIERS

- a) Horizontal line post insulators
- Specifications : DISASABL1; DSP 34-510; SCSAGAAR0
  - System voltage : 132kV (Peak -145kV);
  - IEC Power frequency wet flashover : 275kV;
  - IEC Basic insulation level : 650kV;
  - Minimum pollution creepage (Light) : 20mm/kV (Silicon rubber; EPDM)
  - Maximum safe working load (F.O.S.=2.5) : 5.3kN;
  - End fittings:
  - Live end (Galvanized malleable) : Trunnion with 1 hole drop tongue;
  - Base end (Galvanized malleable) : Standard Gain base (305mm hole centers);
  - Normal angle of inclination : 12°;
  - Connecting length between end fittings : 1 200mm;
  - Minimum horizontal distance (conductor to support) : 1 300mm;
  - Weather shed material (Alternating sheds preferred) : Silicon rubber; EPDM
- b) Composite suspension and strain insulators
- Specifications : DISASABL1; DSP 34-510; SCSAGAAR0
  - System voltage : 132kV (Peak -145kV);
  - IEC Power frequency wet flashover : 275kV;
  - IEC Basic insulation level : 650kV;
  - Minimum pollution creepage (Light) : 20mm/kV (Silicon; EPDM)

- Maximum safe working load (F.O.S.=2.5) : 120kN;
- End fittings:
  - Live end (Galvanized malleable) : IEC120 16mm Ball;
  - Earth end (Galvanized malleable) : IEC120 16mm Socket;
  - Connecting length between end fittings : 1 483mm ( $\pm 20$ mm);
  - Weather shed material (Alternating sheds preferred) : Silicon rubber; EPDM

## **14. ACTIVITY STAGE 9**

### **STRINGING ACTIVITIES**

- a) All ACSR compression dead end type assemblies of phase conductors and earth wires must be tension tested.

#### **14.1. TEST JOINTS**

##### **14.1.1. Compression joint sampling and testing**

- a) The purpose of the test is to ensure that the assembly meets the required strength of 95% of the rated tensile strength of the conductor. By testing an assembly compressed on site with the compression machine to be used on the project and by the personnel appointed to perform the crimps, the entire system is proven.
- b) Before any stringing activities commences, the Eskom Clerk of Works shall randomly select two dead-end fittings and one joint from those on site supplied for the project. He shall check that they conform with buyers' guide drawings D-DT-7000 and DDT-7001, indelibly mark them with his signature and give them to the Contractor to compress.
- c) The Contractor shall compress, in the presence of the Eskom Clerk of Works, a sample phase conductor assembly. The assembly shall consist of two dead-end fittings and a mid-span joint.
- d) The crimping equipment used shall be that allocated for the project and the personnel performing the crimps shall be those appointed to do so. The length of conductor between the fittings shall not be less than 100 times the diameter of the conductor. This test assembly shall be labelled and sent to an approved test laboratory for tensile testing.
- e) The Contractor shall, at his expense, arrange for the samples to be mechanically tested, in the presence of himself and the Clerk of Works, at an approved laboratory.
- f) Test certificates to be provided as part of the Hand-Over Documentation.
- g) Should the Test Joint fail, the Contractor will re-test at his own cost.
- h) Compression assembly sample detail:
- i) An Example of information for the testing of compression fitting assemblies

##### **14.1.2. Compression joint sampling and testing procedure**

- a) The Contractor, using the following testing procedure, shall conduct a tensile test on the samples:

- A tensile load of about 50% of the breaking load of the conductor shall be applied and the conductor shall be marked in such a way that movement relative to the fitting can easily be detected;
- Without any subsequent adjustment of the fitting, the load shall be steadily increased to 95% of the breaking load and then reduced to 90% of the breaking load and maintained for 1 min;
- There shall be no movement of the conductor relative to the fitting due to slip during this period of 1 min. and no failure of the fitting;
- The conductor shall then be loaded to failure, and shall again withstand a minimum load of 95% of the minimum breaking strength of the conductor for it to be deemed acceptable. b) Compression joint test failures
- If the sample fails in any sense during the testing thereof, a further three (3) samples shall be tested and shall all be required to pass the above test procedure;
- If any one or more of these samples fail, no stringing shall commence until the Project Engineer has satisfied himself that the equipment is acceptable. c) Record keeping
- Four (4) copies of the test report shall be forwarded to the Project Engineer for his review and approval prior to stringing.

## **14.2. STRINGING**

### **14.2.1. Transport of phase conductor and shield wire stringing hardware**

- a) All compression and preformed joint fittings, as well as miscellaneous phase conductor and shield wire repair fittings shall be delivered to site by the Contractor.
- b) Refer to the BOM for summary of stringing material to be supplied by the Contractor.

## **14.3. SAFE STORAGE, HANDLING AND TRANSPORT OF PHASE CONDUCTOR AND SHIELD WIRE STRINGING HARDWARE**

- a) The Contractor shall be responsible for the safe storage, handling and delivery to the construction site of all the phase conductors, shield wires supplied by the Employer.
- b) All compression type fittings shall be stored in an enclosed storage facility.
- c) The ACSR phase conductor as well as the Galvanized Steel or ACSR shield wire shall be supplied and delivered to the Contractor's construction yard site by the Employer.
- d) Refer to the Design BOM and order BOM of this document for the quantities of the phase conductor and shield wire supplied by the Employer for this project.
- e) The Contractor and Clerk of Works shall check and record all phase conductor and shield wire drum numbers delivered to site. Records shall be submitted to the Project Manager for acknowledgement.

#### 14.4. SAFE HANDLING, TRANSPORT TO DRUM SITES AND COMPLETE STRINGING, REGULATING CLAMPING OF PHASE CONDUCTORS AND SHIELD WIRES

- a) The following Standards, Specifications, Guidelines and Drawings apply:
- **TRMSCAAC1 Rev. 3 -Section 8** Transmission line tower and Line construction;  
Project File Route Plan;
  - **Project File** PLSCADD design profile sheets;
  - **Project File** PLSCADD Stringing Sag & Tension Charts.
- b) The Project Engineer shall provide all PLSCADD generated Stringing sag and Tension Charts for the project to the Contractor. The Stringing Sag and Tension Charts shall be verified and accepted by the Contractor prior to the stringing and regulating activities. Any discrepancies with regards to the Stringing Sag and Tension Charts shall be immediately reported to the Project Engineer via the Clerk of Works.
- c) Sag & Tension loading criteria
- The calculations of sag corrections for creep and clamping off sets, shall be the responsibility of the Contractor and will be based on the Stringing Sag and Tension Charts supplied by the Project Engineer.
  - Criteria for the calculations for the Stringing Sag and Tension Charts for the damped "ACSR" phase conductor must be based on a maximum final conductor loading after creep of: h) 70% UTS @ -5°C EDT 1050Pa wind load or C-value = 2450m for its "Ruling Condition". i) 70% UTS @ 15°C 1050Pa wind load or C-value = 1 800m for its "Ruling Condition".
  - Criteria for the calculations for the Stringing Sag and Tension Charts for the damped "ACSR and Galvanized Steel" shield wire must be based on a maximum final conductor loading of j) 70% UTS @ -5°C EDT under 1050Pa wind load or C-value = 2750m for its "Ruling Condition". k) 70% UTS @ 15°C 1050Pa wind load or C-value = 2100m for its "Ruling Condition"
  - The overhead shield wire will be sagged to follow the initial parabolic profile of the OPGW;
  - The initial tension criteria for the phase conductor at any temperature shall under no circumstances exceed 70% of the conductor specified UTS value under 1050Pa wind load.
  - The final tension criteria for the phase conductor at -5°C with 1050Pa wind loading shall under no circumstances exceed 70% of the conductor specified UTS value.
- d) Contractor's work comprise
- Sampling and testing of all phase conductor and shield wire compression fittings, prior to the commencement and stringing activities.
  - The safe handling & transport to drum station, stringing, jointing, regulating and clamping of ACSR phase conductor.
  - The safe handling & transport to drum station, stringing, jointing, regulating and clamping of ACSR or Galvanized Steel shield wire.
- e) The phase conductor and shield wire drum numbers shall be recorded by the Contractor, when delivered to "Drum Sites" and verified by the Clerk of Works.
- f) Stringing method

- All phase conductors shall be tension strung over the entire length of the line, unless otherwise permitted by the Project Engineer;
- Non-tension stringing will be allowed for stringing of overhead shield wires, only if the Contractor can ensure that the shield wires will under no circumstances be dragged on the ground or be damaged in any degree during the stringing process;
- The equipment and methods used for stringing the phase conductors and shield wires shall be such that the phase conductors and/or shield wires will not be damaged. Particular care must be taken at all times to ensure that the phase conductors and shield wires do not become kinked, twisted or abraded in any matter.
- Vehicle traffic passing over phase conductors lying on the ground will not be permitted in any sense. The Contractor at his own cost will replace all damaged conductors caused by such incidents.
- The Contractor shall make suitable arrangements for temporary staying of structures and anchoring of conductors when necessary.
- Conductors may not be anchored to any portion of any structure, except strain towers and then only at the points designed for conductor attachment.
- Temporary anchoring to footings and guy anchors will not be permitted. Where temporary anchoring is required, suitable temporary anchors shall be provided. Installation and removal of temporary anchors will be the Contractor's responsibility.
- At no time shall the pulling tension in the conductors shall exceed the tensions shown on the stringing sag charts. Pulling of more than one drum length of conductor shall be subject to the Clerk of Works acceptance.
- Adequate protection shall be provided where there is danger of conductors being damaged by vehicles or other equipment and objects. Conductors shall not be left in contact with the ground, vegetable matter or any conducting or semi-conducting material. Wood lagging or similar material shall be used to protect the conductor when working at ground level.
- Radio communications shall be used to relay information and instructions between the conductor tensioning station, intermediate check points, mobile stations and the pulling station at all times during a stringing-tensioning operation. An outage of radio communications at any station will require immediate cessation of conductor pulling operations.
- The placement of tensioning and pulling equipment shall be such that the vertical angle of pull on a cross-arm during stringing operations shall not be more than 20°. Conductors shall not be pulled around angles that exceed 20°.
- During stringing operations and before regulating, if it becomes necessary to leave the conductor in the blocks for longer than eighteen hours, the conductor shall be left at reduced tension, and the Clerk of Works immediately notified. The percentage of sag, spans involved, time interval, and correction for creep shall be noted, and records forwarded to the Clerk of Works. In no case shall conductors be left with less than the following clearances:
  - Cultivated or open country : 6,0m,
  - Roads and trails : 8,0m,
  - Railway tracks : 9,0m.
- Stringing shall be done in "Daylight-hours" only.
- n) Stringing shall not be allowed to commence in abnormal windy conditions.

- The use of phase conductor and shield wire are to be optimized to avoid excessive waste. All off-cuts and surplus phase conductor and shield wire shall be returned to the Employer upon completion of the project.
- Matched conductor drums, marked with the same number followed by the suffix A, B, C etc., shall be used for each pull of multiple conductors per phase to ensure even sag characteristics and a minimum number of joints. The Contractor shall select the most suitable sets of matched conductor drums for each stringing position to minimize wastage of conductor. The Contractor shall keep an accurate record of the phase conductor and shield wire drum numbers and their position in the line. On completion a copy of these records shall be submitted to the Project Manager.

#### **14.4.1. Stringing equipment**

- a) Calibration and test certificates for all dynamometers and stringing equipment shall be submitted to the Clerk of Works for evaluation and approval, well in advance of the commencement of any stringing activities.
- b) Swivels shall be used to attach the pulling line and conductors to the running board. Swivels shall be small enough to pass through the blocks without damage to either, and shall have ball bearings and be free turning under load.
- c) The sheaves shall conform to the conductor manufacturer's recommendation as to diameter, and to size and shape of groove for the size of conductor used. Sheaves shall have a minimum diameter of fifteen times the conductor diameter at the base of the groove.
- d) Block surfaces that will be in contact with the conductor shall be coated with neoprene or rubber. This covering shall be kept clean and free of materials that might damage the conductor surface.
- e) The conductor sheaves shall have a separate groove for the pulling line. The pulling line shall not run on the rubber covered conductor grooves. The sheaves shall be inspected for damage or contamination before each usage.
- f) The Contractor shall not use any sheaves rejected by the Clerk of Works due to damage or excessive wear. The Contractor shall immediately remove such sheaves from the site.

#### **14.4.2. Stringing program**

- a) The Contractor shall submit a complete stringing program to the Project Manager at least 50 days in advance of the stringing activities. The Project Manager will then arrange all crossing permits with the relevant Service Owners from this stringing program;
- b) All existing overhead services for example, Telkom lines, Railway lines, Power lines and Proclaimed Roads, etc. are indicated on the profile drawings. All crossing notices and permits will be obtained and coordinated by the Clerk of Works;
- c) The Contractor shall notify the Clerk of Works at least 35 days in advance, of the time he intends to make a crossing over any existing overhead services;
- d) All crossings over existing services shall be done in accordance with TRMSCAAC 1 Section 8.2.1.

### 14.4.3. Crossings

- a) No crossing over above mentioned services will commence without proof of the official Eskom Land Development application for these services crossings, as well as the written acceptance and approval from the relevant service authorities.
- b) Special scaffolding to be erected at Spoornet Railway line crossings to ensure the safe passing of trains at all times during the stringing activities. Special scaffolding only to be removed on completion of the regulating and clamping of the phase conductors and shield wires.
- c) Special scaffolding to be erected at National road crossings to ensure the safe passing of traffic at all times during the stringing activities. Special scaffolding only to be removed on completion of the regulating and clamping of the phase conductors and shield wires.
- d) Temporary "Goal post" type structures to be erected at all service crossings to ensure safe clearances over these crossing at all times during the stringing activities. Temporary structures to be removed on completion of the regulating and clamping of the phase conductors and shield wires, only.

**NOTE: Minimum design clearances are measured at:**

- 70°C conductor temperature for over-crossings;
- -5°C conductor **temperature for under-crossings**

### 14.4.4. Insulation of overhead shield wire

- a) The following Standards, Specifications, Guidelines and Drawings apply:
  - **SCSASABF9 Section 4.9** Sub-transmission line Earthing Specification;
  - **Project** File PLSCADD design profile sheets;
  - **Project File** PLSCADD design staking table.
- b) The shield wire insulators shall be 120kN units in accordance with D-DT-7012. Where shield wire insulators are fitted with adjustable spark-gaps, the gap shall be set to 8mm for all cases.
- c) Except for the structures listed, all other structures on the entire line shall not be equipped with shield wire insulators:

## 14.5. MAKING OFF AND REGULATION

### 14.5.1. Regulate of phase conductors and shield wires

- a) The Contractor shall string all phase conductors and shield wires to the appropriate sags and tensions as determined from the conditions specified in above. The calculation of sag corrections for creep and clamping offsets shall be the responsibility of the Contractor, based on charts supplied by the Project Engineer. Such calculations shall be submitted to, and accepted by the Project Engineer prior to regulating.
- b) Phase conductors and shield wires shall be strung to the appropriate sag determined for the actual span length, and the equivalent span of the strain section involved.
- c) The appropriate conductor temperature to be used for sagging shall be determined by means of a Celsius-thermometer inserted in the end of a suitable length of phase conductor or shield wire from which a 150mm length has been removed

from the centre strand, or other accepted method. The wire with the thermometer inserted shall be hung at cross-arm level for at least two hours before the temperature is read.

- d) The length of a section of phase conductors and shield wires to be regulated at any one time shall be limited to that length that will assure attainment of correct sag based upon terrain and obstructions.
- e) Where there are a large number of suspension towers between strain towers, regulating of phase conductors and shield wires shall be done at intervals of 3 to 5 spans. In hilly country the conductors may require to be temporarily anchored one span away from the spans being regulated. The sag spans chosen shall be near each end of the section pulled for single conductor lengths, and near each end and at the middle for double conductor lengths. In addition, the sags shall be checked in all spans over 500m. In unusual situations, the Clerk of Works may require additional checks.
- f) The Contractor shall provide, and maintain in good condition, suitable dynamometers, sag boards or other accepted apparatus for the proper checking of the work. Dynamometers shall read in Newton and shall be tested and re-calibrated at regular intervals, at least for every major line project. The Contractor shall keep dynamometer calibration certificates at the site office.
- g) The Contractor shall notify the Clerk of Works at least twenty-four hours prior to any planned regulating operation. No regulating shall be done except in his presence, unless otherwise authorized. The Contractor shall furnish labour and equipment, for signalling and climbing purposes as requested by the Clerk of Works, to facilitate his inspection of the sag.
- h) In pulling up the conductor, caution shall be used to avoid pulling the conductor above sag.
- i) The maximum elapsed time from the beginning of the pulling operation to the completion of the regulating operation shall not exceed seventy two hours, nor shall the maximum elapsed time between the completion of the regulating operation and the completion of the clamping operation exceed seventy two hours. Conductor remaining in the blocks longer than the established limits shall be subject to inspection and, if damaged, replaced. The Contractor shall furnish labour and equipment as requested by the Clerk of Works for this purpose, as well as for inspection in the event of sudden windstorms.
- j) No minus regulating tolerance will be allowed. A plus regulating tolerance of 0,01 times the theoretical sag, but not exceeding 150mm will be allowed, provided all conductors in the regulating span assume the same relative position to true sag. Sags of conductors in the same bundle shall not vary more than 35mm relative to one another. Sag variances between phases shall not be apparent to the naked eye.
- k) When finally adjusting the sags of the phase conductors and shield wires, the sag shall be checked with sag boards, or other accepted methods in spans where the levels of the two structures are approximately the same, and the span length is approximately equal to the equivalent span length of the strain section. Upon completion of this regulating operation, as many successive spans as can be observed from the sag board position shall be checked for uniformity of sag.
- l) All conductors, except for conductors in sag sections over flat terrain, shall be plumb-marked at each structure for the complete section regulated, before clamping-in or dead-ending of the conductor is begun. Conductors shall be marked with paint crayon or wax pencil -not with metal objects.



- m) Insulator strings on three suspension towers adjacent to a new section to be regulated must be clamped to the conductor before temporary anchors are removed and regulating of the new section begins. These insulators shall remain in the plumb position upon completion of regulating of the new section and during plumb-marking.
- n) Regulating operations shall be conducted during daylight hours only. Regulating operations shall be suspended at any time, when in the opinion of the Clerk of Works, wind or other adverse weather conditions would prevent satisfactory regulating.
- o) Records of temperature sag and tension for each section regulated shall be kept by the Contractor, and a copy submitted to the Project Manager.
- p) On completion of regulating of a section of the line, the Contractor shall measure and record all clearances over roads, power lines, communication lines, railways etc. along the route. A copy of these records is to be submitted to the Project Manager. The Clerk of Works is to be notified immediately of any discrepancy found between the actual clearance and that shown on the profiles.

## **14.6. MIDSPAN JOINTS**

### **14.6.1. Jointing general**

- a) As far as possible, complete drum lengths of phase conductor and earth wire shall be used to reduce the number of joints;
- b) Joints shall not be closer than 15,0m from the nearest suspension structure and 30,0m from the nearest strain structure;
- c) Joints shall not be installed in spans crossing Railway lines, Proclaimed roads, Power lines, major communication lines and rivers;
- d) In no case shall more than one joint be installed in any given span, nor shall a joint be installed in a span dead-ended at both ends;
- e) The minimum distance between joints on the same phase shall be 300m.
- f) Whenever joints or dead-ends are made, auxiliary erection clamps and hauling devices shall not be placed closer than 8,0m to the point of joint or dead-end. The auxiliary erection clamps shall not allow relative movement of strands or layers of wire, and shall not birdcage, over tension or deform individual wires.
- g) The conductor shall be cut with a ratchet or guillotine cutter to produce a clean cut, retaining the normal strand lay and producing minimum burrs. The Aluminium strands shall then be stripped from the steel core by using an acceptable stripper. Under no circumstances shall high tensile hacksaw blades be used to cut conductor.
- h) The conductor shall be laid out for a distance of 15,0m and straightened at the ends before preparation for installation of joints or dead-ends. Compression jointing shall be carried out on a clean tarpaulin or jointing trailer. The lay of wires shall be tightened before the first compression is made. The conductor strands shall be cleaned by wire brushing and an accepted non-oxidizing paste applied.
- i) Compression shall be carefully made so that the completed joint or dead-end is as straight as possible. To minimize distortion, the joint should be rotated 180° between each compression operation, the joint and conductor being fully supported in the same plane as the compression jaws.

- j) If, in the opinion of the Clerk of Works, the completed joint or dead-end requires straightening, it shall be straightened on a wooden block by use of a sledgehammer and shaper or wooden mallet.
- k) If, in the opinion of the Clerk of Works, the joint or dead-end has not been satisfactorily straightened or has been damaged in the process, the Contractor shall replace it at his own cost.
- l) After compression has been completed, all corners, sharp projections and indentations resulting from compression shall be carefully rounded. All other edges and corners of the fitting that have been damaged shall be carefully rounded to their original radius. Nicked or abraded surfaces shall be carefully smoothed. Tape, tape residue and filler paste shall be removed from fittings and conductors.
- m) Sufficient notification must be given to Clerk of Works prior to the installation of compression fittings. Unless previously agreed all joints and dead-ends shall be installed in the presence of the Clerk of Works.
- n) Under no circumstances shall compression joint be allowed to pass through the travellers (stringing pulleys).
- o) During the progress of the stringing, the Contractor shall keep an accurate record of the spans in which conductor and earth conductor joints are made, the date of assembly onto the conductor. A copy of these records shall be supplied to the Project Manager.
- p) Only coded jointers authorized by the Project Manager shall carry out compression joints on the phase conductors & shield wires.
- q) Each coded jointer shall be issued with his own unique identification number or sign, which he shall use to punch completed joints as a register of his acceptance.
- r) All current carrying connections, contact surfaces, clamps, conductor and terminals shall be prepared as follows:
  - s) Wipe the mating surfaces free from grease and dirt (except the bores of compression sleeves);
  - t) Apply 1mm thick coating of approved jointing compound to the surfaces using a non-metallic spatula or similar tool;
  - u) Scrub all the coated surfaces thoroughly with a wire brush which is new or which has been used solely for this purpose;
  - v) Wipe off the jointing compound;
  - w) Apply a fresh 1mm thick coating of compound; and
  - x) After a period of not more than one minute make the connection in the normal manner and remove excess extruded compound.
- y) NOTE: No compound squeezed out by clamping pressure shall be used in making further joints. The Contractor shall apply such compound as necessary for making the connections by the method outlined above. On bolted connections care shall be taken during the tightening to avoid overstressing the bolts or components of the clamps. A torque wrench shall be used for tightening each bolt to the required torque.
  - Tighten all bolts and U-bolts to their specified torque.
  - Leave clamps for **24 hours** to allow Aluminium conductor to expand and contract.
  - Check all bolts to ensure that they are still at the required torque.

## **14.7. REPAIR SLEEVES**

### **14.7.1. Conductor repairs**

- a) Damage caused by the Contractor shall be repaired in a manner determined by the Clerk of Works.
  - Damage is any deformity on the surface of the conductor that can be detected by eye or by feel.
  - Damage includes, but is not limited to nicks, scratches, abrasions, kinks, bird caging, and popped out and broken strands.
- b) Depending upon the severity of the damage and the length of damaged section, the repair shall be made by careful smoothing with extra fine sandpaper, covering with preformed repair rods, installing a compression-type repair sleeve, or by cutting and splicing.
- c) Kinked, bird caged or severely damaged sections of conductor shall be cut out. When there is repeated damage in the same span, or in consecutive spans, the entire conductor in such spans shall be replaced.
- d) All damage caused by auxiliary erection clamps or other gripping devices shall be repaired or cut out, as instructed by the Supervisor, before the conductor is sagged.
- e) Preformed repair rods shall be installed if no more than one strand is broken, or nicked deeper than one third of the strand diameter, or when a number of strands are reduced in area not exceeding the area of one strand. Not more than two sets of preformed repair rods shall be installed on any one conductor in any given span.
- f) A compression-type repair sleeve shall be installed, if not more than one third of the outer strands of the conductor are damaged over a length of not more than 100mm, or not more than two strands are broken in the outer layer of conductor and the area of any other damaged strands is not reduced by more than 25%.
- g) Compression-type repair sleeves shall not be installed on one conductor in a given span if it already contains a conductor splice, conductor dead-end or another compression-type repair sleeve.
- h) Damage to the steel strands or aluminium strands, exceeding the stated limits for repair sleeves, shall be cut out and spliced by means of a compression type mid-span joint.
- i) Any foreign matter such as pitch, paint and grease placed on the conductor and fittings by the Contractor shall be removed by methods approved by the Supervisor prior to regulating.

## **14.8. CLAMPING IN**

### **14.8.1. Clamp of phase conductors and shield wires**

- a) The phase conductors and shield wires shall be clamped-in by the Contractor after the Clerk of Works has accepted the regulating operation as being in full compliance with the specifications and stringing data. Where offsets are required, the conductors shall be accurately adjusted in accordance with the offset clamping information developed by the Contractor.
- b) All conductors in a sag section shall normally be clamped-in, beginning at the second structure from the forward end of the pull, and shall progress structure by structure, until the conductors at all structures are clamped-in.

- c) The Contractor shall exercise extreme care in moving the phase conductors and shield wires from the stringing blocks to the suspension clamps.
- d) Where armour rods or conductor clamps incorporating armor rods are called for, they shall be installed in strict accordance with the manufacturer's recommendations. Armor rods shall be centered in each suspension clamp in such a manner that the clamp is not more than 50mm from the center of the rods. Variations between the ends of the individual rods shall not exceed 12mm.
- e) Aluminium rods shall be handled with the same care as the phase conductor.
- f) Properly calibrated torque wrenches shall be used to tighten suspension clamp and dead-end bolts to the Manufacturer's specified torque values. U-bolts shall be drawn up evenly to torque values.
- g) Bolts shall not be tightened excessively. Proof of calibration must be submitted to the Clerk of Works.
- h) All phase conductor support assemblies shall be installed such that the insulator string will hang in a vertical plane through points of insulator string attachment to structure, with the structure properly aligned.

## **14.9. VIBRATION DAMPERS**

### **14.9.1. Installation of vibration control devices**

- a) All work to be done in strict accordance with specification DST 34-1204
- b) Except for terminal structures at the closings span sides, all other structures on the entire line shall be equipped phase conductor and shield wire vibration dampers.
- c) The number of vibration dampers to be installed per span shall be as recommended by the manufacturer. The spacing from the mouth of the strain clamp or the centre of the suspension clamp shall be in accordance with the manufacturer's recommendations.
- d) If the use of armour rods makes it impossible to meet this spacing, the first damper shall be positioned at the end of the armour rods, and any additional dampers shall then be spaced from the first damper. Dampers shall be located within 25mm of their correct position.
- e) Vibration dampers shall be installed when clamping the conductor, but only after the conductor has been securely fastened in the conductor support assembly.
- f) Multi frequency Stockbridge type vibration dampers shall be installed so that they hang directly under the conductor.
- g) The installation of vibration dampers shall be in accordance with the manufacturer's recommendations.
- h) Vibration dampers shall be installed within 72 hours after clamping of the phase conductors and shield wires.
- i) All vibration control devices supplied by the Contractor for the project shall be technically approved by the Project Engineer prior to the installation thereof.

### **14.9.2. Phase conductor vibration damper positioning**

- a) Helically attached "Multi frequency Stockbridge or Dog-bone type" vibration dampers are to be installed on ACSR type phase conductor;
- b) The dampers must be installed in strict accordance with the Manufacturer's specifications;

- c) The number of multi frequency vibration dampers per span shall be:
  - Spans up to 350m : 2 (2 Subsets of 1);
  - Spans 351m to 550m : 4 (2 Subsets of 2);
  - Spans 551m to 730m : 6 (2 Subsets of 3);
  - Multi frequency vibration damper positioning is specific conductor related and specified per project.
- d) Min. 50mm bare conductor between armour rod ends to be maintained at all times;
- e) No damper must be positioned with the overlapping of the amour rods of any clamp.
- f) No damper must be positioned, overlapping the amour rods of any clamp and/or the next damper.
- g) Vibration dampers shall comply with D-DT 7005; bolted attachments are prohibited.

Note: The attachment clamp used to connect the damper to the conductor has traditionally been a bolted type of clamp. This type of clamping is not an acceptable clamping technology for distribution lines. A good clamping technology is helically formed rods. Clamping with helically formed rods ensures consistency and effectiveness of attachment.

The Dogbone vibration damper is used on larger conductors especially Rail. It has a damping efficiency as high as 70% in the 12-40 Hz range as compared to 40% efficiency in the range 11-13 Hz accepted for the traditional damper.

No tool is required for the installation. Installation or removal can be carried out without shut-down of the line by using hot stick application. There is a neoprene pad between damper and conductor which offers conductor protection from abrasion at the point of attachment. No concentrated radial stresses are set up under the clamp and the design completely eliminates any moisture build up and corrosion.

### **14.9.3. GS shield wire vibration damper positioning**

- a) "PVC Spiral" type vibration dampers are to be installed on the overhead GS shield-wire;
- b) The dampers must be installed in strict accordance with the Manufacturer's specifications;
- c) The number of spiral type vibration dampers per span shall be:
  - Spans up to 250m : 2 (2 Subsets of 1);
  - Spans 251m to 500m : 4 (2 Subsets of 2);
  - Spans 551m to 750m : 6 (2 Subsets of 3);
- d) Positioning of earth conductor dampers to be one hand's width from the mouth of the strain clamp or end of the suspension clamp armour rods and also one hand's width apart for cases where more than one damper are to be installed;
- e) No damper must be positioned with the overlapping of the amour rods of any clamp
- f) Positioning of the shield wire dampers to be one hand's width from the mouth of the strain clamp or end of the suspension clamp armour rods and also one hand's width apart for cases where more than one damper are to be installed. No damper must be positioned, overlapping the amour rod of any clamp and/or the next damper.

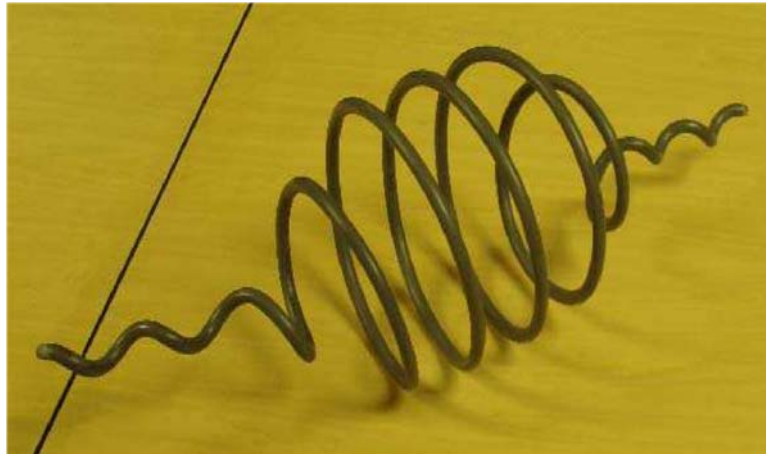
#### **14.9.4. Installation of jumper assemblies**

- a) The Contractor will be responsible for the safe storage, handling and transport of all jumper assembly fittings to the specified structures and the complete installation thereof.
- b) The phase conductor jumpers shall be formed to provide the maximum amount of clearance from earthed hardware and structure steelwork. The positioning of phase conductor jumpers shall comply with the clearances stated under the specified displacements.
- c) All phase to earth jumper clearances at phase conductor jumpers shall be measured by the Contractor in the presence of and as instructed by the Clerk of Works and records shall be submitted to the Project Engineer for acceptance.
- d) Jumper clearances not meeting the requirements shall be removed and replaced at the Contractor's own cost.
- e) Compression type jumper terminals shall be installed at all phase conductor jumper ends.
- f) Phase conductor jumpers around all mono-pole strain structures shall be supported with jumper insulator support assemblies.
- g) The shield wire jumpers shall be solid connected to all steel pole structures, except in cases where shield wire insulators are installed and at structures where it is specified that the overhead shield wire shall be omitted.

#### **14.10. BIRD FLIGHT DIVERTERS**

##### **14.10.1. Installation of bird flight diverters**

- a) The following Standards, Specifications, Guidelines and Drawings apply:
  - SCSASABF9 Section 4.9 Sub-transmission line Earthing Specification;
  - Project File
  - PLSCADD design profile sheets;
    - Project File PLSCADD design staking table;
    - Environmental **Management Plan Project File.**
- b) The "Bird diverters" for this project shall be supplied and installed by the Contractor.
- c) The Environmental Management Plan for the project will specify the bird flight routes and bird sensitive areas for the installation of "Bird diverters".
- d) "Bird diverters" shall be installed on 70% of the indicated spans, spread equally over mid span and 7,0m-10,0m apart with alternating colours GREY and WHITE.
- e) "Bird diverters" will be technically approved by the Employer's Environmental Manager prior to the purchasing and installation thereof.
- f) The "Tyco Flight Diverter" -Buyers guide reference D-DT-3107 is recommended for installation on this project.



**Figure 22: Tyco Flight Diverter**

- g) The "Tyco Flight Diverter" has been used successfully in many places around the world and has been installed on a line in the former North Western Region in conjunction with EWT and proved very successful as a mitigating device.

## **14.11. AIRCRAFT WARNING DEVICES**

### **14.11.1. Installation of aircraft warning devices**

- a) Aircraft warning devices required for this project shall be supplied and installed by the Contractor.
- b) The following Standards, Specifications, Guidelines and Drawings apply:
  - DSP 34-1681 Standard for aircraft warning devices used on overhead transmission, sub-transmission and distribution lines;
  - DST 34-2052 Aviation requirements for power lines, buildings, towers, wind turbines and related structures;
  - DSP\_34-254 Manufacturing specification for distribution equipment labels
  - Civil Aviation Act no. 13 of 2009 South African Civil Aviation Authority Act no. 40 of 1998 ICAO Annex 14 Volume 1 - Chapter 6 Visual aids for denoting obstacles;
  - Project File - PLSCADD design profile sheets.
- c) Aircraft warning sphere specifications
  - Maximum diameter = 600mm;
  - Maximum weight/unit = 5kg.
  - The two standard colours for the aircraft warning devices, as listed in SANS 1091, shall be:
    - Cloud White (SANS.G80, NCS 0704-G38Y, Nearest NCS 0505-G20Y); -
    - International Orange (SANS.A15, NCS 1777-Y72R, Nearest NCS 2075-Y70R).
- d) Aircraft warning sphere installation
  - AWS shall be installed by alternating the colours;
  - On a single overhead shield wire AWS shall be installed max. 30,0m apart;
  - On two overhead shield wires shall be installed alternating max. 30,0m apart (Max. 60,0m apart on the same shield wire);
  - In both single and/or double overhead shield wires the aircraft warning spheres shall be equally spread on either side of mid span.

- e) The centre mount "Aircraft Warning Sphere" manufactured by "Inotec Innovative Technologies (Pty) Ltd" or similar approved is preferred for application on this project.



Figure 23: Aircraft Warning Sphere

## 15. ACTIVITY STAGE 10

### POWER LINE LABELLING ACTIVITIES

#### 15.1. SUPPLY AND TRANSPORT TO SITE OF LINE AND STRUCTURE IDENTIFICATION LABELS AND ACCESSORIES

- a) The following Standards, Specifications, Guidelines and Drawings apply:
- TRMSCAAC1 Rev. 3 -Section 7.7.4 Transmission line tower and Line construction;
  - 34-1439 Eskom's Labelling Standard;
  - DISASZAA2 Section 2 Application standard for Distribution Equipment Labels;
  - Project File Project File Route Plan;
  - Project File Label manufacturing detail drawings;
  - Project File PLSCADD design profile sheets.
- b) The power line labels as well as all material required for the installation power line labels shall be supplied and delivered to site by the Contractor.
- c) Prior to the purchasing of power line labels written confirmation of the structure identification label codes shall be obtained from the Gauteng Operation Unit Network Planning Manager.
- d) The labels to be supplied by the Contractor:
- Line designation labels:
    - Label 1:-"Line Label Name" to be installed at the terminal structure at Substation Name.
    - Label 2:-"Line Label Name" to be installed at the line terminal structure at Substation Name.
    - Label 3:-"Line Label Name" to be installed at the Substation Name to Substation Name T-off structure.
    - The labels shall be manufactured to specification: DSP\_34254.
    - The 122mm x 1,0mm thick (Length of label will vary to suit relevant line designation) "Line Designation"
  - Structure identification labels:
    - The new "Line Name" codes shall be as follow:
    - " Line Label Name " starting at Substation Name up to the Substation Name



- The labels shall be manufactured to specification: DSP\_34254 Latest Revision.
  - 122mm x 1,0mm thick (Length of label will vary to suit relevant line code) "Structure identification".
  - Phase colour disc labels:
    - The labels shall be manufactured to drawing: D-DT-5047s3.
    - Dia 230mm x 1,0mm thick "Phase Colour Disc" labels (RED, WHITE, BLUE).
  - Line crossing labels:
    - 406 x 900mm x 1,0mm thick "Line crossing" labels must be manufactured to specification: DSP\_34254 and supported by a 15mm x 15mm x 1,6mm Aluminium square tube frame.
- Each label shall be properly strapped to the pole or structure with 4 x 12mm x 1,7mm thick heavy duty bandit strapping.

## **15.2. SAFE STORAGE, HANDLING AND TRANSPORT TO PEG OF LINE AND STRUCTURE IDENTIFICATION LABELS AND ACCESSORIES**

- a) The Contractor will be responsible for safe storage of all power line labels and accessories.
- b) Labels shall be stored on a flat surface not to cause any bend and cracks to the finished label surfaces.
- c) Special care shall be taken in handling and transport of line labels not to cause any surface damage to the line labels.

## **15.3. SAFE HANDLING AND COMPLETE INSTALLATION OF POWER LINE AND STRUCTURE IDENTIFICATION LABELS**

- a) The labels shall be installed by the Contractor:
  - Line designation labels:
    - Labels shall be fitted vertically below the bottom phase conductor attachment at the specified structures.
    - The line designation label shall face towards the substation where it must be installed.
    - Each label shall be properly strapped to the pole structure with 4 x 12mm x 1,7mm thick heavy-duty bandit strapping.
  - Structure identification labels:
    - Labels shall be fitted vertically midway between the lowest conductor attachment and ground level on every structure on the line.
    - The label shall face towards the substation first mentioned on the label code.
    - Each label shall be strapped to the pole structure with 3 x 12mm x 1,7mm thick heavy-duty bandit strapping.
  - Phase colour disc labels:
    - The line phases shall be identified by means of phase colour disc labels installed at the beginning and end of the line, as well as any other position on the line specified by the Project Engineer
    - The labels shall be fitted at the phases in the correct orientation at the Substation Name substation line terminal structure, and at the Substation Name substation line terminal structure.
    - Each label shall be strapped to the pole structure with 1 x 12mm x 1,7mm thick heavy-duty bandit strapping.

- Line crossing labels:
  - Line crossing labels must be installed at all major line crossings, unless otherwise specified by the Project Engineer.
  - The first, second and third structures away from an intersection point in all directions must be provided with line crossing labels.
  - At mono-pole structures the label shall be installed at the top of the structure, below the shield wire attachment and facing away from the point of intersection, or
  - At lattice steel towers the label shall be installed the transverse face of the cross-arm, facing away from the point of intersection.
  - Each label shall be properly strapped to the pole or structure with 4 x 12mm x 1,7mm thick heavy duty bandit strapping.

## **16. ACTIVITY STAGE 11**

### **DISMANTLING AND REMOVAL OF THE EXISTING NAME LINE**

#### **16.1. DECOMMISSIONING EXISTING LINE AND DISCONNECT LINE SECTIONS**

- a) The existing Name line section between Name to be decommissioned and disconnected as specified in the design document.

#### **16.2. DISMANTLE, CUT, BUNDLE, TRANSPORT AND STOCKPILE OF PHASE CONDUCTOR, SHIELD WIRE, STAY ASSEMBLIES, INSULATORS & HARDWARE**

- a) The phase conductors and/or shield wires shall not be cut under ruling tension conditions. The phase conductors and shield wires must be carefully slacken-out and dropped from the structures.
- b) Special care shall be taken to prevent any unsafe conditions and/or damages to services such as Railway lines, proclaimed roads, Telkom lines and power lines, etc. crossing under the existing line.
- c) ACSR phase conductor, shield wire and stay wires shall be cut, bundled and transported and stockpiled at a pre-allocated storage site for further disposal by the Employer, unless otherwise requested by the Employer's Asset Disposal Manager.
- d) Copper phase conductor shall be cut and bundled by the Contractor, only. All further handling and removal from site shall be done by an Eskom accredited scrap dealer. The Eskom Clerk of Works shall arrange and supervise such removal.
- e) All Copper phase conductor loads shall be weighed and recorded in the presence of the Eskom Clerk of Works, prior to removal from site by the Eskom accredited scrap dealer.
- f) All dismantled, insulators, line hardware, stay assemblies shall be removed from site by the Contractor, transported and stockpiled at a pre-allocated storage-site for further disposal by the Employer, unless otherwise requested and/or specified by the Employer's Asset Disposal Manager.

### **16.3. MINIMUM EXCAVATIONS AROUND STRUCTURE LEGS AND UNDERGROUND STAY ASSEMBLIES**

- a) All existing steel pole structure legs shall be completely removed. Minimum excavations shall be done around structure legs to the various planted depths, for the complete removal thereof.
- b) In veld and rocky areas underground stay assemblies can be cut min. 1,0m below natural ground level.
- c) In other areas such as cultivated lands, town developments, etc. underground stay assemblies shall be completely removed.

### **16.4. COMPLETE DISMANTLING AND REMOVAL OF EXISTING POWER LINE STRUCTURES**

- a) All steel structure legs shall be completely removed from the ground. No part of any structure shall be cut off and/or left in the ground.
- b) Steel structures shall be dismantled into manageable parts.
- c) All dismantled structure members and legs shall be removed from site by the Contractor, transported and stockpiled at a pre-allocated storage-site for further disposal by the Employer, unless otherwise requested and/or specified by the Employer's Asset Disposal Manager.

### **16.5. RE-INSTATE ALL EXISTING STRUCTURE SITES**

- a) All work to be done in accordance with the Environmental Management Plan for this project.
- b) All excavations left from structure legs and underground stay assemblies shall be properly backfilled with in-situ excavated material and thoroughly compacted.
- c) Where additional backfill material is required, the Contractor shall import any suitable topsoil to complete the backfilling.
- d) All dismantled structure sites shall be properly reinstated to prevent any possible erosion that might originate from these sites.
- e) All damaged and deep vehicle tracks caused to the veld and environment on the dismantled line route shall be properly covered with suitable top soil and re-instated by the Contractor.

## **17. ACTIVITY STAGE 12**

### **TAKING OVER OF THE WORKS AND CLEARANCE OF SITE**

#### **17.1. RE-INSTATE ENTIRE CONSTRUCTION SITE AND ROADS**

##### **17.1.1. Re-instate entire construction site**

- a) The Contractor shall clear the entire construction site. All construction waists, cement bags, conductor strand off-cuts, shall be removed from site and disposed as prescribed in the Environmental Management Plan.

- b) Closing of construction access roads and providing of the necessary erosion protection measures on all construction areas, as specified in TRMSCAAC1 Clause 4.5 and 4.6 and to the relevant Landowner's satisfaction.
- c) Any position along the line route showing signs of possible soil erosion caused by construction activities shall be properly re-instated by the Contractor.
- d) Arrangements shall be made by the Contractor to rip and re-instate all cultivated lands compacted due to construction activities.
- e) Landowners shall be compensated by the Employer for any crop damages caused inside the servitude due to construction activities. Any damages caused to crops outside the servitude by the Contractor during construction activities shall be compensated by the Contractor.

## 17.2. CLOSURE OF CONSTRUCTION ROADS

- a) Upon completion, only roads as indicated by the Clerk of Works shall be closed, unless otherwise specified by the Employer and/or Landowner.
- b) In areas where no cut or fill has been made, barriers of earth, rocks or other suitable material shall affect closure.
- c) In areas 30 % slope and less, the fill of the road shall be placed back into the roadway using equipment that does not work outside the road-cut (e.g. back-hoe). In areas of greater than 30 % slope, the equipment shall break the road shoulder down so that the slope nearly approximates to the original slope of the ground. The cut banks shall be pushed down into the road, and a near normal side slope shall be re-established and re-vegetated.
- d) Replacement of earth shall be at slopes less than the normal angle of repose for the soil type involved.
- e) Construction of water diversion berms
  - Water diversion berms shall be installed as specified in this document
  - Borrow pits:
    - The **Contractor's** decision as to the location of borrow pits, shall be at the **Clerk of Works** acceptance;
    - The **Contractor** shall be responsible for the rehabilitation and re-vegetation of the borrow pits.
    - It is the **Contractor's** responsibility to negotiate the royalties for borrow pits with the relevant **Landowners**.

## 17.3. FINAL INSPECTION OF THE LINE

- a) The pre-commissioning final inspection on the line shall be carried out in accordance with the relevant Eskom Specifications and Standards, Design Profile Drawings and Route Plan, as well as the "Installation Records" of the line and the "Contract Documentation" for the project.
- b) A pre-arranged final inspection on the entire line shall be held, at least 10 days prior to the commissioning of the new line.
- c) The compulsory final inspection shall be accompanied by the following individuals:
  - The Contractor;
  - The Project Manager;
  - The Clerk of Works; d) The Project Engineer;
  - The Environmental Control Officer and the Employers Environmental Official;

- The Field Services and Plant Officials responsible for the line.
- d) The final quality inspection shall be held "Pole-to-Pole" covering all aspects of the new installation.
- e) All quality related defects from the "Defects List" compiled during the final inspection shall be rectified by the Contractor, prior to the commissioning of the line.

#### **17.4. HANDING OVER, TEST & COMMISSIONING**

- a) Indemnity forms shall be signed by all relevant Landowners in the presence of the Clerk of Works, expressing their satisfaction or dissatisfaction with the Contractors performance and behaviour on his/her property, prior to the handing-over of the project to the Field Services Manager.
- b) All jumper clearances shall be measured and submitted for handing-over by the Contractor.
- c) The Contractor shall assist the Employer in commissioning the new power line.

#### **17.5. SUBMISSION OF "AS BUILT" INFORMATION**

- a) The Contractor in conjunction with the Clerk of Works will be responsible for the compilation of the "As Built" information on the newly constructed power line.
- b) Four copies of a complete "Line Inventory" of the total line shall be submitted to the Employer on completion of all the work on site.
- c) The following information to be included in the "Line Inventory":
  - Copies of the "Introduction Agreements" and "Indemnity Agreements" between the Employer, the Contractor and all the Landowners on the power line;
  - "As Built" Line route data (Gate installation/refurbishment; Bush clearing; Herbicides application and Access road data);
  - Structure and structure label data;
  - Structure foundation type data;
  - Structure footing resistance data;
  - Insulator assembly and hardware data;
  - Phase conductor & shield wire drum data;
  - "As Built" Sag & tension data;
  - Mid span joint and conductor repair data;
  - Crossing clearances data;
  - Jumper clearances data;
  - Stringing equipment calibration certificates;
  - Compression joint test certificates;
  - "As Built" drawings.

#### **17.6. SITE CLEARANCE**

- a) In the event of the Contractor not pricing the items of the Taking over of the Works and Clearing of site Activities in sufficient detail, the Employer reserves the right to exercise its own discretion in the apportionment to individual items of the total

Taking over of the Works and Clearing of site Activity prices within the contract documents.

- b) The Contractor will be responsible for the proper clearance of the construction as well as camp sites:
- Removal of all temporary established items by the Contractor, see Activity Stage 1;
  - Clearing of construction camp sites from all rubble, waste and rubbish resulting from construction activities and re-instatement of these terrains.
  - Removal of all excess material supplied by the Employer (Hardware, insulators, copper, etc.) from site and returning of such material to the nearest Identified Site.

## 18. CONSTRUCTION GUIDELINES

### 18.1. GENERAL INFORMATION

#### 18.1.1. Information Tables

Table 30: Conductor Properties

| Conductor Type   | Stranding & wire diameter (mm) | Overall diameter (mm) | Al area (mm <sup>2</sup> ) | Steel area (mm <sup>2</sup> ) | Total area (mm <sup>2</sup> ) | Weight Mass (kg/m) | N/m     | UTS (kN) |
|------------------|--------------------------------|-----------------------|----------------------------|-------------------------------|-------------------------------|--------------------|---------|----------|
| <b>MAGPIE</b>    | 3/4/2.118                      | 6.35                  |                            |                               | 24.71                         | 0.1397             | 1.3705  | 18.57    |
| <b>SQUIRREL</b>  | 6/1/2.11                       | 6.33                  |                            |                               | 24.48                         | 0.0852             | 0.8358  | 8.02     |
| <b>FOX</b>       | 6/1/2.79                       | 8.37                  | 36.68                      | 6.11                          | 42.80                         | 0.1490             | 1.4617  | 13.10    |
| <b>MINK</b>      | 6/1/3.66                       | 10.98                 | 63.13                      | 10.52                         | 73.65                         | 0.2570             | 2.5212  | 21.90    |
| <b>HARE</b>      | 6/1/4.72                       | 14.16                 | 104.98                     | 17.50                         | 122.48                        | 0.4270             | 4.1889  | 36.00    |
| <b>WOLF</b>      | 30/7/2.59                      | 18.13                 | 158.06                     | 36.88                         | 194.94                        | 0.7300             | 7.1613  | 69.20    |
| <b>CHICKADEE</b> | 18/1/3.77                      | 18.87                 | 200.93                     | 11.16                         | 212.09                        | 0.6430             | 6.3078  | 44.90    |
| <b>LYNX</b>      | 30/7/2.79                      | 19.53                 | 183.4                      | 42.77                         | 226.20                        | 0.8460             | 8.2993  | 79.30    |
| <b>PANTHER</b>   | 30/7/3.00                      | 21.00                 | 212.06                     | 49.48                         | 261.54                        | 0.9700             | 9.5157  | 90.80    |
| <b>PELICAN</b>   | 18/1/4.21                      | 20.70                 | 242.31                     | 13.46                         | 255.77                        | 0.7750             | 7.6028  | 53.80    |
| <b>BEAR</b>      | 30/7/3.35                      | 23.45                 | 264.42                     | 61.70                         | 326.12                        | 1.2200             | 11.9682 | 112.00   |
| <b>GOAT</b>      | 30/7/3.71                      | 25.97                 | 324.31                     | 75.67                         | 399.98                        | 1.5000             | 14.7150 | 136.00   |
| <b>KINGBIRD</b>  | 18/1/4.78                      | 23.88                 | 323.01                     | 17.95                         | 340.20                        | 1.0280             | 10.0847 | 69.80    |
| <b>TERN</b>      | 45/3.38+7/2.25                 | 27.00                 | 403.77                     | 27.83                         | 431.60                        | 1.3400             | 13.1454 | 98.70    |

|                      |                |       |        |       |        |        |         |        |
|----------------------|----------------|-------|--------|-------|--------|--------|---------|--------|
| <b>ZEBRA</b>         | 54/7/3.18      | 28.62 | 428.88 | 55.60 | 484.48 | 1.6300 | 15.9903 | 133.00 |
| <b>BERSFORT</b>      | 48/4.27+7/3.32 | 35.58 |        |       | 747.96 | 2.369  | 23.24   | 177.65 |
| <b>Steel 19/2.65</b> | 19/2.65        | 13.25 |        |       | 104.8  | 0.826  | 8.1     | 113    |
| <b>Steel 7/3.35</b>  | 7/3.35         | 10.50 |        | 61.70 | 61.70  | 0.4850 | 4.7579  | 67.45  |
| <b>Steel 3/3.35</b>  | 3/3.35         | 7.35  |        | 26.44 | 26.44  | 0.2150 | 2.1092  | 29.10  |

**Table 31: Standard Electrical Clearances**

| System Nominal Voltage (kV) | System Highest Voltage (kV) | Minimum clearance (mm) |                | Working clearance (m) |            |
|-----------------------------|-----------------------------|------------------------|----------------|-----------------------|------------|
|                             |                             | Phase to Earth         | Phase to Phase | Vertical              | Horizontal |
| <b>3.3</b>                  | 3.6                         | 80                     | 110            | 2.5                   | 1.2        |
| <b>6.6</b>                  | 7.2                         | 150                    | 200            | 2.6                   | 1.2        |
| <b>11</b>                   | 12                          | 200                    | 270            | 2.7                   | 1.3        |
| <b>15</b>                   | 17.5                        | 230                    | 310            | 2.7                   | 1.3        |
| <b>22</b>                   | 24                          | 320                    | 430            | 2.8                   | 1.4        |
| <b>33</b>                   | 36                          | 430                    | 580            | 2.9                   | 1.5        |
| <b>44</b>                   | 48                          | 540                    | 730            | 3                     | 1.6        |
| <b>66</b>                   | 72                          | 770                    | 1050           | 3.2                   | 1.8        |
| <b>88</b>                   | 100                         | 840                    | 1150           | 3.3                   | 1.9        |
| <b>132</b>                  | 145                         | 1200                   | 1650           | 3.7                   | 2.3        |
| <b>220</b>                  | 245                         | 1850                   | 2300           | 4.3                   | 2.9        |
| <b>275</b>                  | 300                         | 2350                   | 2950           | 4.8                   | 3.4        |
| <b>330</b>                  | 362                         | 2900                   | 3600           | 5.4                   | 4          |
| <b>400</b>                  | 420                         | 3200                   | 4000           | 5.7                   | 4.3        |

**Table 32: Power Line Servitudes and Building Restrictions**

| Line Voltage (kV)           | Building Restriction | Separation     | Timber Restriction |
|-----------------------------|----------------------|----------------|--------------------|
|                             | From Line Centre     | Parallel Lines | Forestry Area      |
| <b>22 and below</b>         | 11                   | 12             | -                  |
| <b>33 (H-pole)</b>          | 15.5                 | 14             | -                  |
| <b>66</b>                   | 15.5                 | 14             | 33                 |
| <b>88 (Horizontal)</b>      | 15.5                 | 21             | 33.5               |
| <b>88 (Delta)</b>           | 15.5                 | 15             | 33.5               |
| <b>132 (Mono pole)</b>      | 15.5                 | 15             | 36                 |
| <b>132 (Horizontal)</b>     | 15.5                 | 21             | 36                 |
| <b>132 (Double circuit)</b> | 15.5                 | 32             | 36                 |
| <b>275</b>                  | 23.5                 | 32             | 38.5               |
| <b>400</b>                  | 23.5                 | 35             | 38.5               |
| <b>765</b>                  | 40                   | 60             | -                  |



**Table 33: Standard Insulation Levels and Creepage Distances**

| System<br>Nominal<br>Voltage<br>(kV) | System<br>Highest<br>Voltage<br>(kV) | BIL<br>at<br>sea<br>level<br>(kV) | 60 sec power<br>Hz withstand<br>test<br>(kV) | Creepage distance over external<br>insulation |                 |                 |
|--------------------------------------|--------------------------------------|-----------------------------------|--|---|-----------------|-----------------|
|                                      |                                      |                                   |  | Normal<br>(mm)                                | Special<br>(mm) | Extreme<br>(mm) |
| <b>3.3</b>                           | 3.6                                  | 45                                | 16   | 70  | 70              | 125             |
| <b>6.6</b>                           | 7.2                                  | 75                                | 22   | 140   | 140             | 180             |
| <b>11</b>                            | 12                                   | 95                                | 28   | 240   | 240             | 300             |
| <b>15</b>                            | 17.5                                 | 110                               | 38   | 350   | 350             | 440             |
| <b>22</b>                            | 24                                   | 150                               | 50   | 480   | 480             | 600             |
| <b>33</b>                            | 36                                   | 200                               | 70   | 720   | 720             | 900             |
| <b>44</b>                            | 48                                   | 250                               | 95   | 960   | 960             | 1200            |
| <b>66</b>                            | 72                                   | 350                               | 140  | 1400  | 1400            | 1800            |
| <b>88</b>                            | 100                                  | 380                               | 150  | 2000  | 2000            | 2500            |
| <b>132</b>                           | 145                                  | 550                               | 230  | 2900  | 2900            | 3600            |
| <b>220</b>                           | 245                                  | 825                               | 360  | 3700  | 4900            | 6100            |
| <b>275</b>                           | 300                                  | 1050                              | 460  | 4500  | 6000            | 7500            |
| <b>330</b>                           | 362                                  | 1300                              | 570  | 5500  | 7300            | 9000            |
| <b>400</b>                           | 420                                  | 1425                              | 630  | 6300  | 8400            | 10500           |

Table 34: Minimum Vertical Clearances of Power Lines at Maximum Sag and Swing

| Description  |           | Note   | Data/Minimum Clearance  |      |                                      |                           |      |                                  |                   |                  |                 |      |
|--|-----------|--|---|------|--------------------------------------|---------------------------|------|----------------------------------|-------------------|------------------|-----------------|------|
| System Nominal Voltage (kV)  |           |  | 6.6   | 11   | 22                                   | 33                        | 44   | 66                               | 88                | 132              | 275             | 400  |
| Highest System Voltage (kV)  |           |  | 7.2   | 12   | 24                                   | 36                        | 48   | 72                               | 100               | 145              | 300             | 420  |
| Minimum Safety Clearances  |           |  |   |      |                                      |                           |      |                                  |                   |                  |                 |      |
| Phase to Ground (m)  |           |  | 0.15  | 0.20 | 0.32                                 | 0.43                      | 0.54 | 0.77                             | 1.00              | 1.45             | 2.35            | 3.20 |
| Phase to Phase (m)   |           |  | 0.20  | 0.30 | 0.40                                 | 0.60                      | 0.70 | 1.00                             | 1.20              | 1.70             | 3.00            | 4.00 |
| Minimum Vertical Clearances  |           |  |   |      |                                      |                           |      |                                  |                   |                  |                 |      |
| Above ground outside townships (m)   |           | 1  | 5.0   | 5.1  | 5.2                                  | 5.3                       | 5.4  | 5.7                              | 5.9               | 6.3              | 7.2             | 8.1  |
| Above ground inside townships (m)  |           | 1  | 5.5   | 5.5  | 5.5                                  | 5.5                       | 5.5  | 5.7                              | 5.9               | 6.3              | 7.2             | 8.1  |
| Above roads in townships (m)   |           | 7  | 7.5   | 7.5  | 7.5                                  | 7.5                       | 7.5  | 7.5                              | 7.5               | 7.5              | 8.4             | 9.3  |
| Above proclaimed roads outside townships (m)                                   |           | 7  | 7.5   | 7.5  | 7.5                                  | 7.5                       | 7.5  | 7.5                              | 7.5               | 7.5              | 8.4             | 9.3  |
| To building, poles and structures not part of the power line (m)               |           |  | 3.0   | 3.0  | 3.0                                  | 3.0                       | 3.0  | 3.2                              | 3.4               | 3.8              | 4.4             | 5.6  |
| To other power lines (m)   |           | 2  | 0.7   | 0.8  | 0.9                                  | 1.0                       | 1.1  | 1.4                              | 1.6               | 2.0              | 2.9             | 3.8  |
| To telephone lines - Angle of crossing from right angle                        |           |  | 45°   | 45°  | 30°                                  | 30°                       | 30°  | 30°                              | 30°               | 30°              | 30°             | 30°  |
| To TELKOM telephone lines (m)  |           | 3  | 1.8   | 1.8  | 1.8                                  | 1.8                       | 1.8  | 1.8                              | 1.8               | 2.0              | 2.9             | 3.8  |
| To SPOORNET telephone lines (m)  |           | 3  | 1.4   | 1.4  | 1.5                                  | 1.7                       | 1.8  | 2.0                              | 2.2               | 2.7              | 3.6             | 4.5  |
| To SPOORNET railways non-electrified (m)                                       |           | 4 & 5  | 9.6   | 9.7  | 9.8                                  | 9.9                       | 10.0 | 10.2                             | 10.4              | 10.9             | 11.8            | 12.7 |
| To SPOORNET railways non-electrified (m)                                       |           | 6  | 11.2  | 11.3 | 11.4                                 | 11.5                      | 1.6  | 11.8                             | 12.0              | 12.4             | 13.3            | 14.2 |
| To SPOORNET electrification structures (m)                                     |           |  | 3.0   | 3.0  | 3.0                                  | 3.0                       | 3.0  | 3.2                              | 3.4               | 3.8              | 4.8             | 5.5  |
| To SPOORNET electrification live wires & track earth wires (m)                 |           |  | 2.0   | 2.1  | 2.2                                  | 2.3                       | 2.4  | 2.5                              | 2.8               | 3.3              | 4.2             | 5.0  |
| To SPOORNET earth wires (Power Lines) (m)                                      |           |  | 0.7   | 0.8  | 0.9                                  | 1.0                       | 1.1  | 1.4                              | 1.6               | 2.1              | 2.9             | 3.8  |
| To SPOORNET other power lines (m)  |           | 2  | 1.4   | 1.4  | 1.5                                  | 1.7                       | 1.8  | 2.0                              | 2.2               | 2.4              | 3.5             | 4.5  |
| EXPLOSIVE MAGAZINES  |           |  | QUARRIES  |      |                                      | ROADS (From road reserve) |      |                                  | Parallel to roads |                  | Crossings roads |      |
| Spans  | Clearance | Only single shot blasting is permitted within 457m of a power line |   |      | National roads                       |                           |      | 60m to structure                 |                   | 20m to structure |                 |      |
| Under 30m  | 15.2m     |  |   |      | Important main roads                 |                           |      | 32m to line centre               |                   | 16m to structure |                 |      |
| 30 - 167m  | 31.3m     | AERODROMES & RIFLE RANGES  |   |      | Less important main roads            |                           |      | 32m to line centre               |                   | 16m to structure |                 |      |
| Over 167m  | 30.5m     | See Land Survey Manual Vol. 1                                      |   |      | Low traffic dust roads (from centre) |                           |      | 40m to line centre               |                   | 16m to structure |                 |      |
| NOTES:   |           |  | 4.Single power lines not at station yard                        |      |                                      |                           |      | 7.For abnormal load route = 7.5m |                   |                  |                 |      |
| 1. +0.6m on major line templating  |           |  | 5. Where  |      |                                      |                           |      |                                  |                   |                  |                 |      |
| 2. Higher conductor at 50°C, Lower conductor at -5°C                           |           |  | electrification is not foreseen (See Land Survey Manual Vol. 1) |      |                                      |                           |      |                                  |                   |                  |                 |      |
| 3. Min. clearance as per letter Distribution Engineering Manager (A.Y.Poulton) |           |  | 6.Multiple crossings & single power lines at station yard       |      |                                      |                           |      |                                  |                   |                  |                 |      |

## 19. CONCRETE MIX GUIDELINES

### 19.1. BACKGROUND

- a) A tower is only as stable as its foundation. Therefore the strength of the concrete/reinforcing, that constitutes the foundation, is of utmost importance.

### 19.2. BATCH MIX

This is the preferred method of mixing to be used as it guarantees the required strength.

- b) Concrete strength is normally specified as a certain strength after 28 days. The 28 days create a problem as Construction cannot afford to wait this long before commencing with erection work. To overcome the problem, a stronger strength concrete must be ordered, as concrete reaches 60% of its 28 day strength after 7 days.

|                         |    | Concrete Ordered<br>(MPa) |    |
|-------------------------|----|---------------------------|----|
|                         |    | 42                        | 50 |
| 7 Day strength<br>(MPa) | 20 | 25                        | 30 |

#### NOTES:

- Never add any additional water if the concrete has been batch-mixed, as this weakens the concrete considerably.
- Order 13mm stone concrete for foundations with steel reinforcing.
- Records must be kept (delivery notes) of all batch mix deliveries.
- Take a random sample from such deliveries periodically and allow sample to cure for 28 days. Then get it tested at a reputable laboratory.

## 20. CONCRETE HAND MIX

- a) Hand-mixed concrete should be avoided as far as possible as it is difficult to control the mixing ratios.
- b) However, if concrete must be hand-mixed, the following precautions should be taken:
- Order 13mm stone.
  - Adhere to the given ratios.
  - Do a slump test to prove your mix.
  - Do not over vibrate!


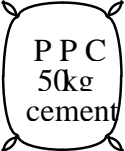
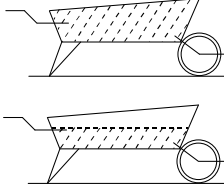
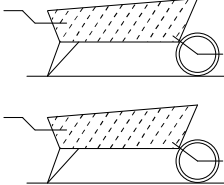
### 20.1. RATIOS

- |                 |   |           |   |      |
|-----------------|---|-----------|---|------|
| • 1 Bag Cement  | = | 33 litre  | = | 50kg |
| • 1 Wheelbarrow | = | 65 litre  |   |      |
| • 1kg Sand      | = | 0,8 litre |   |      |


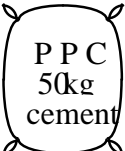
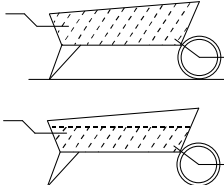
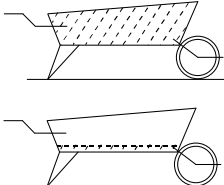
- 1kg Stone (19mm) = 0,75 litre
- 1kg Stone (13mm) = 0,73 Liter

## 20.2. HAND MIX 20MPa CONCRETE MECHANICALLY VIBRATED


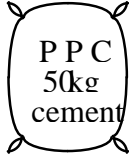
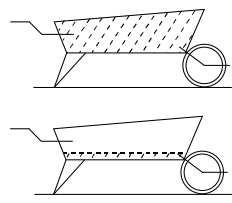
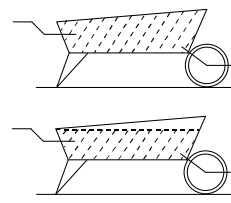
- 19mm Stone: 20MPa
- 1m<sup>3</sup> Concrete = 10 Bags cement + 0.7m<sup>3</sup> Sand + 0.92m<sup>3</sup> Stone

| Water   | Cement  | Sand   | Stone 19mm  |
|---|---|--|---|
|  |  |  |  |
| <b>24 litres</b>  | <b>1 bag</b>  | <b>1 + 1/2 wheelbarrows</b>  | <b>2 wheelbarrows</b>   |
| <b>24 litres</b>  | <b>33 litres</b>  | <b>95 litres</b>   | <b>125 litres</b>   |
|   |   | <b>12 + 6 shovels</b>  | <b>12 + 12 shovels</b>  |

- 9.5mm to 13.2mm Stone: 20MPa
- 1m<sup>3</sup> Concrete = 10 Bags cement + 0.77m<sup>3</sup> Sand + 0.6m<sup>3</sup> Stone

| Water   | Cement  | Sand   | Stone 9.5mm to 13.2mm   |
|---|---|--|---|
|  |  |  |  |
| <b>23.5 litres</b>  | <b>1 bag</b>  | <b>1.6 wheelbarrows</b>  | <b>1.2 wheelbarrows</b>   |
| <b>23.5 litres</b>  | <b>33 litres</b>  | <b>105 litres</b>  | <b>80 litres</b>  |
|   |   | <b>12 + 7 shovels</b>  | <b>12 + 2 shovels</b>   |

- 19mm Stone: 25MPa
- $1\text{m}^3$  Concrete = 10 Bags cement +  $0.6\text{m}^3$  Sand +  $0.81\text{m}^3$  Stone

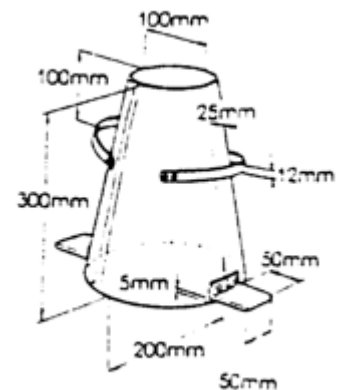
| Water   | Cement  | Sand   | Stone 19mm  |
|---|---|--|---|
|  |  |  |  |
| <b>21.5 litres</b>  | <b>1 bag</b>  | <b>1.2 wheelbarrows</b>  | <b>1.7 wheelbarrows</b>   |
| <b>21.5 litres</b>  | <b>33 litres</b>  | <b>80 litres</b>   | <b>110 litres</b>   |
|   |   | <b>12 + 2 shovels</b>  | <b>12 + 8 shovels</b>   |

- 9.5 to 13.2mm Stone: 25Mpa
- $1\text{m}^3$  Concrete = 10 Bags cement +  $0.66\text{m}^3$  Sand +  $0.6\text{m}^3$  Stone

## 20.3. TESTS ON CONCRETE: SLUMP TEST

### 20.3.1. Materials and Tools

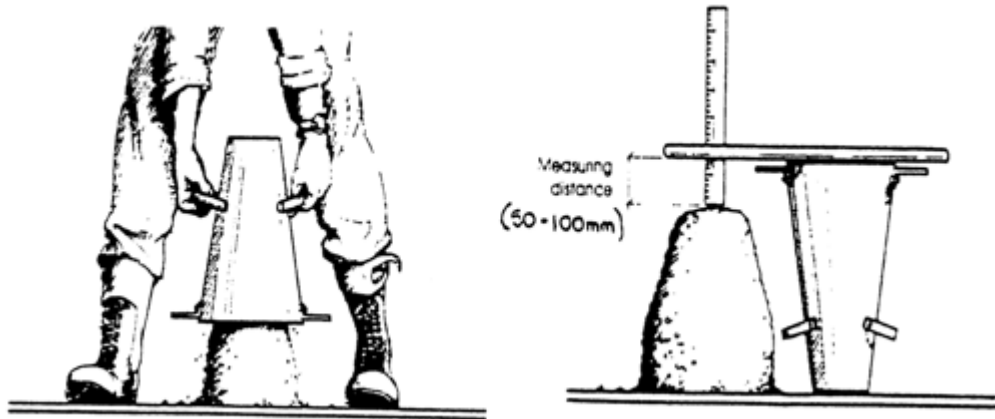
- A wheelbarrow and shovel
- A sample of freshly mixed concrete (about half a wheelbar)
- row full)
- A flat steel plate about 600 x 600mm by 3mm thick
- A metric rule or tape measure
- A scoop
- A steel tamping rod, 16mm in diameter by 600mm long
- with one end rounded
- A small trowel (gauging trowel)
- A standard slump cone



### 20.3.2. How to measure the slump

- Mix the concrete in the wheelbarrow.
- Wipe all the tools with a damp cloth.
- Put the steel plate down on a level place so that it is firm, and then put the slump cone in the foot pieces.
- Fill the slump cone in four layers of about 75mm. Tamp through each layer 25 times with the rounded end of the tamping rod.
- The last layer should more than fill the cone. After tamping the last layer, use the trowel to smooth off the top of the concrete so that it is level with the top of the cone.
- Hold the cone by the handles to keep it steady while you step off the foot pieces.
- Slowly lift the slump cone straight up and off.

- h) Turn the slump cone upside down and place it on the plate, next to the concrete.



## **21. BASIC STRINGING PROCEDURE**

### **21.1. INTRODUCTION**

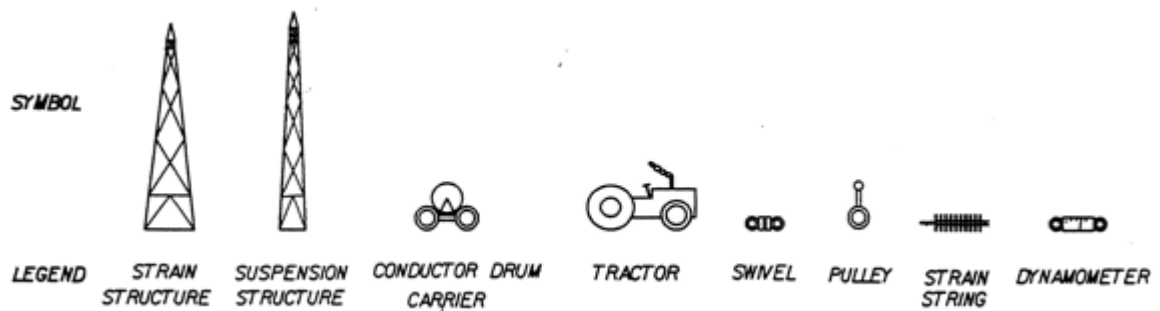
- a) With the phasing out of the glass disc insulators and the introduction of the long rod polymer type insulators, new stringing precautions must be taken.
- b) The new type long rod insulators have some disadvantages. The rubber-like appearance gives one the idea that they cannot break and that they cannot take any cantilever or torsion loads
- c) Care should thus be taken whenever one does stringing with this type of insulators.
- d) Tension stringing is the recommended stringing technique but if it is not possible the alternative stringing procedure as described below must be used.

### **21.2. STRINGING EQUIPMENT PER PHASE**

#### **21.2.1. Equipment:**

- a) Conductor drum carrier : 1;
- b) Swivels : 2;
- c) Dynamometer (Calibrated not longer than 6 months ago) : 1;
- d) Running out pulleys : X amount to suit no. off suspension structures in strain
- e) section;
- f) Come along : 1;
- g) Tractor : 1.

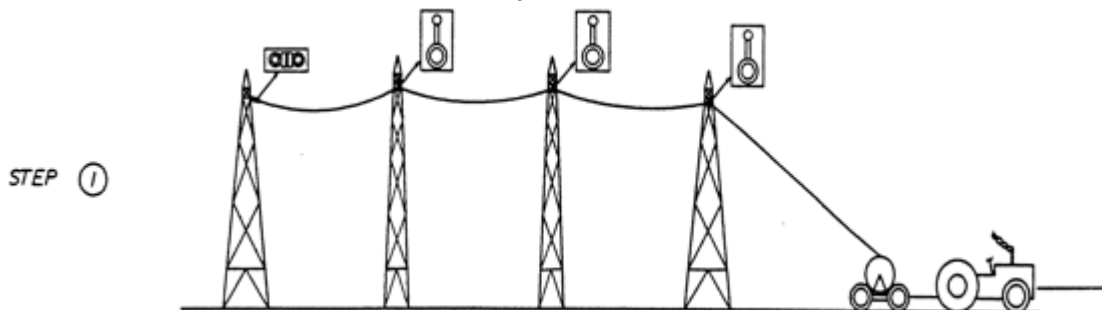
### 21.3. SYMBOLS:



### 21.4. STRINGING PROCEDURE

#### 21.4.1. STEP 1: Running out of the conductor

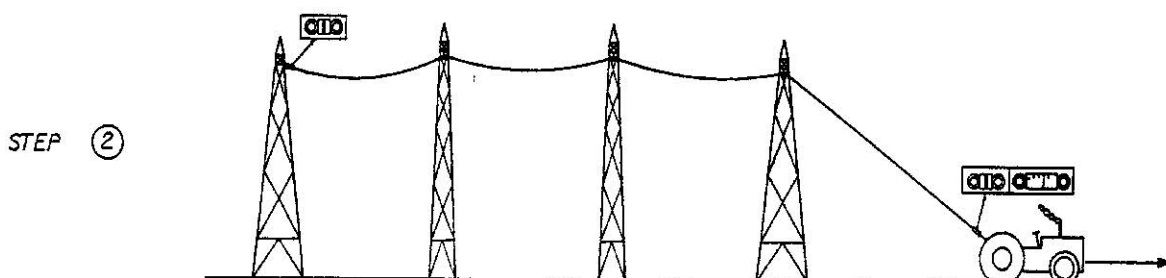
- Secure swivel onto the strain structure (anchor end).
- Terminate the conductor with the compression dead-end onto the swivel.
- Use a conductor drum carrier to run out the conductor along the line and lock the conductor onto the running blocks.
- All unnecessary slack shall be eliminated to prevent conductor friction during tensioning.
- The conductor must never be dragged on the ground, if it is not possible to achieve this, the conductor must be protected with wooden planks form damaging.
- Under no circumstances shall any vehicle be allowed to drive over conductors.



#### 21.4.2. STEP 2: Unwinding of the conductor

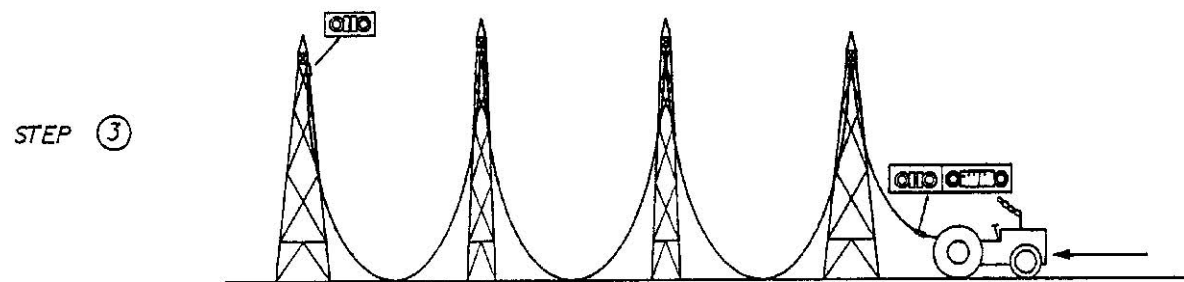
- Cut the conductor.
- Install a swivel and dynamometer at the pulling end.
- Tighten conductor slightly and give the conductor time to unwind.

**NOTE:** The conductor shall not be tensioned more than 27,68kN for “Wolf”; 17,96kN for “Chickadee”; 28,53kN for “Kingbird”; 36,32kN for “Panther” and 44,8kN for “Bear”.



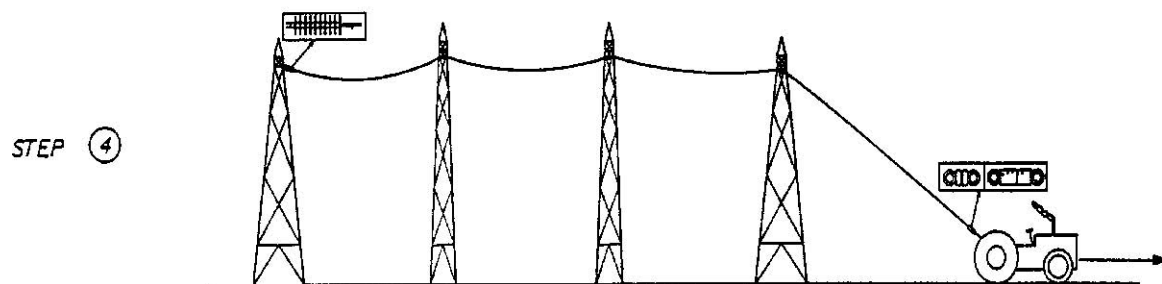
### 21.4.3. STEP 3: Slacking of conductor

- a) Conductor to be slacked after it has unwound.



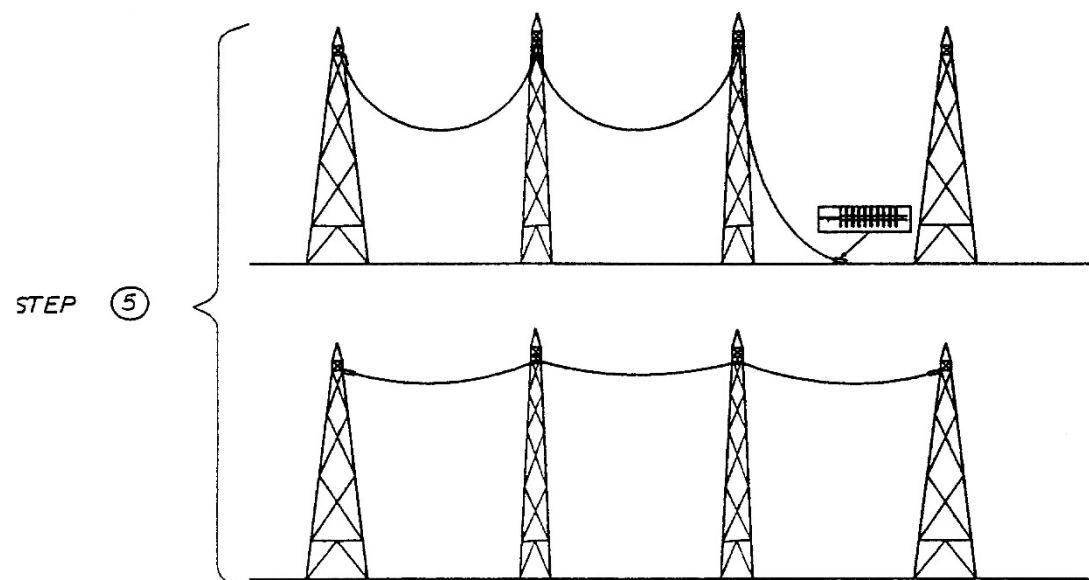
### 21.4.4. STEP 4: Sagging

- a) Remove the swivel at the anchor end.  
b) Install the strain insulator.  
c) Sag conductor according to the provided Sag and Tension Chart.  
d) Ensure that conductor has not snagged on any of the running blocks.



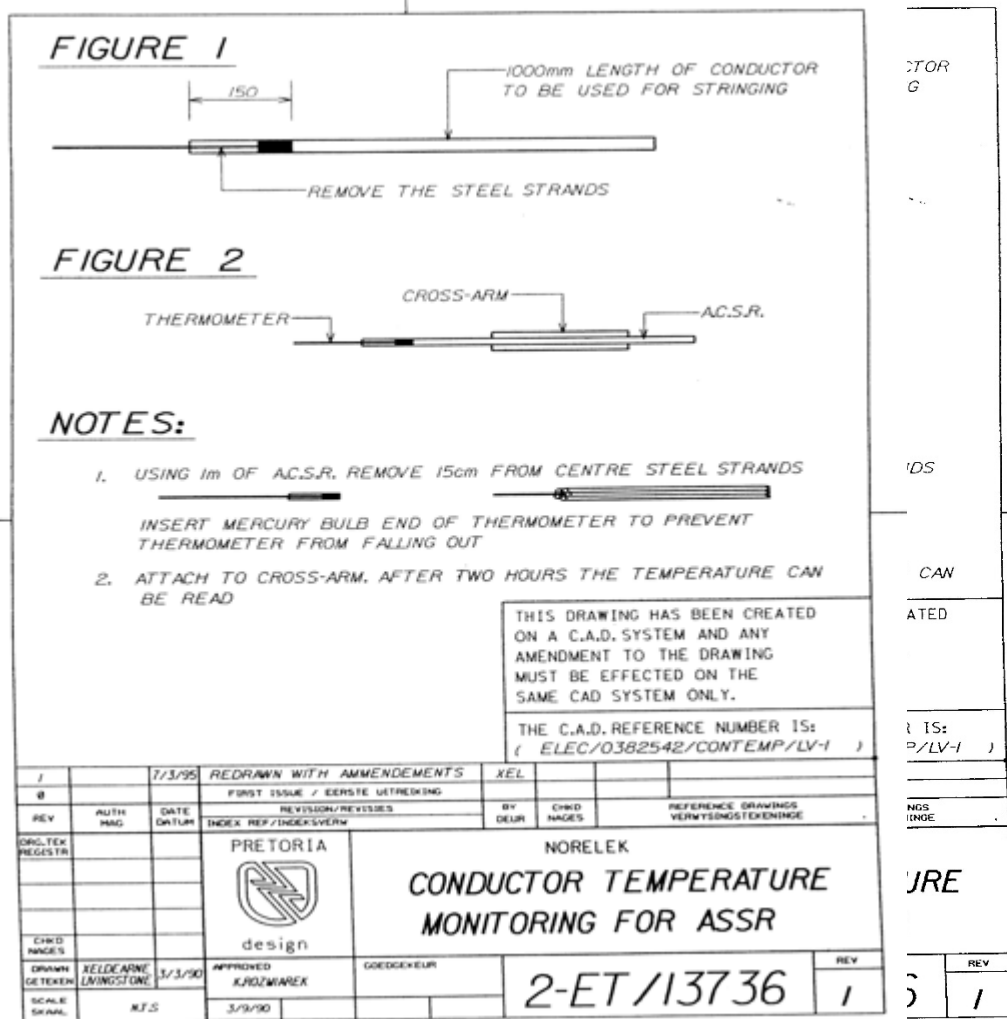
### 21.4.5. STEP 5: Regulation

- a) Install the strain insulator at the pulling end.  
b) Hook conductor into position.  
c) Do regulation (fine tuning) with the turn buckle.  
d) Remove the running blocks and secure the conductor with the suspension clamps.





## 22. AMBIENT TEMPERATURE MEASURING TECHNIQUE



## 23. FOOTING RESISTANCE MEASUREMENT GUIDELINE

- a) This guideline provides the minimum requirements for the measuring of the footing resistance of steel poles

### 23.1. METHOD

#### 23.1.1. Short fall-of-potential

- The short version fall-of-potential method can be used by the contractor. The drawings show the equipment layout and how the measurements must be taken.
- Three resistance values are measured, namely R1, R2 and R3. If the three values agree reasonably, the average can be calculated for the final resistance value. If not, the 61,8% method must be used.

### 23.1.2. 61.8% Method

Figure 1: connections for earth electrodes resistance measurement -61.8% method

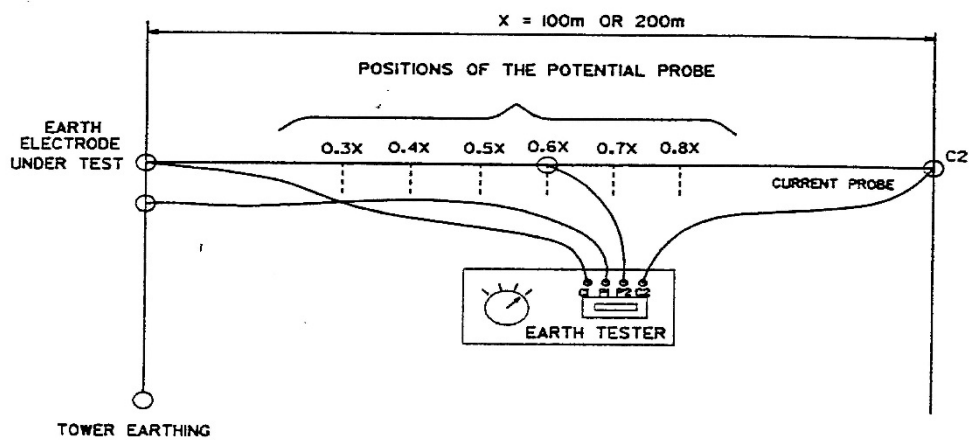


Table 35: Earth Electrode Resistance -61.8% Method Measurement Results

| DEFINITION | POSITION | DISTANCE (m) | RESISTANCE (Ohm) |
|------------|----------|--------------|------------------|
| R1         | 0.2X     |              |                  |
| R2         | 0.4X     |              |                  |
| R3         | 0.5X     |              |                  |
| R4         | 0.6X     |              |                  |
| R5         | 0.8X     |              |                  |

Table 36: Earth Electrode Resistance -61.8% Method Calculated Results 2. Steel Poles

|  |                |
|--|----------------|
| $R = -0,1187R1 - 0,4667R2 + 1,9816R4 - 0,3961R6 =$ | _____ $\Omega$ |
| $R = -2,6108R2 + 4,0508R3 - 0,1626R4 - 0,2774R6 =$ | _____ $\Omega$ |
| $R = -1,8871R2 + 1,1148R3 + 3,6837R4 - 1,9114R5 =$ | _____ $\Omega$ |
| $-6,5225R3 + 13,6816R4 - 6,8803 R5 + 0,7210R6$     | _____ $\Omega$ |
| $R =$  | _____ $\Omega$ |
| <b>TOTAL</b>                                       | _____ $\Omega$ |
| <b>AVERAGE</b>                                     | _____ $\Omega$ |

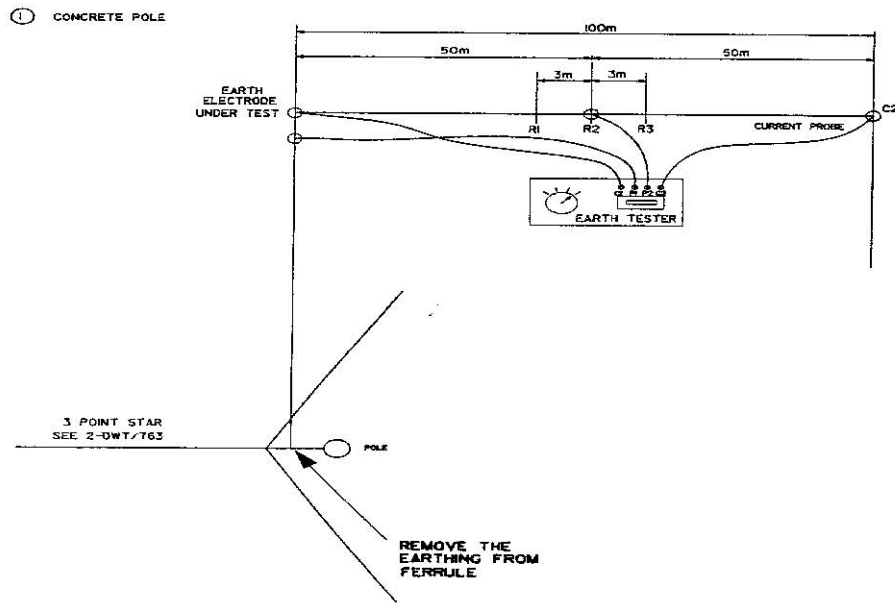


Figure 24: Connections for Earth Electrode Resistance Measurements Fall-Of-Potential Method

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## EMALAHLENI LOCAL MUNICIPALITY

### 40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION OF A 11,5 KM, 132 KV OVERHEAD LINE.

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

#### **C4. SITE INFORMATION**

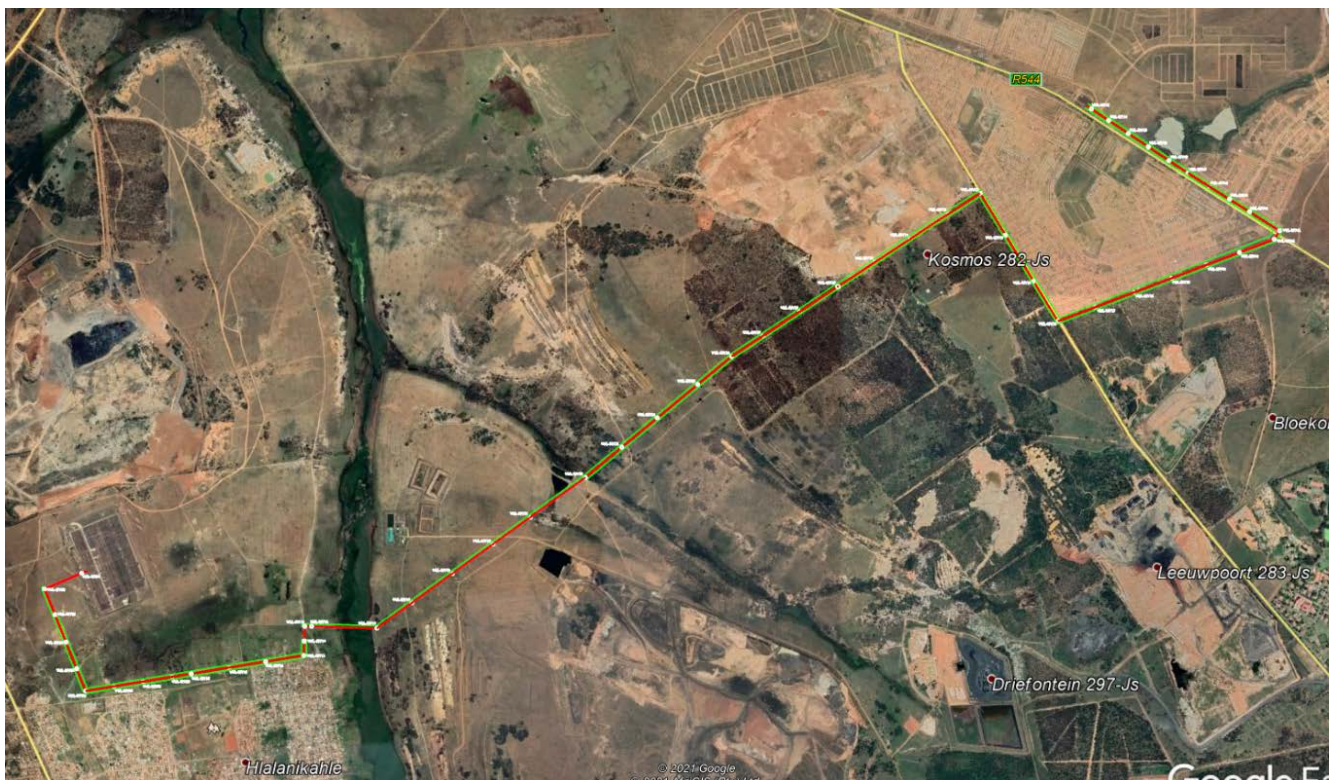
The site falls within the jurisdiction of Emalahleni Local Municipality.

The Contractor shall cater for his own water, electricity and sanitation requirements.

The onus will be on the Contractor to acquaint himself with the site conditions before the tender closing date.

It is recorded that the Contractor has, before signature of this Contract, carried out a site inspection in order to acquaint itself with the site conditions, access and all other matters relating to the site.

The contractor acknowledges that it has allowed for all conditions on site and agrees that extra claims arising from difficult site conditions in respect of transport, handling, loading, off-loading, labour, housing and any other matter relating to the site will not be entertained.



**Figure 7: Locality**

EMALAHLENI LOCAL MUNICIPALITY

40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.

CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)

Table 12: Site information

| Overhead line Information            |  |
|--------------------------------------|--|
| Item                                 | Description                                |
| Start: Co-ordinates (Lat.)           | LAT: 25° 49' 48.72"S                       |
| Start: Co-ordinates (Long.)          | LONG: 29° 06' 30.90"E                      |
| End: Co-ordinates (Lat.)             | LAT: 25° 48' 14.5"S                        |
| End: Co-ordinates (Long.)            | LONG: 29° 10' 16.28"E                      |
| Line Length                          | 11.5 km                                    |
| Number of lines                      | One (1)                                    |
| Number of circuits                   | Single                                     |
| Number of conductors per circuit     | One (1)                                    |
| Line System Voltages                 | 132 kV                                     |
| Structure type                       | Steel                                      |
| Terminal Structures                  | 4 %  |
| Strain Structures                    | 35 %                                       |
| Intermediate (Suspension) Structures | 62 %                                       |
| Conductor type                       | Chickadee                                  |
| Shield wire Type                     | OPGW (48 core)                             |
| Average span length                  | 218 m                                      |
| Altitude                             | between 1 450 m and 1544 m                 |
| Ambient Temp Max. °C                 | 28 °C                                      |
| Ambient Temp Min. °C                 | 7 °C                                       |
| Lightning Density                    | 12 flashes to ground/km <sup>2</sup> /year |
| Rain Fall                            | 966 mm                                     |
| Thunder days/year (mean)             | 38   |
| Snow days/year (mean)                | 0  |
| Max. Wind m/sec                      | 10 m/s                                     |

SIGNED AT ..... ON BEHALF OF THE FIRM .....

ON THIS ..... DAY OF ..... 20....

NAME: .....

SIGNATURE: .....

CAPACITY: .....

# GSE14 – GENERAL SPECIFICATION ELECTRICAL

INSPECTION, TESTING AND HANDOVER

## TABLE OF CONTENTS

|     |   |    |
|-----|---|----|
| 1.  | MANUALS AND DATA RECORDS .....                    | 2  |
| 2.  | DOCUMENTATION AND DRAWINGS .....                  | 3  |
| 3.  | GENERAL REQUIREMENTS .....                        | 3  |
| 4.  | DRAWINGS FOR APPROVAL .....                       | 4  |
| 5.  | FINAL DRAWINGS AND INFORMATION .....              | 5  |
| 6.  | OPERATIONAL AND MAINTENANCE MANUALS .....         | 5  |
| 7.  | DETAILED OPERATIONAL AND DESCRIPTIVE MANUAL ..... | 5  |
| 8.  | PHYSICAL INSPECTION PROCEDURE .....               | 8  |
| 9.  | TESTING AND TEST EQUIPMENT .....                  | 8  |
| 10. | SITE TESTS AND INSPECTIONS .....                  | 9  |
| 11. | COMMISSIONING .....                               | 9  |
| 12. | TRAINING OF PERSONNEL .....                       | 10 |

## TABLE OF TABLES

No Table of Figures Entries Found.

## TABLE OF FIGURES

No Table of Figures Entries Found.

## **1. MANUALS AND DATA RECORDS**

All data pamphlets packed with equipment and other pamphlets, handbooks of equipment, operating instructions of equipment, drawings, etc., shall be kept in safe storage by the Contractor during the Contract period.

The Contractor shall also keep accurate records of all tests carried out on equipment and cables and of the test results achieved.

Records shall be kept of setting values of instrumentation and all readings taken during testing and commissioning, as well as records of all final adjustment readings or changed settings done during the maintenance period.

A comprehensive operational and maintenance hard copy manual shall be built up by the Contractor, using the data mentioned well as other data and descriptions as specified herein.

All drawings and diagrams shall be done in AUTOCAD 2010 (or later) format and all text shall be submitted on the latest edition of Microsoft Word format. All tabular data shall be submitted on the latest edition of Microsoft Excel format. All pamphlet and brochure data shall be submitted in PDF format.

DXF files of other CAD programs can also be submitted, if these are suitable for conversion to AutoCAD format, without scrambling of text or graphics upon conversion.

The number of copies as scheduled in the Pricing Schedules or Bill of Quantities, of the manuals described herein, shall be made up by the Contractor. The quantity of copies required is normally not less than five (5).

The manuals shall be presented to the Engineer on the first day of "wet commissioning", if handover of the Works takes place on that day. The manuals shall be neatly housed in lever arch files and shall be in typewritten and/or printed format, properly indexed, with appropriate 2 or 3-layer card dividers between each section to facilitate ready reference.

A main index shall be placed in the beginning of each manual. The project name and project description shall appear at the top on the main index of the manual. Coloured dividers shall preferably be used.

The manuals and drawings shall cover all installation, operation, and maintenance schedule aspects of each item of equipment and all circuitry provided under this Contract, as specified.

The manuals, if approved, will be handed to the Employer or the representative of the Employer, so that the Works can be operated correctly and safely.

Any changes which may be necessary to the contents of the manual after the commissioning of the Works shall be done by the Contractor and sufficient copies of the altered data shall again be submitted to the Engineer for binding into the manuals. This process shall be repeated for the duration of the maintenance period or until the final certificate is issued by the Engineer for the project.

A "Practical Completion Certificate" and subsequent "Certificate of Commissioning" / "Handing over Certificate" will only be issued on receipt of accurate and final "as-built"



drawings and documentation to the approval of the Engineer. Such documentation shall be presented to the Engineer on the first day of commissioning of the works. Any certification of "Practical Completion", "Commissioning" or "Handing Over" of the works is subject to final approval of such documents and drawings by the Engineer.

Wherever manufacturer's manuals refer to types of equipment other than the exact type as installed, the exact type shall be highlighted throughout such manuals.

### **2. DOCUMENTATION AND DRAWINGS**

All documentation and drawings as specified in the general or equipment specification shall apply to this contract.

### **3. GENERAL REQUIREMENTS**

A stringent requirement of a Contract is to have "as built" data when a contract is complete to ensure that:

- a) The Employer knows where all the equipment and materials are installed
- b) Fault finding in the system can be done in future
- c) Alterations and additions can be undertaken in future by referring to the drawings to determine the built in capacity of the system without having to determine this data on site.

It is therefore imperative for the Contractor to produce acceptable manufacturing drawings at the onset of a project so that equipment can be manufactured and ordered. Drawings such as layout drawings, single line diagrams, block diagrams, typical control diagrams, etc. are normally issued by the Engineer together with documents for tender purposes.

If no drawings or limited drawings are issued by the Engineer at tender stage or thereafter, the Contractor shall arrange a technical meeting or meetings with the Engineer to determine the exact scope of the work and shall then prepare the necessary drawings to enable him to manufacture the specified equipment. This shall include "shop" drawings, diagrams and/or constructional detail drawings.

The drawing or drawings prepared by the Contractor shall obviously make provision or include the drawings or standards normally used by the Contractor to produce acceptable quality of work. The Contractor shall further keep all drawings and diagrams prepared during the course of production and installation of the Works and shall present this to the Engineer on completion of the Contract. Such drawing shall at least consist of all the drawings the Contractor used for construction and installation work as well as all data of final positions and final settings of equipment.

All cable positions on the site of the Works shall be shown on layout drawings, together with dimensions taken on site from fixed points to show exact location of underground cables. Any diagrams (standards or specific) issued by the Engineer shall not be used by the Contractor for making up his own design drawings by adding data or wiring and terminal numbers to such diagrams.

The Contractor shall draw up and submit his own diagrams and general arrangement drawings in the formats and quantities as required by the Engineer. Hand drawn drawings

will not be acceptable, except in the case where formal site layout plans are not available to mark-up equipment and cable positions. Drawings shall preferably be done in A3 booklet format and on the standard border and title block sheets of the Employer or the Engineer, unless permission is granted in writing by the Engineer for other formats of title blocks.

All drawings shall be properly numbered with the numbering system required by the Employer or the Engineer and the number of the particular sheet and the total number of sheets shall be shown on each drawing.

The Contractor may use his own reference number in a separate block if the Engineer requires a special drawing numbering system. Standard drawing sheets in electronic format can be obtained from the Engineer, if available.

Electronic copies (soft copy), of all "as built" drawings prepared by the Contractor during the course of the Contract, as well as all electronic copies of software and descriptions of equipment, handbooks or sales data shall also be handed to the Engineer, together with the hard copy "as built" drawings and manuals, in quantities and formats as specified in the Project Specifications

#### **4. DRAWINGS FOR APPROVAL**

A set of three (3) prints of the shop drawings for all equipment shall be submitted for approval before any of the aforementioned are manufactured.

3D Survey drawings of the existing infrastructure is available in .dwg format for this project. These drawings shall be made available to the contractor on which detail designs are to be populate for approval by the Engineer.

The following information shall be presented:

- a) Single line diagrams for electrical, electronic and power circuits, showing rating of wiring, cables, switchgear, power supplies, current rating of all circuit breakers and fuses, VA rating of all power supplies, sizes, specifications and quantities of cables and cable cores with:
  - the rating, type number, catalogue number, ratio, class, etc. next to each component with the abbreviated reference number
  - the functions of each control circuit or section of control circuit, above each control group of components
  - the functions of each component on control diagrams below the component
  - wire and cable numbers for all control and power wiring together with the colours of all wires.
- b) A general arrangement block diagram of the whole of the Works.
  - Overall dimensions together with material type and thickness used for the framework, doors and covers as well as the type and colour of finish of the material;
  - Front elevations and sections for all the panels and devices;
  - Positions of door locks, hinges, handles, vermin proofing, ventilation facilities, seals on doors and covers, etc.;
  - The IP ratings;
  - Placement positions of all front panel components on panels;

- All labelling information for each component shall be shown in tabulated form on general arrangement drawings.

All drawings shall be done using NRS symbols and the applicable SANS standards for drawings plus any further requirements for drawings which may be bound into this document and which may be required by the end user of the equipment.

The approval of drawings shall not relieve the Contractor of his responsibility to supply the works in according to the requirements of this specification and/or Project Specifications.

### **5. FINAL DRAWINGS AND INFORMATION**

At least three (3) complete sets of "as built" drawings of all panels shall be submitted to the Engineer prior to the installation being handed over to the Employer.

A professional portfolio consisting of still images and details of the entire installation in operation shall be submitted.

A professional overview narrated video shall be submitted in editable soft copy format for marketing purposes

The drawings submitted shall preferably be in A3 format (in hard copy and on CD) and shall also be bound into the "Operational and Maintenance Manuals" as specified herein.

The following information shall be presented:

- a) All the information as described in the section "Drawings for Approval", hereinbefore.
- b) The final, updated drawings and diagrams specified showing the latest revisions after commissioning of the Works.
- c) All final terminal strip numbers, numbers and colours of conductors connected to the terminal strips and numbers and colours of the conductors utilized for the internal wiring.
- d) A separate schedule of all equipment with the name, manufacture, type, model-catalogue number of equipment, as well as the name, address and telephone number of the supplier of each component.
- e) All site and building layout drawings, showing sizes and positions of cables and equipment.
- f) The site layout drawings showing cables shall be dimensioned using fixed points on site such as buildings, beacons, boundary walls, canals, poles, sumps, etc.

### **6. OPERATIONAL AND MAINTENANCE MANUALS**

A minimum of three (3) complete sets (or as scheduled in the Schedules of Quantities) of operational and maintenance manuals for all specified Works.

Also refer to the section "Final Drawings" herein, regarding binding in of "as built" drawings into the required manuals.

### **7. DETAILED OPERATIONAL AND DESCRIPTIVE MANUAL**

This manual shall contain the detailed descriptions of all equipment i.e. all proprietary assemblies, shall be provided to assist the user personnel of the Employer with advanced

knowledge of the equipment for short, medium and long term maintenance and operations of Works.

The descriptions must be complete in all respects and the Contractor shall also ensure that these manuals are prepared in such a manner that, in the opinion of the Engineer, a competent and qualified technician can trace any fault, identify any defective component, replace it with the correct spare part and follow, without difficulty, the exact function of every component.

To this end, care must be exercised to correlate the text with the circuit diagrams, to relate the diagrams one with another and to provide a simple method of diagnosis and test to be used wherever breakdowns occur. The manuals shall also include block diagrams giving the layout of equipment as well as a description of the function and operation of every unit in the system.

The manuals shall be neatly prepared, in typewritten and/or printed format, indexed, with appropriate dividers between each section to facilitate ready reference. All documentation shall be presented in the English language.

The description shall, as a minimum requirement, include:

Operational and maintenance data, details of all assemblies or components of electrical and electronic equipment installed in the Works. Copies of operational manuals of manufacturers can be inserted in these descriptions. In the case of insufficient descriptions in manuals of manufacturers, the Contractor shall provide additional descriptions to enable maintenance of the equipment.

The descriptions shall include:

- a) Technical details of all equipment installed
- b) A complete description of the operation of all equipment.
- c) A parts and spares list of every item of equipment together with a description of the item, the name, address and telephone number of the original supplier or wholesaler of the equipment. Brochures may be added as additional information but must not replace the data required.
- d) Complete equipment schematics
- e) All manufacturers' handbooks having reference to the equipment
- f) Installation test and alignment procedures
- g) All circuit diagrams
- h) All interconnection and inter cabling diagrams
- i) Complete trouble shooting procedures and any other information deemed necessary to permit rapid and efficient maintenance of any part of the equipment by a qualified technician.
- j) Concrete Strength Test Result (7 & 28 days)
- k) Commissioning Reports for LV Network.
- l) Aiming Certificate.
- m) Survey of illumination levels.

The operating procedures contained in the manuals shall contain the following detailed features in fully descriptive format:

- a) Operating Procedures
  - Pre power-up checks of all equipment
  - Routine running attention

- Shutting down the works or parts thereof
  - Prolonged shut-down of the works
  - Re-commissioning of the works after repairs, maintenance or prolonged shut-down.
- b) Maintenance
- Routine maintenance procedures
    - Description
    - Schedule
  - Preventative maintenance
- c) Fault Finding Procedures
- Power supply faults
  - Control faults
  - Investigation procedure for detection of faults and remedies:
    - Symptom
    - Probable fault
    - Remedy
- d) Safety Precautions
- The nature of each hazard
  - The level of seriousness
  - How to avoid the hazard
  - The possible consequences of not avoiding the hazard

In the case of sealed assemblies or advanced assemblies of equipment that cannot be opened or maintained or repaired onsite, the Contractor shall provide sufficient data and instructions for the replacement of the assembly and shall further describe the measures which the user or operator of the works can follow to operate the Works in an emergency and, if necessary, operate the works manually, to overcome total shut-down or non-operation of the Works until a new replacement can be installed.

The descriptions for operational measures shall be of sufficient nature to enable safe operating conditions of the works and shall further not be of a nature which shall cause damage to other parts or sections of the Works:

- a) A schedule of every item of equipment in the Works or panels together with a description of the item, part number, catalogue number, etc., as well as the name, address and telephone number of the original supplier or wholesaler of the equipment. Brochures may be added as additional information but must not replace the data required.
- b) All as-built record drawings, including AC and/or DC schematic and wiring diagram drawings for the equipment. The wiring diagrams shall contain all the terminal numbers and wire numbers of all wiring in the Works. Also refer to "C3.3.16.5 FINAL DRAWINGS" hereof. A4 drawings may be used in manuals but all text must be clearly legible. A3 drawing sizes are preferred.
- c) Technical brochures and pamphlets of equipment as additional information.
- d) Routine and type test certificates issued by factories.
- e) All calibration and setting data of electronics and instrumentation. This data shall also contain all the embedded software, on disc or CD, issued together with the instruments as part and parcel of the selling price of instruments where the instruments cannot be purchased without the embedded software.

## **8. PHYSICAL INSPECTION PROCEDURE**

Once the Contractor has completed the installation, written notice shall be given to the Engineer in order that a mutually acceptable date can be arranged for a joint inspection.

During the course of the inspection, the representative of the Engineer will compile a list of items (if any) requiring further attention. A copy of this list will be provided to the Contractor who will have a period of 7 days in which to rectify the offending items of the installation.

The Contractor shall then provide written notice that he is ready for an inspection of the remedial work to the offending items.

This procedure will continue until the entire installation has been completed to the satisfaction of the Engineer.

## **9. TESTING AND TEST EQUIPMENT**

All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer's instructions and shall be subjected from time to time to such tests and by such persons as the Engineer may direct at the place of manufacture or fabrication or on the site or at all or any of such places.

Except as otherwise provided in the Specification the Contractor shall supply such assistance, accommodation, instruments, machines, labour and materials as are normally required for examining, measuring and testing of any work and the quality, mass or quantity of any materials used and shall supply samples of materials before incorporation in the works for testing as may be selected and required by the Engineer.

All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Specification but if not, then at the cost of the Employer.

The cost of performing any test shall be borne by the Contractor if such test is clearly intended by or provided for in the Specification and (in the case of a test under load or a test to ascertain whether the design of any finished or partly finished work is appropriate for the purposes which it was intended to full fill if such is particularised in the Specification in sufficient detail to enable the Contractor to price or allow for the same in his Contract Price.

If any test is ordered by the Engineer which is either -

- a) not so intended by or provided for; or
- b) not so particularised; or
- c) though so intended by or provided for is ordered by the Engineer to be carried out by an independent person or body at any other place than the site or the place of manufacture or fabrication of the materials or equipment tested;
- d) Then the cost of such test shall be borne by the Contractor if the test shows the workmanship or materials not to be in accordance with the provisions of the Contract or the Engineer's instructions, but otherwise by the Employer.

The Contractor shall keep records of all the data of tests and shall submit this data to the Engineer upon completion of all tests. Tests carried out in the factory of the manufacturer or at a testing facility shall be done in accordance with the prescribed standards for such tests.

The applicable standards for such tests shall be SANS, BSI, IEC, DIN, NEMA or such acceptable standard as may be applicable to the product or equipment or assembly.

The Engineer will have the right to obtain a quotation from the Contractor for any special tests which are required by him and to instruct the Contractor to carry out such tests.

If equipment should fail a standard or prescribed standard test by a testing authority, the cost thereof shall be for the account of the Contractor.

### **10. SITE TESTS AND INSPECTIONS**

The tenderer will also be responsible for arranging Site Acceptance Testing (SAT) on site, which will be attended by the Maintenance Personnel of the Employer and the Engineers Representative.

The inspections of the Engineer of any part of an installation or Works on site does not exempt the Contractor from his responsibilities in terms of the Contract. The Engineer will only accept the completed installation work after having received all test results, commissioning results and certificates of compliance or test certificates on completion of the whole of the Works.

Any abnormal condition, beyond the control of the Contractor, which may come to the attention of the Contractor during any preliminary or final tests or commissioning procedures shall immediately be reported to the Engineer.

The Contractor shall not allow equipment of other contractors to stay connected to, or operate with electric power from his installation if any equipment of other contractors do not operate normally or within the limits laid down by the manufacturer of equipment for other contractors.

### **11. COMMISSIONING**

Commissioning on site shall include the following actions and shall be done with the Engineer present and shall require the presence of the Contractor for as long as it is necessary to carry out all the actions hereunder or as may be further required by the Engineer or the Client.

- a) The system shall be connected to the power supplies and shall operate and communicate as specified in the Project Specification.
- b) Power protection equipment shall be set by the Contractor in the presence of the Engineer. All the settings shall be recorded by the Contractor for handing over to the Engineer after commissioning.
- c) All earthing installation work must be completed.
- d) Communication signals and/or remote control signals shall be tested to ensure that Works are integrated as a complete system and functioning correctly. The communication of signals between the site Works and a remote control room or station shall be verified.
- e) All safety checks and tests of power equipment must be completed.
- f) The number of required maintenance and operational manuals (complete in all respects) shall be handed over to the Engineer.
- g) The spares and tools (if applicable), shall be on site together with inventory sheets, ready for signature of the recipient party.
- h) All panels and electronic equipment shall be clean and neat and wiring shall be neat and strapped. No loose hanging wiring will be acceptable.
- i) All labelling shall be complete.

- j) All cable trunking lids or covers shall be in place and all draw box covers and lids shall be screwed down.
- k) A Certificate of Compliance for all 230V work shall have been handed to the power supply authority with a copy on site for the Engineer.
- l) The Contractor shall hand all the test results of equipment which was logged by him together with the settings of such equipment to the Engineer. This information shall be made available on properly structured test sheets and log sheets and shall be dated and signed by the Contractor.
- m) Any small items such as alterations to labels, faulty electronic equipment, etc. shall be recorded for repairs.
- n) The Contractor shall then proceed with training of the operating personnel of the Employer as may be required in the Project Specification.

No last minute repairs or installation work shall be done by the Contractor on the day of commissioning of the Works:

The successful completion of all the above shall be regarded as the "first hand over day" of the Works to the User or Owner of the installation. The retention period of the Works normally starts on that day, unless abnormal conditions prevent the handing over of the Works to the Client.

An abnormal occurrence preventing handing over will not be seen as failure of the Contractor in this respect. If the commissioning should have to be stopped or abandoned due to the failure of the Contractor to complete the Works and have the Works ready for inspection or as stated above, then the further costs for re-commissioning later will be for the Contractor's account. Such costs will include all the travelling, accommodation and time rate costs of the Engineer or the Client.

The Works will not be regarded as being commissioned if all of the above requirements are not met on the day of commissioning of the Works.

The Contractor shall only apply for inspection by the Engineer once the Contractor have completed his own inspections and rectified snags identified. For Site Acceptance testing should the works or equipment not be in a ready state to be commissioned the Engineers cost for all re-inspections shall be for the Contractors account according to the latest gazetted fee scales as provided by the Engineering Council of South Africa.

## **12. TRAINING OF PERSONNEL**

The training of personnel of the Employer or User of the Works shall only be applicable to the Contract.

Training provided by the Contractor and OEM shall be directly applicable to the actual equipment to be used at the installation. Training shall be carried out on site and at the OEM's works. The priced unit rates in the bill of quantities shall allow for all travel, accommodation and living expenses.

All of the training shall be presented by the OEM and allowed for by the contractor in the bill of quantity's unit rates.

Operators of the installed equipment shall be trained by The Contractor to safely and successfully operate the equipment and controls.



This training course shall include the training of technical personnel of the Employer during the installation period and commissioning stages of equipment on site to make the technical staff and or skilled operators completely conversant with the installed equipment and the use thereof.

The Employer thus reserves the right to appoint certain staff to the Contractor's team during the installation and commissioning phase of the work for training as described in the previous paragraph. The Employer will bear the cost of salaries, accommodation and other allowances and traveling expenses of its personnel, but all other expenses to allow the personnel to attend the said training on site shall be borne by the Contractor.

The Employer may also decide to request the Contractor to make use of the ability of the staff of the Employer to assist with physical installation and commissioning work, and in such instance the Engineer will instruct the Contractor accordingly.

The Contractor shall provide all course material including manuals and training data in this case, and shall present well prepared lectures of the courses in locations which suite the Employer.

Advanced training courses shall proceed within one month after date of first hand-over of the particular section of the Works.

The Contractor shall price the items allowed for training in the Bill of Quantities of the tender document.

At conclusion of any training period, either for the operation and maintenance of equipment, or for advanced software and programming, the Contractor shall issue the necessary certificates at the end of the course and/or a signed statement to the effect that these training sessions were adequate.

The tenderer shall also be responsible for arranging formal training by the agency, distributor or accredited supplier for all specified equipment offsite as well as on site, which will be attended by the Maintenance Personnel of the Employer and the Engineers Representatives. The offsite training shall be held at a premise of the supplier. The number of delegates will be as specified in the BoQ.

Training shall be provided in a class room environment, the OEM shall provide relays or equipment for each delegate attending the training session which will allow for practical interaction with various control, monitoring and measuring equipment. Training material shall include the necessary equipment manuals and software.

Training content shall be approved by the original equipment supplier if the supplier is not the original equipment manufacturer.

Training shall as a minimum have the following objectives.

- Enable the trainee to operate the equipment with confidence.
- Ensure that equipment shall be correctly maintained.

Training shall be provided for the following equipment:

- All IED's in the substation
- All measuring equipment used in the substation

## INSPECTION, TESTING AND HANDOVER

- All switchgear and operation sequences

The tenderer shall also arrange training and testing in the relevant ORHVS modules required to operate and maintain HV Voltage equipment. The ORHVS training shall be done at an accredited institution and an ORHVS Authorisation Certificate shall be issued to the successful delegates. Training shall be in accordance with all parts of NRS 040.

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# GSE18 – GENERAL SPECIFICATION ELECTRICAL

POWER TRANSFORMERS RATED FOR  
1.25 MVA AND ABOVE AND WITH  
HIGHEST VOLTAGE OF 2.2 KV OR ABOVE.

## TABLE OF CONTENTS

|     |   |   |
|-----|---|---|
| 1.  | GENERAL .....                               | 2 |
| 2.  | NORMATIVE REFERENCES .....                  | 2 |
| 3.  | PHYSICAL ARRANGEMENT .....                  | 2 |
| 4.  | BUSHINGS .....                              | 3 |
| 5.  | TAP CHANGER.....                            | 4 |
| 6.  | CORE .....                                  | 4 |
| 7.  | WINDINGS .....                              | 4 |
| 8.  | AUXILIARIES .....                           | 4 |
| 9.  | TANK .....                                  | 4 |
| 10. | INSULATION .....                            | 6 |
| 11. | TRANSFORMER OIL .....                       | 6 |
| 12. | TESTS .....                                 | 6 |
| 13. | OIL SEPARATION AND HOLDING FACILITIES ..... | 7 |
| 14. | TRANSFORMER OFFLOADING.....                 | 7 |

## TABLE OF TABLES

|                                |   |
|--------------------------------|---|
| Table 9: Insulation level..... | 6 |
|--------------------------------|---|

## TABLE OF FIGURES

|  |   |
|--|---|
| Figure 1: Transformer arrangement..... | 3 |
|--|---|

## 1. GENERAL

This general specification covers the general requirements for Power Transformers rated for 1.25 MVA and above and with highest voltage of 2.2 kV or above.

## 2. NORMATIVE REFERENCES

The following documents contain provisions that constitute requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

**Table 1: SANS specifications**

| Document   | Rev./issue | Title and Publisher   |
|------------|------------|---|
| SANS 107   | Latest     | Standard Transformer Bushings.  |
| SANS 1091  | Latest     | National colour standard  |
| SANS 9001  | Latest     | Requirements For Quality Management Systems                                     |
| SANS 14001 | Latest     | Environmental Management Manual International Standards – EMS                   |
| SANS 60034 | Latest     | Rotating electrical machines.   |
| SANS 60076 | Latest     | Power Transformers. All parts   |
| SANS 60137 | Latest     | Insulated bushings for alternating voltages above 1000 V.                       |
| IEC 60085  | Latest     | Thermal evaluation and classification of electrical insulation.                 |
| IEC60156   | Latest     | Insulating liquids – Determination of the breakdown voltage at power frequency. |
| IEC 60214  | Latest     | On-load tap-changers.   |

In addition, the following Eskom specifications shall constitute requirements of this specification. All Eskom standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

**Table 2: Eskom specifications**

| Document     | Rev./issue | Title and Publisher  |
|--------------|------------|--|
| 240-68973110 | 1          | Specification for Power Transformers rated for 1.25 MVA and above and with highest voltage of 2.2 kV or above. |

## 3. PHYSICAL ARRANGEMENT

The power transformer's maximum dimensions, including the bushings, cooler banks and conservator shall be:

Height:                      < 3.1 m (plinth to tank cover)  
                                      < 5 m (top of bushing stem)

## POWER TRANSFORMER LARGER THAN 1.25 MVA

|         |                                |
|---------|--------------------------------|
| Length: | < 5.5 m (conservator tank top) |
|         | < 4.4 m (tank footprint)       |
|         | < 6.5 m (overall)              |
| Width:  | < 1.5m (tank footprint)        |
|         | < 5 m (overall)                |

NOTE: The conservator spatial orientation, with reference to the transformer main tank, must be adjustable to ensure the minimum safe working clearances are satisfied.

The power transformer's physical arrangement shall conform to the layout as per the sketch below.

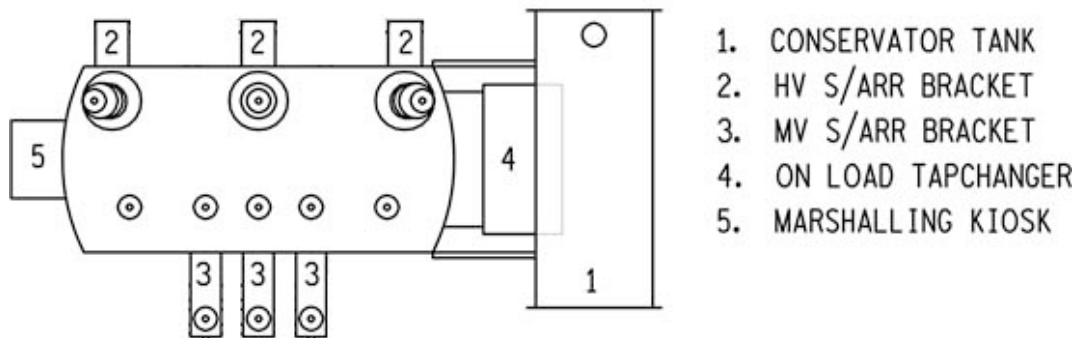


Figure 1: Transformer arrangement

Tenderers shall note that the transformer radiators / cooling fins shall be attached to the transformer main tank only and shall not destabilise the transformer to such an extent that radiator supports are required.

The use of radiator supports shall only be approved where the radiators are installed in a remote location for special applications such as indoor transformers with remote cooling banks and vents.

### 4. BUSHINGS

The following shall apply to the transformer bushings:

1. The HV Bushing shall be symmetrically arranged about the overall transverse Centre line of the transformer.
2. All neutral bushings shall be fitted in line with the MV bushings.
3. Despite the actual operating voltage, the transformer bushings shall have an insulation level corresponding to a nominal system voltage of 33 kV. These bushings shall be equipped with a terminal stem of **38 mm diameter** for secondary side, **26 mm diameter** for primary side and **125 mm length**, have a minimum centre-to-centre spacing of not less than **400 mm for MV side**.
4. The MV bushings shall be of the capacitance graded type.
5. The minimum distance from the transformer base (plinth) to the bushing flange base shall be 2.5 m.
6. The bushing creepage distance shall be 31 mm/kV (MV: at 33 kV).

## 5. TAP CHANGER

The tap changer shall be of the vacuum type. The on-load tap changer shall operate in the range of +5% to -15% of the HV voltage in 16 equal steps of 1.25% each.

The tap changer shall be subject to the following testing:

1. 8 Complete Cycles – not energized
2. 1 Complete operation cycle – 85% of rated voltage applied
3. 1 Complete Cycle energized at rated voltage and frequency (no-load)
4. 10 Tap changes within +/- 2 steps of the principle tap

Care shall be taken to match the tap voltages to the voltage range of other transformers.

## 6. CORE

There shall be no sparking that may upset Dissolved Gas Analysis (DGA) monitoring of the transformer, between bolted mechanical members during inrush or other transient conditions. This requirement shall apply even if DGA is not included at this stage.

The core shall be earthed to the core clamping structure at one point only, through a removable external link suitably situated and protected, to allow testing after installation of the transformer. The core earthing connection shall be larger than 80mm<sup>2</sup>.

Lifting lugs shall be provided for lifting the core and windings.

## 7. WINDINGS

The paper used in the winding insulation shall be thermally upgraded paper. The bracing of the windings and connections shall be such that these parts shall safely withstand the cumulative effects of stresses that may occur during handling, transportation, installation and service, including line-to-line and line-to-ground faults

## 8. AUXILIARIES

All contacts providing an alarm output shall be rated to carry 30 A for 200ms at 250 V<sub>D.C.</sub> and continuously carry 2 A at 250V<sub>D.C.</sub> All secondary wiring shall be 2.5mm<sup>2</sup> with 30 strands (660/100 V as per SANS 1507-2). The auxiliary wiring shall be neatly fitted into a cable tray or compartment onto the transformer.

A 400/230V<sub>A.C.</sub>, 3ph, 4 wire, 50Hz auxiliary power supply shall be provided.

**The marshalling box shall have a certified rating of min. IP55. The marshalling box shall preferably be free standing. All gauges such as oil and winding temperature indications shall be equipped within the marshalling box.**

## 9. TANK

The transformer tank cover shall be bolted.

The interior surfaces of the tank, the cover and the cooling equipment shall be cleaned and dried immediately prior to filling the transformer with oil. Interior surfaces (other than those

## POWER TRANSFORMER LARGER THAN 1.25 MVA

of cooling tubes and headers) above a line that lies at least 50 mm below the oil level that corresponds to an oil temperature of 20 °C, shall be corrosion-protected by varnishing, priming or painting, using materials that are not affected by, or will not adversely affect, the electrical or chemical properties of the insulating oil.

The tank and cover shall be designed so that local heating due to stray flux in any structural part shall not exceed the top oil temperature limit specified for the transformer, by more than 10 °C.

Heating, due to stray flux, shall also not cause local temperature elevations of more than 15 °C relative to the oil temperature at that level.

Thermometer pockets shall be located so as to avoid errors in temperature indication due to the heating effects resulting from stray flux.

The under base shall be suitable for the movement of the transformer in any direction, by sliding on greased rails, and shall be provided with four hauling eyes not less than 50 mm in diameter, as near as possible to the extremities of the length and width of the tank with not less than 100 mm working clearance above them.

Four suitably and symmetrically placed jacking pads shall be provided in positions that shall be accessible when the transformer is loaded on to the transport vehicle, except where jacking pads are used as transport pads on vehicles with built-in jacking.

The position of the jacking pads shall be such that they do not restrict the direction in which the transformer could be moved (forward, backward and sideways) once offloaded on site.

Four symmetrically placed lifting lugs shall be provided so that it will be possible to lift the complete transformer when filled with oil without structural damage to any part of the transformer. The factor of safety at any one point shall not be less than 2.

The lifting lugs shall be arranged and located as to be accessible for use when the transformer is loaded on the transport vehicle, and so as not to cause fouling of any of the transformer fittings and accessories.

Centre of gravity shall be clearly visible and indicated on all sides of the transformer tank.

The transformer primary will be solidly earthed without any Neutral Earthing Resistor. The OEM shall therefore take circulating currents into consideration when the tank wall thickness is calculated to prevent any interior or exterior corrosion.

Provision shall be made for earthing the transformer and associated apparatus as follows:

1. Transformer tank earthing
2. Transformer neutral(s) earthing (direct)
3. Transformer surge arrester earthing (line and neutral surge arresters)
4. All tank attached apparatus, including cable marshalling boxes, tap-changer operating gear and mechanism boxes, and fan and pump motors shall be bonded to their supporting structures.
5. Earthing pads shall also be provided on each end of the supporting structures for all separately mounted cooler banks and oil conservators and on all free-standing cubicles.
6. No copper shall be used as connections for the purpose of earthing.



## 10. INSULATION

The transformer bushing insulation level shall be 10% above the values given in the table below:

**Table 3: Insulation level**

| U <sub>m</sub><br>(kV <sub>rms</sub> ) | U <sub>n</sub><br>(kV <sub>rms</sub> ) | Fault level<br>(kA) | Lightning - BIL<br>(kV peak) |                     | Power<br>Frequency<br>60s 50Hz |         | Bushings |                                     |                  |                                     |                    | Tap changer |  |                  |
|--|--|---------------------|------------------------------|---------------------|--------------------------------|---------|----------|-------------------------------------|------------------|-------------------------------------|--------------------|-------------|--|------------------|
|  |  |                     |                              |                     |                                |         | Line     |                                     | Neutral          |                                     | Creepage (31mm/kV) |             |  |                  |
|  |  |                     | Line<br>Terminal             | Neutral<br>Terminal | Separate<br>source             | Induced | BIL      | 60s<br>50Hz<br>(kV <sub>rms</sub> ) | BIL<br>(kV peak) | 60s<br>50Hz<br>(kV <sub>rms</sub> ) |                    |             | U <sub>n</sub><br>(kV <sub>rms</sub> ) | BIL<br>(kV peak) |
| 12                                     | 11                                     | 25                  | 95                           | 95                  | 28                             | 22      | 200      | 70                                  | 200              | 70                                  | 375                | 11          | 95                                     | 28               |
| 100                                    | 88                                     | 25                  | 380                          | 250x                | 95x                            | 150     | 550      | 230                                 | 350              | 140                                 | 3100               | 44          | 250                                    | 95               |
| 145                                    | 132                                    | 40                  | 550                          | 250x                | 95x                            | 230     | 650      | 275                                 | 350              | 140                                 | 4500               | 44          | 250                                    | 95               |

x - The HV insulation level shall be 48kV RMS without exceeding 165kV Peak for partially graded transformers.

## 11. TRANSFORMER OIL

The transformer main tank oil insulation level shall be 70kV per 2.5mm for virgin oil prior to filling and 60kV per 2.5mm at time of taking over.

## 12. TESTS

The transformer shall be subject to the following test at the cost of the OEM to be witnessed by the Authority and Engineering representative:

1. Voltage Ratio and Phase displacement
2. Winding D.C. Resistance
3. Insulation Resistance to Earth
4. Insulation Characteristics and bushing dielectric loss
5. Separate source voltage withstand
6. Induced Over-voltage withstand
7. Partial Discharge Measurement
8. Lightning impulse Withstand
9. Switching Impulse Withstand
10. Insulation resistance to earth
11. Short circuit AC tests (Partial Discharge)
12. No load loss, magnetizing current and impedance voltage
13. Short Circuit Impedance and load loss
14. Zero Sequence Impedance
15. On load tap changing
16. Temperature rise & overload
17. Overpressure – Leakage Test
18. Oil DGA

19. Determining of Sound Levels / acoustic noise
20. Frequency Response analysis (Factory & Site)
21. Paint thickness & quality
22. Auxiliary wiring functionality & pressure test (Factory)
23. Impact Recorders during transport, loading and offloading
24. Short circuit withstand calculations for the transformer shall be provided.

### **13. OIL SEPARATION AND HOLDING FACILITIES**

The transformer bay shall be equipped with oil drainage, water separation and oil holding facilities. The system shall be automated with system healthy and system in operation indications to the SCADA systems. All ancillaries such as float levels, sump pumps etc. shall be included by the bidder in the bill of quantities' rates.

### **14. TRANSFORMER OFFLOADING**

Loading and offloading of the transformers shall be done by means of rigging on skids. The transformer mounted on the low bed vehicle will be brought into position adjacent to the transformer bay. The transformer must be lifted with jacks to install railway rails underneath the transformer. By means of a system of packers and jacks, the tank is then lowered onto a pair of greased railway rails along which it can be slid to its position over the plinth. The required position of the tank on the plinth must be accurately marked. When the tank is correctly positioned on the plinth, it must then be carefully examined for any signs of damage or any other indication that it might have been abused during transport.

The impact recorder that has been fitted for transport shall now be read or downloaded and then switched off and removed. Any additional clamping that has been applied to the core and windings for transport must now be removed according to the instruction manual. The coolers, pipework, bushing, turrets, etc. which were removed for transport, will now be fitted and connected, requiring the removal of blanking plates giving access to the tank.

Such opening of the tank must be kept to a minimum time to reduce the possibility of moisture entering the tank. If the transformer has been transported with the tank full of nitrogen, it is necessary to perch this fully with dry air.

When all bushings have been fitted, access covers replaced, conservator and Buchholtz pipe work erected as well as associated pipe work installed and connected to the radiators, preparation can begin with the filling of the transformer with oil.

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# GSE18 – GENERAL SPECIFICATION ELECTRICAL

POWER TRANSFORMERS RATED FOR  
1.25 MVA AND ABOVE AND WITH  
HIGHEST VOLTAGE OF 2.2 KV OR ABOVE.

## TABLE OF CONTENTS

|     |   |   |
|-----|---|---|
| 1.  | GENERAL .....                               | 2 |
| 2.  | NORMATIVE REFERENCES .....                  | 2 |
| 3.  | PHYSICAL ARRANGEMENT .....                  | 2 |
| 4.  | BUSHINGS .....                              | 3 |
| 5.  | TAP CHANGER.....                            | 4 |
| 6.  | CORE .....                                  | 4 |
| 7.  | WINDINGS .....                              | 4 |
| 8.  | AUXILIARIES .....                           | 4 |
| 9.  | TANK .....                                  | 4 |
| 10. | INSULATION .....                            | 6 |
| 11. | TRANSFORMER OIL .....                       | 6 |
| 12. | TESTS .....                                 | 6 |
| 13. | OIL SEPARATION AND HOLDING FACILITIES ..... | 7 |
| 14. | TRANSFORMER OFFLOADING.....                 | 7 |

## TABLE OF TABLES

|                                |   |
|--------------------------------|---|
| Table 9: Insulation level..... | 6 |
|--------------------------------|---|

## TABLE OF FIGURES

|  |   |
|--|---|
| Figure 1: Transformer arrangement..... | 3 |
|--|---|

## 1. GENERAL

This general specification covers the general requirements for Power Transformers rated for 1.25 MVA and above and with highest voltage of 2.2 kV or above.

## 2. NORMATIVE REFERENCES

The following documents contain provisions that constitute requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

**Table 1: SANS specifications**

| Document   | Rev./issue | Title and Publisher   |
|------------|------------|---|
| SANS 107   | Latest     | Standard Transformer Bushings.  |
| SANS 1091  | Latest     | National colour standard  |
| SANS 9001  | Latest     | Requirements For Quality Management Systems                                     |
| SANS 14001 | Latest     | Environmental Management Manual International Standards – EMS                   |
| SANS 60034 | Latest     | Rotating electrical machines.   |
| SANS 60076 | Latest     | Power Transformers. All parts   |
| SANS 60137 | Latest     | Insulated bushings for alternating voltages above 1000 V.                       |
| IEC 60085  | Latest     | Thermal evaluation and classification of electrical insulation.                 |
| IEC60156   | Latest     | Insulating liquids – Determination of the breakdown voltage at power frequency. |
| IEC 60214  | Latest     | On-load tap-changers.   |

In addition, the following Eskom specifications shall constitute requirements of this specification. All Eskom standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

**Table 2: Eskom specifications**

| Document     | Rev./issue | Title and Publisher  |
|--------------|------------|--|
| 240-68973110 | 1          | Specification for Power Transformers rated for 1.25 MVA and above and with highest voltage of 2.2 kV or above. |

## 3. PHYSICAL ARRANGEMENT

The power transformer's maximum dimensions, including the bushings, cooler banks and conservator shall be:

Height:                      < 3.1 m (plinth to tank cover)  
                                      < 5 m (top of bushing stem)

## POWER TRANSFORMER LARGER THAN 1.25 MVA

|         |                                |
|---------|--------------------------------|
| Length: | < 5.5 m (conservator tank top) |
|         | < 4.4 m (tank footprint)       |
|         | < 6.5 m (overall)              |
| Width:  | < 1.5m (tank footprint)        |
|         | < 5 m (overall)                |

NOTE: The conservator spatial orientation, with reference to the transformer main tank, must be adjustable to ensure the minimum safe working clearances are satisfied.

The power transformer's physical arrangement shall conform to the layout as per the sketch below.

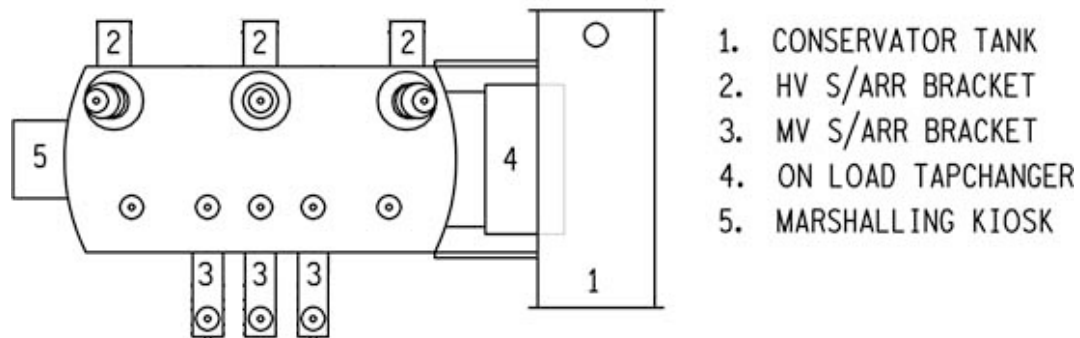


Figure 1: Transformer arrangement

Tenderers shall note that the transformer radiators / cooling fins shall be attached to the transformer main tank only and shall not destabilise the transformer to such an extent that radiator supports are required.

The use of radiator supports shall only be approved where the radiators are installed in a remote location for special applications such as indoor transformers with remote cooling banks and vents.

### 4. BUSHINGS

The following shall apply to the transformer bushings:

1. The HV Bushing shall be symmetrically arranged about the overall transverse Centre line of the transformer.
2. All neutral bushings shall be fitted in line with the MV bushings.
3. Despite the actual operating voltage, the transformer bushings shall have an insulation level corresponding to a nominal system voltage of 33 kV. These bushings shall be equipped with a terminal stem of **38 mm diameter** for secondary side, **26 mm diameter** for primary side and **125 mm length**, have a minimum centre-to-centre spacing of not less than **400 mm for MV side**.
4. The MV bushings shall be of the capacitance graded type.
5. The minimum distance from the transformer base (plinth) to the bushing flange base shall be 2.5 m.
6. The bushing creepage distance shall be 31 mm/kV (MV: at 33 kV).

## 5. TAP CHANGER

The tap changer shall be of the vacuum type. The on-load tap changer shall operate in the range of +5% to -15% of the HV voltage in 16 equal steps of 1.25% each.

The tap changer shall be subject to the following testing:

1. 8 Complete Cycles – not energized
2. 1 Complete operation cycle – 85% of rated voltage applied
3. 1 Complete Cycle energized at rated voltage and frequency (no-load)
4. 10 Tap changes within +/- 2 steps of the principle tap

Care shall be taken to match the tap voltages to the voltage range of other transformers.

## 6. CORE

There shall be no sparking that may upset Dissolved Gas Analysis (DGA) monitoring of the transformer, between bolted mechanical members during inrush or other transient conditions. This requirement shall apply even if DGA is not included at this stage.

The core shall be earthed to the core clamping structure at one point only, through a removable external link suitably situated and protected, to allow testing after installation of the transformer. The core earthing connection shall be larger than 80mm<sup>2</sup>.

Lifting lugs shall be provided for lifting the core and windings.

## 7. WINDINGS

The paper used in the winding insulation shall be thermally upgraded paper. The bracing of the windings and connections shall be such that these parts shall safely withstand the cumulative effects of stresses that may occur during handling, transportation, installation and service, including line-to-line and line-to-ground faults

## 8. AUXILIARIES

All contacts providing an alarm output shall be rated to carry 30 A for 200ms at 250 V<sub>D.C.</sub> and continuously carry 2 A at 250V<sub>D.C.</sub> All secondary wiring shall be 2.5mm<sup>2</sup> with 30 strands (660/100 V as per SANS 1507-2). The auxiliary wiring shall be neatly fitted into a cable tray or compartment onto the transformer.

A 400/230V<sub>A.C.</sub>, 3ph, 4 wire, 50Hz auxiliary power supply shall be provided.

**The marshalling box shall have a certified rating of min. IP55. The marshalling box shall preferably be free standing. All gauges such as oil and winding temperature indications shall be equipped within the marshalling box.**

## 9. TANK

The transformer tank cover shall be bolted.

The interior surfaces of the tank, the cover and the cooling equipment shall be cleaned and dried immediately prior to filling the transformer with oil. Interior surfaces (other than those

## POWER TRANSFORMER LARGER THAN 1.25 MVA

of cooling tubes and headers) above a line that lies at least 50 mm below the oil level that corresponds to an oil temperature of 20 °C, shall be corrosion-protected by varnishing, priming or painting, using materials that are not affected by, or will not adversely affect, the electrical or chemical properties of the insulating oil.

The tank and cover shall be designed so that local heating due to stray flux in any structural part shall not exceed the top oil temperature limit specified for the transformer, by more than 10 °C.

Heating, due to stray flux, shall also not cause local temperature elevations of more than 15 °C relative to the oil temperature at that level.

Thermometer pockets shall be located so as to avoid errors in temperature indication due to the heating effects resulting from stray flux.

The under base shall be suitable for the movement of the transformer in any direction, by sliding on greased rails, and shall be provided with four hauling eyes not less than 50 mm in diameter, as near as possible to the extremities of the length and width of the tank with not less than 100 mm working clearance above them.

Four suitably and symmetrically placed jacking pads shall be provided in positions that shall be accessible when the transformer is loaded on to the transport vehicle, except where jacking pads are used as transport pads on vehicles with built-in jacking.

The position of the jacking pads shall be such that they do not restrict the direction in which the transformer could be moved (forward, backward and sideways) once offloaded on site.

Four symmetrically placed lifting lugs shall be provided so that it will be possible to lift the complete transformer when filled with oil without structural damage to any part of the transformer. The factor of safety at any one point shall not be less than 2.

The lifting lugs shall be arranged and located as to be accessible for use when the transformer is loaded on the transport vehicle, and so as not to cause fouling of any of the transformer fittings and accessories.

Centre of gravity shall be clearly visible and indicated on all sides of the transformer tank.

The transformer primary will be solidly earthed without any Neutral Earthing Resistor. The OEM shall therefore take circulating currents into consideration when the tank wall thickness is calculated to prevent any interior or exterior corrosion.

Provision shall be made for earthing the transformer and associated apparatus as follows:

1. Transformer tank earthing
2. Transformer neutral(s) earthing (direct)
3. Transformer surge arrester earthing (line and neutral surge arresters)
4. All tank attached apparatus, including cable marshalling boxes, tap-changer operating gear and mechanism boxes, and fan and pump motors shall be bonded to their supporting structures.
5. Earthing pads shall also be provided on each end of the supporting structures for all separately mounted cooler banks and oil conservators and on all free-standing cubicles.
6. No copper shall be used as connections for the purpose of earthing.



## 10. INSULATION

The transformer bushing insulation level shall be 10% above the values given in the table below:

**Table 3: Insulation level**

| Table 6: Insulation level              |  |                     |                              |                     |                                |         |          |                                     |                  |                                     |                    |             |  |                  |
|--|--|---------------------|------------------------------|---------------------|--------------------------------|---------|----------|-------------------------------------|------------------|-------------------------------------|--------------------|-------------|--|------------------|
| U <sub>m</sub><br>(kV <sub>rms</sub> ) | U <sub>n</sub><br>(kV <sub>rms</sub> ) | Fault level<br>(kA) | Lightning - BIL<br>(kV peak) |                     | Power<br>Frequency<br>60s 50Hz |         | Bushings |                                     |                  |                                     |                    | Tap changer |  |                  |
|  |  |                     |                              |                     |                                |         | Line     |                                     | Neutral          |                                     | Creepage (31mm/kV) |             |  |                  |
|  |  |                     | Line<br>Terminal             | Neutral<br>Terminal | Separate<br>source             | Induced | BIL      | 60s<br>50Hz<br>(kV <sub>rms</sub> ) | BIL<br>(kV peak) | 60s<br>50Hz<br>(kV <sub>rms</sub> ) |                    |             | U <sub>n</sub><br>(kV <sub>rms</sub> ) | BIL<br>(kV peak) |
| 12                                     | 11                                     | 25                  | 95                           | 95                  | 28                             | 22      | 200      | 70                                  | 200              | 70                                  | 375                | 11          | 95                                     | 28               |
| 100                                    | 88                                     | 25                  | 380                          | 250x                | 95x                            | 150     | 550      | 230                                 | 350              | 140                                 | 3100               | 44          | 250                                    | 95               |
| 145                                    | 132                                    | 40                  | 550                          | 250x                | 95x                            | 230     | 650      | 275                                 | 350              | 140                                 | 4500               | 44          | 250                                    | 95               |

x - The HV insulation level shall be 48kV RMS without exceeding 165kV Peak for partially graded transformers.

## 11. TRANSFORMER OIL

The transformer main tank oil insulation level shall be 70kV per 2.5mm for virgin oil prior to filling and 60kV per 2.5mm at time of taking over.

## 12. TESTS

The transformer shall be subject to the following test at the cost of the OEM to be witnessed by the Authority and Engineering representative:

1. Voltage Ratio and Phase displacement
2. Winding D.C. Resistance
3. Insulation Resistance to Earth
4. Insulation Characteristics and bushing dielectric loss
5. Separate source voltage withstand
6. Induced Over-voltage withstand
7. Partial Discharge Measurement
8. Lightning impulse Withstand
9. Switching Impulse Withstand
10. Insulation resistance to earth
11. Short circuit AC tests (Partial Discharge)
12. No load loss, magnetizing current and impedance voltage
13. Short Circuit Impedance and load loss
14. Zero Sequence Impedance
15. On load tap changing
16. Temperature rise & overload
17. Overpressure – Leakage Test
18. Oil DGA

19. Determining of Sound Levels / acoustic noise
20. Frequency Response analysis (Factory & Site)
21. Paint thickness & quality
22. Auxiliary wiring functionality & pressure test (Factory)
23. Impact Recorders during transport, loading and offloading
24. Short circuit withstand calculations for the transformer shall be provided.

### **13. OIL SEPARATION AND HOLDING FACILITIES**

The transformer bay shall be equipped with oil drainage, water separation and oil holding facilities. The system shall be automated with system healthy and system in operation indications to the SCADA systems. All ancillaries such as float levels, sump pumps etc. shall be included by the bidder in the bill of quantities' rates.

### **14. TRANSFORMER OFFLOADING**

Loading and offloading of the transformers shall be done by means of rigging on skids. The transformer mounted on the low bed vehicle will be brought into position adjacent to the transformer bay. The transformer must be lifted with jacks to install railway rails underneath the transformer. By means of a system of packers and jacks, the tank is then lowered onto a pair of greased railway rails along which it can be slid to its position over the plinth. The required position of the tank on the plinth must be accurately marked. When the tank is correctly positioned on the plinth, it must then be carefully examined for any signs of damage or any other indication that it might have been abused during transport.

The impact recorder that has been fitted for transport shall now be read or downloaded and then switched off and removed. Any additional clamping that has been applied to the core and windings for transport must now be removed according to the instruction manual. The coolers, pipework, bushing, turrets, etc. which were removed for transport, will now be fitted and connected, requiring the removal of blanking plates giving access to the tank.

Such opening of the tank must be kept to a minimum time to reduce the possibility of moisture entering the tank. If the transformer has been transported with the tank full of nitrogen, it is necessary to perch this fully with dry air.

When all bushings have been fitted, access covers replaced, conservator and Buchholtz pipe work erected as well as associated pipe work installed and connected to the radiators, preparation can begin with the filling of the transformer with oil.

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# GSE20 – GENERAL SPECIFICATION ELECTRICAL

COMBINED THREE-PHASE NEUTRAL  
ELECTRO-MAGNETIC COUPLERS WITH  
NEUTRAL EARTHING RESISTORS AND  
AUXILIARY TRANSFORMERS (NECRT's)"

## TABLE OF CONTENTS

|    |                            |   |
|----|----------------------------|---|
| 1. | GENERAL .....              | 2 |
| 2. | NORMATIVE REFERENCES ..... | 2 |

## TABLE OF TABLES

No Table of Figures Entries Found.

## TABLE OF FIGURES

No Table of Figures Entries Found.

## 1. GENERAL

This general specification covers the general requirements for Power Transformers rated for 1.25 MVA and above and with highest voltage of 2.2 kV or above.

## 2. NORMATIVE REFERENCES

The following documents contain provisions that constitute requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

**Table 1: SANS specifications**

| Document    | Rev./issue | Title and Publisher   |
|-------------|------------|---|
| SANS 107    | Latest     | Standard Transformer Bushings.  |
| SANS 1091   | Latest     | National colour standard  |
| SANS 2093   | Latest     | Electroplated coatings of tin - Specification and test methods.                                 |
| SANS 9001   | Latest     | Quality Management Systems.   |
| SANS 60076  | Latest     | Power Transformers. All parts.  |
| SANS 60137  | Latest     | Insulated bushings for alternating voltages above 1000 V.                                       |
| SANS 60270  | Latest     | High-voltage test techniques - Partial discharge measurements.                                  |
| SANS 60815  | Latest     | Selection and dimensioning of high-voltage insulators intended for use in polluted conditions.  |
| NRS 079-1   | Latest     | Mineral insulating oils (uninhibited) Part 1: Purchase, management, maintenance and testing.    |
| IEC 60071   | Latest     | Insulation co-ordination.   |
| IEC 60085   | Latest     | Thermal evaluation and classification of electrical insulation.                                 |
| IEC 60156   | Latest     | Insulating liquids – Determination of the breakdown voltage at power frequency.                 |
| IEC 60185   | Latest     | Current transformers.   |
| IEC 60216-2 | Latest     | Guide for the determination of thermal endurance properties of electrical insulating materials. |
| IEC 60233   | Latest     | Tests on hollow insulators for use in electrical equipment.                                     |
| IEC 60505   | Latest     | Guide for the evaluation of insulation systems of electrical equipment.                         |
| IEC 60507   | Latest     | Artificial pollution tests on high voltage insulators to be used on ac. systems.                |

In addition, the following Eskom specifications shall constitute requirements of this specification. All Eskom standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

**Table 2: Eskom specifications**

| <b>Document</b> | <b>Rev./issue</b> | <b>Title and Publisher</b>  |
|-----------------|-------------------|---|
| 240-57648848    | 1                 | Specification For Combined Three-Phase Neutral Electro-Magnetic Couplers With Neutral Earthing Resistors And Auxiliary Transformers (Necrt's)". |

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# GSE48 – GENERAL SPECIFICATION ELECTRICAL

OPTICAL GROUND WIRE (OPGW)

## TABLE OF CONTENTS

|       |                                     |   |
|-------|-------------------------------------|---|
| 1.    | GENERAL .....                       | 2 |
| 2.    | NORMATIVE REFERENCES .....          | 2 |
| 2.1.  | GENERAL REQUIREMENTS .....          | 2 |
| 3.    | SERVICE CONDITIONS .....            | 4 |
| 4.    | DESIGN DETAILS .....                | 4 |
| 4.1.  | FIBRE OPTIC .....                   | 4 |
| 4.2.  | ARMOUR .....                        | 4 |
| 4.3.  | CRUSH RESISTANCE .....              | 4 |
| 4.4.  | TENSILE PERFORMANCE .....           | 5 |
| 4.5.  | CABLE DEFORMATION .....             | 5 |
| 4.6.  | STRESS-STRAIN .....                 | 5 |
| 4.7.  | IMPACT .....                        | 5 |
| 4.8.  | AEOLIAN VIBRATION .....             | 5 |
| 4.9.  | CONDUCTOR CREEP .....               | 5 |
| 4.10. | TEMPERATURE CYCLE .....             | 5 |
| 4.11. | SHORT - CIRCUIT CURRENT .....       | 5 |
| 4.12. | LIGHTNING .....                     | 5 |
| 4.13. | MACRO-BEND RESISTANCE .....         | 6 |
| 5.    | INSTALLATION .....                  | 6 |
| 6.    | TESTS .....                         | 6 |
| 7.    | MARKING, LABELLING, PACKAGING ..... | 6 |
| 8.    | DOCUMENTATION .....                 | 6 |
| 9.    | TRAINING .....                      | 6 |

## TABLE OF TABLES

|  |   |
|--|---|
| Table 1: SANS specifications .....                           | 2 |
| Table 2: General Requirements .....                          | 3 |
| Table 3: Damped conductor tension limits (SANS10280-1) ..... | 4 |



## 1. GENERAL

This general specification covers the general requirements for Optical Ground Wire (OPGW).

Optical Ground Wire (OPGW) serves as a medium for protection, SCADA and general communication as well as the conventional purpose of a shield i.e. lightning overage and earth wire.

## 2. NORMATIVE REFERENCES

The following documents contain provisions that constitute requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

**Table 1: SANS specifications**

| Document        | Rev./issue | Title and Publisher  |
|-----------------|------------|--|
| NRS 061         | Latest     | Specification for overhead ground wire with optical fibre:   |
| NRS 061-1       | Latest     | Product specification  |
| NRS 061-2       | Latest     | Installation guidelines  |
| NRS 081         | Latest     | Single-Mode Non-Dispersion Shifted Optical Fibres  |
| SANS 10280-1    | Latest     | Overhead Power Lines for conditions prevailing in South Africa.  |
| SANS 60815      | Latest     | Guide for the selection of insulators in respect of polluted conditions.                                     |
| SANS 60793-2    | Latest     | Optical fibres. Part 2: Product specifications – General.  |
| SANS 60794-4-1  | Latest     | Optical fibre cables. Part 4: Sectional specification – Aerial optical cables along electrical power lines.  |
| SANS 60793-2-30 | Latest     | Optical fibres Part 2-30: Product specifications - Sectional specification for category A3 multimode fibres. |

### 2.1. GENERAL REQUIREMENTS

- The general requirements for OPGW are specified below, where conflicting requirements with NRS 061-1 occur, this specification shall take precedence.
- The OPGW shall have the necessary protective outer layer to prevent damage to the fibre due to mechanical elongation, bending, twisting and crushing forces.
- The stranded bare conductor shall consist of the same electrical and mechanical characteristics as a conventional overhead ground wire.

- d) Full details of the construction of the fibre cable offered shall be provided, as well as the measures taken to minimize hydrogen absorption in the fibres.
- e) Each fibre shall be measured for continuity and length, while the cable is on a drum, prior to delivery.
- f) Sample tests shall be performed to ensure that the material used and the manufacturing processes are without defect.
- g) Type test certificates shall be provided and routine tests shall be carried out in accordance with NRS061-1.
- h) Each fibre shall be uniquely identified in an approved manner.
- i) There shall be no fibre splices in any individual drum length of OPGW.
- j) The fibre carrier design shall be such that no moisture shall be able to penetrate and come in contact with the fibres and no grease shall be applied on the conductor.
- k) The wires shall be stranded in such a manner that, when the complete conductor is cut, the individual layers can easily be regrouped.

### 2.1.1. OPGW TYPES

Dependant on the power line detail design one of the following 24 Core or 48 Core OPGW types shall be selected as stated in the project specification, Bill of Quantities or project drawings.

OPGW types shall be either 12, 24 or 48 Core (G.652.D) in accordance with NRS081 and shall comply with the general requirement as tabled below. The Ultimate Tensile Strength stipulated is the expected extremity between manufacturers and the short circuit current rating stipulated is a minimum value.

**Table 2: General Requirements**

| ITEM | DIAMETER (mm) | UTS (kN) | CURRENT RATING (1s) |
|------|---------------|----------|---------------------|
| 5kA  | 10.8          | 66kN     | 5.66kA              |
| 10kA | 13.3          | 69.7kN   | 10kA                |
| 12kA | 14.9          | 113.4kN  | 12kA                |
| 16kA | 16.6          | 104.5kN  | 16.5kA              |
| 18kA | 17.7          | 118.3kN  | 18.68kA             |
| 21kA | 19.3          | 141.5kN  | 22.34kA             |

For all of the above OPGW types the relevant PLS CADD seed /wire file shall be submitted by the Contractor to the Engineer, as supplied by the Original Equipment Manufacturer (OEM). No material shall be ordered by the Contractor prior to written approval by the Engineer that the OPGW type was successfully integrated into and tested as part of the PLS CADD power line design.

For high fault levels or double circuit power lines the Engineer may opt to combine the use of OPGW with steel or ACSR wires. The use of single strand ACSR conductor shall be prohibited to prevent unnecessary fatigue failure due to vibration. Contractors shall provide the Engineer with the OPGW's DC resistance in order to confirm fault current

sharing provisions. The Contractor shall note that with the use of ACSR as a second shield wire reduced tensions in the shield wire and thus also in phase conductors will be required to retain adequate lightning coverage and compliance with relevant standards.

### 3. SERVICE CONDITIONS

The OPGW shall be designed for use under the following typical in-land service conditions:

- a) Pollution level : very heavy
- b) Maximum temperature : 50 °C
- c) Minimum temperature : -10 °C
- d) Route altitude : 1 000m - 2 000m (Above sea level)

The conductor tension limits for un-damped conductors (after creep) shall be 1425m. The sag for earth / shield wires shall be limited to 90% of the conductor sag.

Tension limits for damped conductors shall comply with the table below:

**Table 3: Damped conductor tension limits (SANS10280-1)**

| 1                              | 2                | 3                |
|--------------------------------|------------------|------------------|
| Conductor condition            | Phase conductor  | Earthwire        |
| After creep condition at -5 °C | C limit: 2 450 m | C limit: 2 750 m |
| After creep at EDT             | C limit: 1 800 m | C limit: 2 100 m |
| Ultimate wind/Ice load         | 70 % of UTS      |                  |

### 4. DESIGN DETAILS

#### 4.1. FIBRE OPTIC

- a) These shall be **SINGLE MODE** fibres as in accordance with, IEC 60793-1 and IEC 60793-2. The number of cores shall be 12, 24 or 48.

#### 4.2. ARMOUR

- a) The OPGW armour shall be designed to provide similar mechanical and electrical characteristics as a conventional shield wire, and meet short-circuit current requirement.
- b) The construction of the armour shall comprise bare metallic wires of combined metals stranded in one or more layer(s).
- c) The direction of lay shall be reversed in successive layers.

#### 4.3. CRUSH RESISTANCE

During stringing, the conductor is subjected to side compression when it passes over metal pulleys or when clamps are installed. To endure these stresses, the fibre shall have a high anti-crushing resistance. When tested there shall be no measurable permanent changes in optical attenuation coefficient at 1310 nm and 1550 nm (nanometer), while any temporary change in attenuation shall be less than 0,1 dB (decibels).

**Note:** *Attenuation is the reduction of signal strength during transmission.*

#### **4.4. TENSILE PERFORMANCE**

The conductor shall be designed in such a manner that it can withstand a specified tensile load without damaging influence on the optical fibres. The tensile performance shall comply with NRS 061-1 clause 4.2.7.

#### **4.5. CABLE DEFORMATION**

During installation the cable shall be subjected to passing, under tension, over several metal pulleys. The cable deformation shall comply with NRS 061-1 clause 4.2.8.

#### **4.6. STRESS-STRAIN**

There shall be no visual change to the cable strands. The stress-strain shall comply with NRS 061-1 clause 4.2.9. The stress-strain curve, creep and UTS shall be an exact match to the typical galvanized steel wires utilized namely 3/4.00, 7/3.35 or 19/2.65 unless otherwise specified in documentation presiding over this general specification.

#### **4.7. IMPACT**

The impact shall comply with NRS 061-1 clause 4.2.10.

#### **4.8. AEOLIAN VIBRATION**

The optical attenuation increase shall be less than 0,05 dB/km at 1550 nm. The Aeolian vibration shall comply with NRS 061-1 clause 4.2.11.

#### **4.9. CONDUCTOR CREEP**

The manufacturer shall submit records of a long term (>1 000 h) elongation test, with extrapolation to 15 years of a conductor sample tensioned at 20 % RTS.

#### **4.10. TEMPERATURE CYCLE**

The temperature cycle shall comply with NRS 061-1 clause 4.2.13.

#### **4.11. SHORT - CIRCUIT CURRENT**

The short-circuit current shall comply with NRS 061-1 clause 4.2.14.

#### **4.12. LIGHTNING**

The lightning shall comply with NRS 061-1 clause 4.2.15.

#### **4.13. MACRO-BEND RESISTANCE**

The macro-bend resistance shall comply with NRS 061-1 clause 4.2.5 for G.652 fibres respectively.

#### **5. INSTALLATION**

All requirements as per NRS061-2 shall be met and provided for. Before initiation the installation process the Contractor shall provide the Engineer with his quality check list for approval. Stringing shall not start until the Contractors quality checklist is approved by the Engineer.

#### **6. TESTS**

The OPGW type tests; routine test and sample test set out in NRS 061-1 shall apply to this specification. OTDR tests shall be conducted as routine tests.

#### **7. MARKING, LABELLING, PACKAGING**

Marking, labelling and packaging shall comply with the requirements of NRS 061-1.

#### **8. DOCUMENTATION**

- a) PLS CADD seed / wire file
- b) Technical product catalogue and manuals shall be provided.
- c) Full detailed dimensions drawings shall be provided (including all splice boxer and attachment method).
- d) All splice position relating to the station lengths of the line shall be submitted for approval before orders for material are placed.
- e) A copy of all type test certificates and routine test reports in English shall be provided.
- f) A copy of the proposed routine test certificates in English shall be provided.

#### **9. TRAINING**

A necessary certified training course shall be offered to relevant local authority staff. The training shall include, amongst other things, the handling, storage and installation of the OPGW.

The associated costs for a certified training course shall be given per person and shall be fixed for the period of the contract.

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**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**



**THE CONTRACT PART 3: SCOPE OF THE WORK**

**C5: ANNEXURES AND DRAWINGS**

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**ANNEXURE 1: EMPLOYER H & S SPECIFICATION**

**EMALAHLENI LOCAL MUNICIPALITY**

**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

**ANNEXURE 2: EMPLOYER ENVIRONMENTAL SPECIFICATION**



**EMALAHLENI LOCAL MUNICIPALITY**

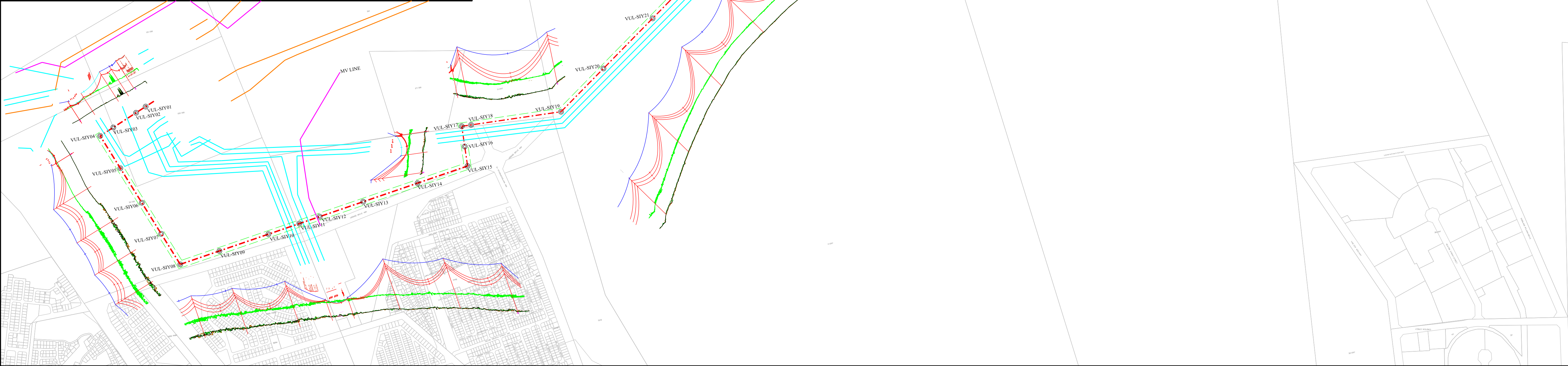
**40 MVA/132/11 KV, SIYANQOBA SUBSTATION PHASE 5 - CONSTRUCTION  
OF A 11,5 KM, 132 KV OVERHEAD LINE.**

**CONTRACT NUMBER: ELM 20/2021 (RE-ADVERT)**

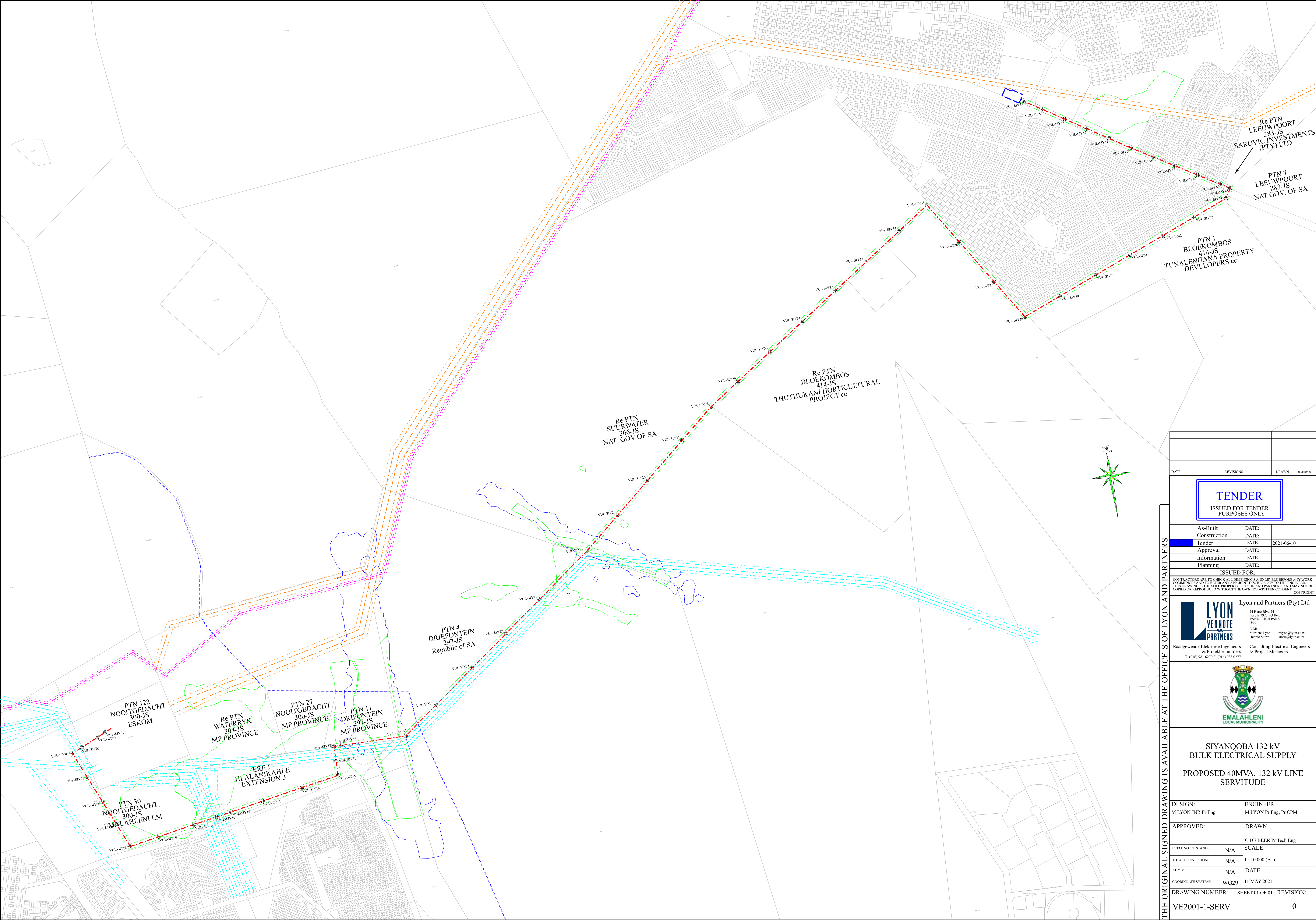
**ANNEXURE 3: DRAWINGS**



| NO. | POLE LABEL | DESCRIPTION                        | POLE LENGTH (m)    | EMBEDDED (m)   | STATION (m) | AHEAD SPAN (m) | CAH   |      |      |      | CROSSING LABEL | SW            | STAYS | COMMENT                |
|-----|------------|------------------------------------|--------------------|----------------|-------------|----------------|-------|------|------|------|----------------|---------------|-------|------------------------|
|     |            |                                    |                    |                |             |                | SW    | T    | M    | B    |                |               |       |                        |
| 1   | VUL-SIY00  | Gantry-12m beam 106                |                    |                | 6           | 39             | 14.83 | 10.6 | 10.6 | 10.6 | N              | Non Insulated |       | Existing Gantry Beam   |
| 2   | VUL-SIY01  | Str_4pole_in_line_15m_17m.pole     | 3 x 15m<br>1 x 17m | 2.3m           | 44          | 51             | 14.7  | 12.5 | 12.5 | 12.5 | N              | Non Insulated | 8     | 4 Poles                |
| 3   | VUL-SIY02  | Str_4pole_in_line_15m_16m.pole     | 3 x 15m<br>1 x 16m | 2.3m<br>2.4m   | 96          | 122            | 13.6  | 12.5 | 12.5 | 12.5 | N              | Non Insulated | 8     | 4 Poles                |
| 4   | VUL-SIY03  | Str_4pole_in_line_10m_11m.pole     | 3 x 10m<br>1 x 11m | 1.8m<br>1.7m   | 218         | 70             | 9.3   | 8    | 8    | 8    | N              | Non Insulated | 8     | 4 Poles                |
| 5   | VUL-SIY04  | Str_4pole_90deg_10m_12m.pole       | 3 x 10m<br>1 x 12m | 1.8m<br>1.8m   | 288         | 172            | 10.2  | 8    | 8    | 8    | N              | Non Insulated | 8     | 4 Poles                |
| 6   | VUL-SIY05  | Str_mono_in_line_20m.pole          | 20m                | 2              | 460         | 184            | 18    | 16.6 | 14.8 | 13   | Y              | Non Insulated | 7     |                        |
| 7   | VUL-SIY06  | Int_mono_SC_22m.pole               | 22                 | 2.8            | 644         | 165            | 19.2  | 17   | 15.9 | 14.8 | Y              | Non Insulated |       |                        |
| 8   | VUL-SIY07  | Int_mono_SC_22m.pole               | 22                 | 2.8            | 809         | 163            | 19.2  | 17   | 15.9 | 14.8 | 2 x Y          | Non Insulated |       |                        |
| 9   | VUL-SIY08  | Str_mono_SC_7615d_r2_20m.pole      | 20m                | 2              | 972         | 187            | 18    | 16.6 | 14.8 | 13   | Y              | Non Insulated | 7     |                        |
| 10  | VUL-SIY09  | Int_mono_SC_22m.pole               | 22                 | 2.8            | 1159        | 234            | 19.2  | 17   | 15.9 | 14.8 | Y              | Non Insulated |       |                        |
| 11  | VUL-SIY10  | Int_mono_SC_22m.pole               | 22                 | 2.8            | 1393        | 148            | 19.2  | 17   | 15.9 | 14.8 | N              | Non Insulated |       |                        |
| 12  | VUL-SIY11  | Str_4pole_in_line_10m.pole         | 4 x 10m            | 1.8m           | 1540        | 97             | 8.2   | 8    | 8    | 8    | Y              | Non Insulated | 8     | 4 Poles                |
| 13  | VUL-SIY12  | Str_4pole_in_line_11m.pole         | 4 x 11m            | 1.9m           | 1637        | 208            | 9.1   | 8.9  | 8.9  | 8.9  | Y              | Non Insulated | 8     | 4 Poles                |
| 14  | VUL-SIY13  | Int_mono_SC_24m_FM.pole            | 1 x 24m            | flange mounted | 1845        | 259            | 24    | 21.8 | 20.7 | 19.6 | Y              | Non Insulated |       | Flange Mounted         |
| 15  | VUL-SIY14  | Int_mono_SC_24m_FM.pole            | 1 x 24m            | flange mounted | 2104        | 239            | 24    | 21.8 | 20.7 | 19.6 | Y              | Insulated     |       | Flange Mounted         |
| 16  | VUL-SIY15  | Str_mono_SC_23.2m_FMS.pole         | 1 x 23.2m          | flange mounted | 2342        | 89             | 23.2  | 21.8 | 20   | 18.2 | Y              | Insulated     |       |                        |
| 17  | VUL-SIY16  | Str_4pole_in_line_10m_12m.pole     | 3 x 10m<br>1 x 12m | 1.8m<br>1.7m   | 2431        | 92             | 10.2  | 8    | 8    | 8    | N              | Insulated     | 8     | 4 Poles                |
| 18  | VUL-SIY17  | Str_4pole_90deg_10m_12m.pole       | 3 x 10m<br>1 x 12m | 1.8m<br>1.8m   | 2524        | 42             | 10.2  | 8    | 8    | 8    | N              | Insulated     | 8     | 4 Poles                |
| 19  | VUL-SIY18  | Str_mono_SC_23.2m_FMS.pole         | 1 x 23.2m          | flange mounted | 2566        | 410            | 23.2  | 21.8 | 20   | 18.2 | Y              | Insulated     | N/A   |                        |
| 20  | VUL-SIY19  | Str_mono_SC_23.2m_FMS.pole         | 1 x 23.2m          | flange mounted | 2977        | 273            | 23.2  | 21.8 | 20   | 18.2 | Y              | Insulated     | N/A   |                        |
| 21  | VUL-SIY20  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 3250        | 317            | 25.3  | 23.1 | 22   | 20.9 | Y              | Insulated     |       | Flange Mounted         |
| 22  | VUL-SIY21  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 3567        | 305            | 25.3  | 23.1 | 22   | 20.9 | Y              | Insulated     |       | Flange Mounted         |
| 23  | VUL-SIY22  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 3872        | 297            | 25.3  | 23.1 | 22   | 20.9 | Y              | Insulated     |       | Flange Mounted         |
| 24  | VUL-SIY23  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 4169        | 423            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 25  | VUL-SIY24  | Str_3pole_in_line_12m.pole         | 3 x 12m            | flange mounted | 4592        | 297            | 32    | 30.5 | 30.5 | 30.5 | Y              | Non Insulated | 7     | Tied at top            |
| 26  | VUL-SIY25  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 4890        | 289            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 27  | VUL-SIY26  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 5179        | 326            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 28  | VUL-SIY27  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 5505        | 273            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 29  | VUL-SIY28  | Str_mono_in_line_20m.pole          | 20m                | 2              | 5779        | 231            | 18    | 16.6 | 14.8 | 13   | Y              | Non Insulated | 6     | Based on 7615          |
| 30  | VUL-SIY29  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 6010        | 275            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 31  | VUL-SIY30  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 6285        | 281            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 32  | VUL-SIY31  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 6566        | 276            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 33  | VUL-SIY32  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 6843        | 260            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 34  | VUL-SIY33  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 7103        | 281            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 35  | VUL-SIY34  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 7384        | 240            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 36  | VUL-SIY35  | Str_mono_SC_7615d_r2_24.pole       | 24m                | 2              | 7624        | 303            | 22    | 20.6 | 18.8 | 17   | N              | Non Insulated | 7     |                        |
| 37  | VUL-SIY36  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 7927        | 333            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 38  | VUL-SIY37  | Int_mono_SC_25.3m_FM.pole          | 25.3m              | flange mounted | 8260        | 290            | 25.3  | 23.1 | 22   | 20.9 | Y              | Non Insulated |       | Flange Mounted         |
| 39  | VUL-SIY38  | Str_mono_SC_7615d_r2_24.pole       | 24m                | 2              | 8551        | 251            | 22    | 20.6 | 18.8 | 17   | N              | Non Insulated |       |                        |
| 40  | VUL-SIY39  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 8802        | 260            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted         |
| 41  | VUL-SIY40  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 9061        | 251            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted         |
| 42  | VUL-SIY41  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 9312        | 236            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted         |
| 43  | VUL-SIY42  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 9548        | 224            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted         |
| 44  | VUL-SIY43  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 9772        | 235            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted         |
| 45  | VUL-SIY44  | Str_mono_SC_7615d_r2_24.pole       | 24m                | 2              | 10007       | 68             | 22    | 20.6 | 18.8 | 17   | N              | Non Insulated | 7     |                        |
| 46  | VUL-SIY45  | Str_2pole_2xSC_23.2mcah-MV_FM.pole | 2 x 23.2m          | flange mounted | 10075       | 71             | 23.2  | 21.8 | 20   | 18.2 | N              | Non Insulated |       |                        |
| 47  | VUL-SIY46  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 10145       | 150            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 48  | VUL-SIY47  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 10295       | 150            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 49  | VUL-SIY48  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 10445       | 150            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 50  | VUL-SIY49  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 10595       | 150            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 51  | VUL-SIY50  | Str_2pole_2xSC_23.2mcah-MV_FM.pole | 2 x 23.2m          | flange mounted | 10745       | 149            | 23.2  | 21.8 | 20   | 18.2 | N              | Non Insulated |       |                        |
| 52  | VUL-SIY51  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 10894       | 152            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 53  | VUL-SIY52  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 11046       | 149            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 54  | VUL-SIY53  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 11195       | 150            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 55  | VUL-SIY54  | Int_mono_DCHVdcvm_24m_FM.pole      | 1 x 24m            | flange mounted | 11345       | 135            | 24    | 21.8 | 20.7 | 19.6 | N              | Non Insulated |       | Flange Mounted with MV |
| 56  | VUL-SIY55  | Str_2pole_2xSC_19mcah-MV_FM.pole   | 1 x 19m            | flange mounted | 11480       | 37             | 19    | 17.6 | 15.8 | 14   | N              | Non Insulated | 7     |                        |
| 57  | VUL-SIY56  | 132kv-12m beam-double 106          |                    |                | 11516       | 0              | 14.83 | 10.6 | 10.6 | 10.6 | N              | Non Insulated |       | Existing Gantry Beam   |







|       |           |       |             |
|-------|-----------|-------|-------------|
| DATE: | REVISIONS | DRAWN | REVISION NO |
|       |           |       |             |
|       |           |       |             |
|       |           |       |             |

|                                 |       |            |
|---------------------------------|-------|------------|
| TENDER                          |       |            |
| ISSUED FOR TENDER PURPOSES ONLY |       |            |
| As-Built                        | DATE: |            |
| Construction                    | DATE: |            |
| Tender                          | DATE: | 2021-06-10 |
| Approval                        | DATE: |            |
| Information                     | DATE: |            |
| Planning                        | DATE: |            |

ISSUED FOR:  
CONTRACTORS ARE TO CHECK ALL DIMENSIONS AND LEVELS BEFORE ANY WORK COMMENCES AND TO REPORT ANY APPARENT DISCREPANCY TO THE ENGINEER. THIS DRAWING IS THE SOLE PROPERTY OF LYON AND PARTNERS, AND MAY NOT BE COPIED OR REPRODUCED WITHOUT THE OWNER'S WRITTEN CONSENT. COPYRIGHT



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SIYANQOBA 132 kV  
BULK ELECTRICAL SUPPLY  
PROPOSED 40MVA, 132 kV LINE  
SERVITUDE

|                               |                                    |
|-------------------------------|------------------------------------|
| DESIGN:<br>M LYON JNR Pr Eng  | ENGINEER:<br>M LYON Pr Eng, Pr CPM |
| APPROVED:                     | DRAWN:<br>C DE BEER Pr Tech Eng    |
| TOTAL NO. OF STANDS: N/A      | SCALE:<br>1 : 10 000 (A1)          |
| TOTAL CONNECTIONS: N/A        | DATE:<br>11 MAY 2021               |
| ADMD: N/A                     | REVISION:                          |
| COORDINATE SYSTEM: WG29       |                                    |
| DRAWING NUMBER: VE2001-1-SERV |                                    |