



**Transnet Freight Rail**, a division of

**TRANSNET SOC LTD**

Registration Number 1990/000900/30

[hereinafter referred to as **Transnet**]

**REQUEST FOR QUOTATION [RFQ] No BLE/52254**

**DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF RECTIFIERS, AC/DC DISTRIBUTION PANELS, PCB CONTROL PANELS, POSITIVE ISOLATOR SWITCHES AT PIETER MEINTJIES 3KV DC TRACTION SUBSTATION.**

**PERIOD: 3 WEEKS**

**ISSUE DATE: 27 MAY 2013**

**CLOSING DATE: 25 JUNE 2013**

**CLOSING TIME: 10:00**

## **SCHEDULE OF DOCUMENTS**

### **Section**

- 1. Notice to Bidders**
- 2. Quotation Form**
- 3. Standard Terms and Conditions for the Supply of Goods or Services to Transnet**
- 4. General Bid Conditions (Services) – Appendix (i)**
- 5. Standard Terms and Conditions of Contract (Form ST&C - Services) – Appendix (ii)**
- 6. Supplier Declaration Form**

### **Annexures:**

BBB 0496 version 14:	3KV, 5MW rectifier for traction substations
BBB 3620 version 5:	3KV DC earthing arrangement – Traction Substation
BBB 3059 version 2:	3KV DC Traction Substation Earthing System For High Voltage Outdoor Yard
BBB 5452 version 6:	Transnet Freight Rail requirements for installation of electrical equipment for 3kv DC substations
BBB 2721 version 10:	AC Primary Circuit Breaker Control Panel and AC/DC Distribution Panel for 3kv DC Traction Substation
CEE-TBD-0007:	Earthing arrangement for traction substations
CEE-TBK-0027:	Control circuit diagrams – No Volt operation
CEE-TBK-0028:	Trip, lockout and indication circuit diagram
BBB 4724 version 4:	Positive Isolator Switch for 3kv DC Traction Substations
BBB 2502 version 6:	Requirements for battery chargers for 3kv DC traction substations
BBB 3005 version 1:	3kv DC Under Voltage Relay manufacturing specification
BBC 0198 version 1:	Specifications for the supply of cables
CEE. 0023.90:	Specifications for installation of cables
CEE. 0045.2002/1:	Painting of steel components of electrical equipment
CEE. 0183.2002:	Hot dip galvanizing and painting of electrical equipment
CEE 0224.2002:	Drawings, catalogues, instruction manuals and spares list for electrical equipment supplied under contract

## Section 1 NOTICE TO BIDDERS

Quotations which must be completed as indicated in Section 2 of this RFQ are to be submitted as follows:

1. Quotations are requested from selected persons, companies, close corporations or enterprises (hereinafter referred to as the "**Respondent(s)**") to supply the above-mentioned requirement(s) to TRANSNET.

On or after **27 May 2013** the RFQ documents may be inspected at, and are obtainable from the office Of Local Acquisition Council Room 631 6th Floor, Transnet Park Building, Robert Sobukwe Road

A non-refundable RFQ fee of R150, 00 (inclusive of VAT) is applicable per RFQ. Payment is to be made to Transnet Freight Rail, Standard Bank Account No. 203158598, Branch code 004805. The deposit slip must reflect as reference: RFQ BLE/52254 and your company name. Receipt / proof of payment to be presented prior to collection of RFQ/s (No proof of payment no RFQ).

**NOTE 1.1** This amount is not refundable. RFQ documents will only be available until

**06 June 2013 at 14h00.**

1.2 No RFQ documents will be sold after the deadline indicated above

2. A compulsory site briefing session will be conducted at Pieter Meintjies Sub-Station ( Bidders who do not know the directions to the site can meet the Project Manager at Total Garage in Touwsrivier at 08h00, then they will all proceed from there), on the 10 June 2013, at 09h00 for a period of ± 1 hour. (**Respondent to provide own transportation and Accommodation**).

Respondents failing to attend the compulsory site briefing session will be disqualified.

**The site briefing session will start punctually at 09h00.**

**NOTE: THERE WILL BE NO RFQ BRIEFING SESSION IF THERE ARE ANY ENQUIRIES PLEASE REFER THEM TO TAMARA DLAMINI ON 021 940 3831 OR [tamara.dlamini@transnet.net](mailto:tamara.dlamini@transnet.net)**

**SAFETY ON SITE:** Reflective jackets and Safety shoes to be worn when visiting the site.

Without the safety clothing and depending on the environment you will be entering, respondent(s) won't be allowed at the various sites if safety apparel is required.

3. Quotations which must be completed as indicated in Section 2 of this RFQ are to be submitted as follows:

**METHOD FOR DELIVERY INSTRUCTIONS:** (a) post, (b) hand delivered and/or courier

**CLOSING VENUE** : Refer to options below.

- a) **If posted**, the envelope must be addressed as below and must be dispatched in time for sorting by the Post Office to reach the Secretary before the closing time of the RFQ.

<p><b>THE SECRETARIAT</b> Acquisition Council P O Box 2986 Bellville 7535</p>
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- b) **If delivered by hand or by courier**, the envelope is to be deposited in the TRANSNET RFQ box and should be addressed as follows:

<p><b>THE SECRETARIAT</b> Acquisition Council Ground Floor Transnet Park Building Sobukwe Road Bellville</p>
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The measurements of the "RFQ slot" are **500mm wide x 100mm high**, and Respondents must please ensure that response documents or files are not larger than the above dimensions. Responses which are too bulky (i.e. more than 100mm thick) must be split into two or more files, and placed in separate envelopes.

**It should also be noted that the above RFQ box is located at the main entrance and is accessible to the public 24 hours per day, 7 days a week.**

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**1 Responses to RFQ**

Responses to this RFQ [**Quotations**] must not include documents or reference relating to any other quotation or proposal. Any additional conditions must be embodied in an accompanying letter.

**2 Broad-Based Black Economic Empowerment [B-BBEE]**

Transnet fully endorses and supports the Government's Broad-Based Black Economic Empowerment Programme and it would therefore prefer to do business with local business enterprises who share these same values. Transnet will accordingly allow a "preference" to companies who provide a valid B-BBEE Verification Certificate. All procurement transactions will be evaluated accordingly.

**2.1 B-BBEE Scorecard and Rating**

As prescribed in terms of the Preferential Procurement Policy Framework Act (PPPFA), Act 5 of 2000 and its Regulations, Respondents are to note the following:

- Proposals will be evaluated on price which will be allocated 80 or 90 points and preference which will be allocated 20 or 10 points, dependent on the value of the Services.
- The 80/20 preference point system applies where the acquisition of the Services will be less than R1 000 000.00.
- If the 80/20 preference point system is stipulated and all Bids received exceed R1 000 000.00, the RFQ will be cancelled.
- The 90/10 preference point system applies where acquisition of the Services will exceed R1 000 000.00
- If the 90/10 preference point system is stipulated and all Bids received are equal to or below R1 000 000.00, the RFQ will be cancelled.

- In this RFQ, Transnet will apply 90/10 preference point system prescribed in the PPPFA.

In compliance with the Government Gazette No 34612, Notice No. 754 dated 23 September 2011, as from 1 October 2011 valid B-BBEE Verification Certificates must be issued by:

- (i) Verification Agencies accredited by the South African National Accreditation System [SANAS]; or
- (ii) Registered Auditors approved by the Independent Regulatory Board of Auditors [IRBA], in accordance with the approval granted by the Department of Trade and Industry.

Enterprises will be rated by such agencies based on the following:

**a) Large Enterprises [i.e. annual turnover greater than R35 million]:**

- Rating level based on all seven elements of the B-BBEE scorecard

**b) Qualifying Small Enterprises – QSE [i.e. annual turnover between R5 million and R35 million]:**

- Rating based on any four of the elements of the B-BBEE scorecard

**c) Exempted Micro Enterprises – EME [i.e. annual turnover less than R5 million]:**

In accordance with B-BBEE Codes of Good Practice [Statement 000, Section 4], any enterprise with annual total revenue of R 5 million or less qualifies as an EME.

- Automatic rating of B-BBEE Level 4 irrespective of race or ownership
- Black ownership greater than 50% or Black Women ownership greater than 50% automatically qualify as B-BBEE Level 3

Sufficient evidence to qualify as an EME would be a certificate (which may be in the form of a letter) from an auditor or accounting officer or a certificate from a Verification Agency accredited by SANAS. The certificate must confirm the company's turnover, black ownership / black female ownership, B-BBEE status level and validity date.

*Respondents are required to furnish proof of the above to Transnet. [i.e. a valid detailed scorecard as stipulated above in respect of Large Enterprises and QSEs, or a valid certificate in respect of EMEs].*

Transnet will accordingly allocate a maximum of **10 [ten] points** in accordance with the **90/10** preference point system prescribed in the Preferential Procurement Policy Framework Act (PPFA), Act 5 of 2000 and its Regulations to the Respondent's final score based on an entity's B-BBEE scorecard rating. [Refer **Annexure A – B-BBEE Preference Points Claim Form** for further details].

N.B. Failure to submit a B-BBEE certificate, which is valid as at the Closing Date of this RFP, will result in a score of zero being allocated for B-BBEE.

*[Refer clause below for Returnable Documents required]*

### 3 Communication

Respondents are warned that a response will be liable for disqualification should any attempt be made by a Respondent either directly or indirectly to canvass any officer(s) or employee of Transnet in respect of this RFQ between the closing date and the date of the award of the business.

A Respondent may, however, before the closing date and time, direct any written enquiries relating to the RFQ to the following Transnet employee:

Name: Tamara Dlamini  
Email: [Tamara.Dlamini@transnet.net](mailto:Tamara.Dlamini@transnet.net)

Respondents may also, at any time after the closing date of the RFQ, communicate with the Secretariat of the Transnet Acquisition Council on any matter relating to its RFQ response:

Telephone 021 940 3831  
Email [Tamara.Dlamini@trasnsnet.net](mailto:Tamara.Dlamini@trasnsnet.net)

### 4 Tax Clearance

The Respondent's original valid Tax Clearance Certificate must accompany the Quotation. Failure to provide this document with the RFQ submission will result in disqualification.

### 5 VAT Registration

The valid VAT registration number must be stated here: \_\_\_\_\_ [if applicable].

### 6 Legal Compliance

The successful Respondent shall be in full and complete compliance with any and all applicable national and local laws and regulations.

### 7 Changes to Quotations

Changes by the Respondent to its submission will not be considered after the closing date and time.

### 8 Pricing

All prices must be quoted in South African Rand on a fixed price basis, excluding VAT.

### 9 Prices Subject to Confirmation

Prices quoted which are subject to confirmation will not be considered.

### 10 Negotiations

Transnet reserves the right to undertake post-bid negotiations with selected Respondents or any number of short-listed Respondents.

### 11 Binding Offer

Any Quotation furnished pursuant to this Request shall be deemed to be an offer. Any exceptions to this statement must be clearly and specifically indicated.

## 12 Disclaimers

Transnet is not committed to any course of action as a result of its issuance of this RFQ and/or its receipt of a Quotation in response to it. Please note that Transnet reserves the right to:

- modify the RFQ's goods / service(s) and request Respondents to re-bid on any changes;
- reject any Quotation which does not conform to instructions and specifications which are detailed herein;
- disqualify Quotations submitted after the stated submission deadline;
- not necessarily accept the lowest priced Quotation;
- reject all Quotations, if it so decides;
- place an order in connection with this Quotation at any time after the RFQ's closing date;
- award only a portion of the proposed goods / service/s which are reflected in the scope of this RFQ;
- split the award of the order/s between more than one Supplier/Service Provider; or
- make no award at all.

In addition, Transnet reserves the right to exclude any Respondent from the bidding process who has been convicted of a serious breach of law during the preceding 5 [five] years, including but not limited to breaches of the Competition Act 89 of 1998. Respondents are required to indicate below whether or not they have been found guilty of a serious breach of law during the past 5 [five] years:

I/We \_\_\_\_\_ do hereby certify that *I/we have/have not been* found guilty during the preceding 5 [five] years of a serious breach of law, including but not limited to a breach of the Competition Act, 89 of 1998, by a court of law, tribunal or other administrative body. The type of breach that the Respondent is required to disclose excludes relatively minor offences or misdemeanours, e.g. traffic offences.

Where found guilty of such a serious breach, please disclose:

NATURE OF BREACH: \_\_\_\_\_  
\_\_\_\_\_

DATE OF BREACH: \_\_\_\_\_

Furthermore, I/we acknowledge that Transnet SOC Ltd reserves the right to exclude any Respondent from the bidding process, should that person or entity have been found guilty of a serious breach of law, tribunal or regulatory obligation.

## 13 Evaluation Criteria

Transnet will utilise the following criteria in choosing a Supplier/Service Provider, if so required:

- Administrative responsiveness - Completeness of response and returnable documents
- Weighted evaluation based on 90/10 preference point system as indicated in paragraph 2:

- Pricing and price basis [firm] - whilst not the sole factor for consideration, competitive pricing and overall level of unconditional discounts<sup>1</sup> will be critical
- B-BBEE status of company
- Preference will be given to local suppliers in the Saldanha area

Preference points will be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

<b>B-BBEE Status Level of Contributor</b>	<b>Number of points (90/10 system)</b>
1	10
2	9
3	8
4	5
5	4
6	3
7	2
8	1
Non-compliant contributor	0

**14 Validity Period**

Transnet desires a validity period of 90 [ninety] days from the closing date of this RFQ.  
This RFQ is valid until \_\_\_\_\_.

**15 Banking Details**

BANK: \_\_\_\_\_  
BRANCH NAME / CODE: \_\_\_\_\_  
ACCOUNT HOLDER: \_\_\_\_\_  
ACCOUNT NUMBER: \_\_\_\_\_

**16 Company Registration**

Registration number of company / C.C. \_\_\_\_\_  
Registered name of company / C.C. \_\_\_\_\_

**17 Disclosure of Prices Quoted**

Respondents must indicate here whether Transnet may disclose their quoted prices and conditions to other Respondents:

YES  NO

<sup>1</sup> Only unconditional discounts will be taken into account during evaluation. A discount which has been offered conditionally will, despite not being taken into account for evaluation purposes, be implemented when payment is effected.



**18 Returnable Documents**

**Returnable Documents** means all the documents, Sections and Annexures, as listed in the tables below.

- a) Respondents are required to submit with their Quotations the **mandatory Returnable Documents**, as detailed below.

***Failure to provide all these Returnable Documents at the Closing Date and time of this RFQ will result in a Respondent’s disqualification. Respondents are therefore urged to ensure that all these Documents are returned with their Quotations.***

All Sections, as indicated in the footer of each page, must be signed, stamped and dated by the Respondent. Please confirm submission of these mandatory Returnable Documents by so indicating [Yes or No] in the table below:

Returnable Documents	Submitted [Yes or No]
SECTION 2 : Quotation Form	
- Original valid Tax Clearance Certificate [Consortia / Joint Ventures / Sub-contractors must submit a separate Tax Clearance Certificate for each party]	

- b) In addition to the requirements of section (a) above, Respondents are further required to submit with their Quotations the following **essential Returnable Documents** as detailed below.

***Failure to provide all these Returnable Documents may result in a Respondent’s disqualification. Respondents are therefore urged to ensure that all these documents are returned with their Quotations.***

All Sections, as indicated in the footer of each page, must be signed, stamped and dated by the Respondent. Please confirm submission of these essential Returnable Documents by so indicating [Yes or No] in the table below:

Returnable Documents	Submitted [Yes or No]
SECTION 1 : Notice to Bidders	
- Valid B-BBEE Verification Certificate [RSA Large Enterprises and QSEs] Note: failure to provide a valid B-BBEE Verification Certificate at the closing date and time of the bid will result in an automatic score of zero being allocated for B-BBEE scorecard	
- Valid B-BBEE certificate from auditor, accounting officer or SANAS accredited Verification Agency [RSA EMEs] Note: failure to provide a valid B-BBEE Verification Certificate at the closing date and time of the bid will result in an automatic score of zero being allocated for B-BBEE scorecard	
- In the case of Joint Ventures, a copy of the Joint Venture Agreement or written confirmation of the intention to enter into a Joint Venture Agreement	
- SECTION 3 : Standard Terms and Conditions of Contract for the Supply of	

<b>Returnable Documents</b>	<b>Submitted [Yes or No]</b>
Services to Transnet	
- SECTION 4 : General Bid conditions – Services (Appendix i)	
- SECTION 5 : Standard Terms and conditions of contract – Services (Appendix ii)	
SECTION 6 : Supplier Declaration Form	
- Original cancelled cheque or bank verification of banking details	
- Certified copies of IDs of shareholder/directors/members [as applicable]	
- Certified copy of Certificate of Incorporation [CM29/CM9 name change]	
- Certified copy of share certificates [CK1/CK2 if C.C.]	
- Entity's letterhead	
- Certified copy of VAT Registration Certificate [RSA entities only]	
- Certified copy of valid Company Registration Certificate [if applicable]	
- A signed letter from Respondent's auditor or accountant confirming most recent annual turnover figures	
- Letter of Good Standing from The Compensation Commissioner	
<p><b>Annexures:</b></p> <p>BBB 0496 version 14: 3KV, 5MW rectifier for traction substations</p> <p>BBB 3620 version 5: 3kv DC earthing arrangement – Traction Substation</p> <p>BBB 3059 version 2: 3kv DC Traction Substation Earthing System For High Voltage Outdoor Yard</p> <p>BBB 5452 version 6: Transnet Freight Rail requirements for installation of electrical equipment for 3kv DC substations</p> <p>BBB 2721 version 10: AC Primary Circuit Breaker Control Panel and AC/DC Distribution Panel for 3kv DC Traction Substation</p> <p>CEE-TBD-0007: Earthing arrangement for traction substations</p> <p>CEE-TBK-0027: Control circuit diagrams – No Volt operation</p> <p>CEE-TBK-0028: Trip, lockout and indication circuit diagram</p> <p>BBB 4724 version 4: Positive Isolator Switch for 3kv DC Traction Substations</p> <p>BBB 2502 version 6: Requirements for battery chargers for 3kv DC traction substations</p> <p>BBB 3005 version 1: 3kv DC Under Voltage Relay manufacturing specification</p> <p>BBC 0198 version 1: Specifications for the supply of cables</p> <p>CEE. 0023.90: Specifications for installation of cables</p> <p>CEE. 0045.2002/1: Painting of steel components of electrical equipment</p> <p>CEE. 0183.2002: Hot dip galvanizing and painting of electrical equipment</p> <p>CEE 0224.2002: Drawings, catalogues, instruction manuals and spares list for electrical equipment supplied under contract</p>	

**19 PERFORMANCE RECORD/REFERENCES**

Please indicate below the company names and contact details of existing customers whom Transnet may contact to seek third party evaluations of your current service levels:

Name of Company	Nature of work & period	Telephone number	Contact Person

"PREVIEW COPY ONLY"

\_\_\_\_\_  
Respondent's Signature

\_\_\_\_\_  
Date & Company Stamp

## Section 2

### QUOTATION FORM

I/We \_\_\_\_\_  
hereby offer to supply the goods/services at the prices quoted in the Price Schedule below, in accordance with the conditions related thereto.

I/We agree to be bound by those terms and conditions in:

- the Standard Terms and Conditions for the Supply of Goods or Services to Transnet [Section 3 hereof]; and
- any other standard or special conditions mentioned and/or embodied in this Request for Quotation.

I/We accept that unless Transnet should otherwise decide and so inform me/us, this Quotation [and, if any, its covering letter and any subsequent exchange of correspondence], together with Transnet's acceptance thereof shall constitute a binding contract between Transnet and me/us.

I/We further agree that if, after I/we have been notified of the acceptance of my/our Quotation, I/we fail to deliver the said goods/service/s within the delivery lead-time quoted, Transnet may, without prejudice to any other legal remedy which it may have, cancel the order and recover from me/us any expenses incurred by Transnet in calling for Quotations afresh and/or having to accept any less favourable offer.

#### 1. SCOPE OF WORK

##### 1.1 Sufficiency of RFQ

- 1.1.1 Where equipment offered does not comply with standards or publications referred to in any of the specifications, Bidders shall state which standards of specifications apply and submit a copy of the applicable specification.
- 1.1.2 Any drawings and information required by Transnet but not included in the specification shall be furnished on request.
- 1.1.3 All relevant information of the material used for the installation shall be submitted with the RFQ document including the technical specification.
- 1.1.4 The Contractor shall indicate at the bidding stage what steps have been taken to implement a Quality System in terms of ISO 9002 and shall submit such a Quality Plan.

##### 1.2 Duration of contract

- 1.2.1 The contract will commence immediately after the acknowledgement of receipt of the notification of acceptance of rfq with Transnet Freight Rail.
- 1.2.2 The contract will be completed within 3 weeks of acknowledgement of receipt of the notification of acceptance of tender with Transnet Freight Rail.

**1.3 Compliance with statutes**

1.3.1. The Contractor shall comply with all applicable legislation, Codes of Practice and Local, Regional or Provincial Authority regulations. The Contractor shall in particular, comply with the following Instructions, Acts etc;

- SANS 1019 Standard voltage, current and insulating level for electrical supply

**1.4 Maintenance period**

A maintenance period of 6 months after the date of completion of the works will be instituted to ensure that installation works has been properly done. Contractor shall repair any defects within two weeks from the date of such notification of the defect(s).

**1.5 Retention money**

10% of the total value of the contract will be retained for the maintenance period, until work has been satisfactory completed.

**1.6 Penalties for late completion**

A penalty fee for late completion of R1500 per calendar day shall be levied.

**1.7 To be provided by the contractor**

1.7.1 In addition to all labour, water, materials, plant, equipment and incidentals needed to complete the work, the Contractor shall provide all accommodation and toilet facilities for his/her employees. No accommodation shall be erected or utilised on Transnet Freight Rail property.

1.7.2 The Contractor shall provide safe and secure storage facilities for all tools, machineries plant equipment brought onto and in use on the site. Such facilities shall be capable of ensuring that unauthorised persons or animals cannot gain access to such chemicals and equipment. Such storage facilities shall not be on Transnet Freight Rail property.

1.7.3 The Contractor shall provide at his/her own cost any security measures he/she may deem necessary for safe and effective execution of the work within the contract area.

1.7.4 An effective safety procedure to be followed by all personnel on any work site shall be compiled by the Contractor and implemented before any work commences. The procedure shall be updated whenever the need arises and any changes shall be communicated to all employees on a work site before work proceeds.

**1.8 Schedule of quantities and prices**

1.8.1 The quantities in the Service and Cost are estimated and may be more or less than stated.

1.8.2 The tenderer shall price each item. If the Contractor has omitted to price any items in the Schedule, the cost of the work included in such items will be held to be included in the price given for preliminary and general.

- 1.8.3 The absence of stated quantities in the Schedule is no guarantee that none will be required. Reasonable prices should therefore be inserted for every item as these prices may be considered in adjudication of tenders.
- 1.8.4 The short descriptions of the items in the Schedule are for identification purposes only. In so far as these documents have any bearing, they shall be referred to for details of the description, quality, and test of plant and material used, and the workmanship, conditions, obligations, liabilities and instructions generally which shall be complied with in carrying out the Contract. The cost of complying with all conditions, obligations and liabilities described in the contract documents including profit, shall be deemed to be included in the rates quoted by the Contractor in the Schedule of Prices.

### **1.9 Site meetings**

The Contractor shall attend site meetings when required. These meetings will be held under the chairmanship of the Supervisor or his/her deputy. When sub-contractors are required to attend, the Contractor shall ensure their attendance.

### **1.10 Site books**

- 1.10.1 The Contractor shall provide a site instruction book and a daily diary (both in triplicate) at the site as directed by the Supervisor for the duration of the contract.
- 1.10.2 The site instruction book shall only be used by the Supervisor or his/her deputy and will be used for the issuing of instructions to the Contractor.
- 1.10.3 The site diary book shall be used to record any unusual events during the period of the contract. All delays caused by the Contractor, Transnet Freight Rail employees and due to natural causes shall be recorded. Such delays must be counter-signed by the appointed Supervisor. Other delays caused by the 3<sup>rd</sup> party shall be reported to the Project Manager immediately in writing.
- 1.10.4 The Contractor shall complete the daily diary and a detailed description of the work done shall be recorded on a daily basis. Neither of the books shall be removed from the site without the permission of the Supervisor or his/her deputy.

### **1.11 Information to be provided with tender**

- 1.11.1. The Contractor shall undertake the planning and programming of the entire installation works and shall submit to the Supervisor for approval full particulars thereof with his/her tender.
- 1.11.2. An undertaking that all equipment will be ready for operation and that the work can commence timeously, to comply with requirements of the contract.
- 1.11.3. The contractor must indicate whether he/she intends using sub-contractors.

### **1.12 Hours of work**

Hours of work will be limited from Monday to Friday, 07:30 – 16:30. No work shall be performed outside these hours unless prior approval is granted by Transnet Freight Rail.

### **1.13 Contractual obligation**

- 1.15.1 The Contractor shall provide a provisional Gantt or a similar chart showing proposed work program. The final chart shall be submitted within seven working days of awarding the tender.
- 1.15.2 This Instruction book shall be used to record any instructions to the Contractor and disputes regarding the quality of work on site. This book will be filled in by the Supervisor or Manager and must be countersigned by the Contractor.
- 1.15.3 The site diary and the site instruction book shall be the property of Transnet and shall be handed over to the Supervisor or Manager on the day of energizing or handing over.
- 1.15.4 Transnet reserves the right to be present during installation and testing and must be timeously advised of the dates of commencement of the installation and testing. Arrangements must be made with the Manager or his designated personnel to perform witness and authorize the tests.
- 1.15.5 Calibration certificates less than 12 months old issued by a recognized authority for all the instruments to conduct tests on lightning arresters shall be made available for inspection, if requested by Transnet.
- 1.15.6 The Contractor shall repair any damage resulting from negligence of his or her staff to the substation equipment.
- 1.15.7 No sub-contractor shall be appointed without obtaining prior authority from the Project Manager.

### **1.14 Safety requirements**

- 1.16.1 The Contractor or his/her Sub-Contractor shall be required to work on site in accordance with Transnet Freight Rail's safety specification E4E of August 2007 and the occupation Health and safety act 85 of 1993.
- 1.16.2 The Contractor shall be required to work under direct supervision of Transnet's appointed Supervisor on site and shall work only in the area, which shall be demarcated by suitable barriers.
- 1.16.3 Transnet shall during the contract have a Supervisor available on site for the necessary isolation of electrical equipment and issuing of work permits.
- 1.16.4 Substation permit condition shall be determined during site meeting and should be approximately 1-4 weeks.
- 1.16.5 All team members, visitors or casual workers are to be inducted if they do not have a current induction certificate valid for the site.
- 1.16.6 Ensure that safety performance expectations are clearly communicated regularly to the project team.
- 1.16.7 Lengthy discussion of safety performance expectations preferably face-to-face (where possible) shall be held by the Contractor of which Contractor, Project Manager, Technical Officer, Safety Rep or Supervisor has the right to be a witness.
- 1.16.8 The Contractor shall produce Health & Safety Plan for the team including all sub-contractors.

- 1.16.9 The Contractor shall list all training requirements for the team for any specific competency and/or awareness training according to various Transnet Freight Rail policies
- 1.16.10 Workers must carry proof of training attended for execution of the works
- 1.16.11 The contractor shall carry out the risk assessment of the work site to identify hazards before work commences
- 1.16.12 Records to be kept in Health and Safety file including sub-contractors:
- i. All safety audits will be discussed and corrective actions monitored
  - ii. All audit results are to be recorded in the site diary
  - iii. Unscheduled visits and "**STOP**" Visits using stop cards shall be conducted by Transnet Freight Rail
  - iv. The Contractor must communicate Safety Critical incidents via Green Areas to the rest of TFR
  - v. The Contractor shall check if assets are safe for operations e.g. Train ops, safe access and exit of buildings etc
  - vi. Review safety performance stats: Incidents, Corrective Action matrix, audits etc.
  - vii. The contractor must supply his own PPE
  - viii. Employees that do not wear the necessary PPE will not be allowed on site.
  - ix. Defective PPE must be reported immediately to their Supervisor.

"PREVIEW COPY ONLY"



## **2. PROJECT SPECIFICATION**

### **2.1 Scope of work**

This contract covers the design, supply, install, testing and commissioning of rectifier, AC/DC distribution panel, PCB control panel and positive isolator switches at Pieter Meintjies 3kV DC Traction substation.

### **2.2 Description of work**

The Contractor shall perform the following at Pieter Meintjies 3kV Traction Substation.

#### **2.2.1 Busbars**

- 2.2.1.1 Supply and install all copper bus-bars 50mm x10mm busbars to and from the rectifier, reactor coil, positive isolator and the negative bar.
- 2.2.1.2 The Contractor shall dismantle, remove and transport all old equipment from site to Salt River Scrap Bank.
- 2.2.1.3 All busbars connections shall be greased by means of silicon substance
- 2.2.1.4 Nuts and bolts on busbars connections shall be stainless steel.

#### **2.2.2 Supply and installation of cables**

- 2.2.2.1 Contractor shall supply and install all the control and power cables in accordance with the specifications BBC 0198 version 1 and CEE 0023 of 1990.
- 2.2.2.2 The Contractor shall supply all the control cable from the AC disconnects to the indoor substation building.
- 2.2.2.3 The Contractor shall make provision for terminating the armoured cables both in the substation indoor building and outdoor yard.
- 2.2.2.4 The Contractor shall supply joint kits and all necessary terminations.
- 2.2.2.5 Supply and install the auxiliary isolating switch control cable (50mm<sup>2</sup> x 4 core). The Contractor shall terminate and connect on the auxiliary transformer and inside the control panel.
- 2.2.2.6 The Contractor shall supply and connect the 95 mm<sup>2</sup> PVC insulated welding cable to interconnect all new and existing equipment to the DC earth leakage relay system.

#### **2.2.3 Mechanical interlocking devices and checker plates**

- 2.2.8.1 Supply and install an interlocking mechanism complete of the key exchange type, which include the AC disconnects, positive isolator, auxiliary transformer short out links to the HT bay gate in the correct sequence in accordance with the specification BBB 5452 version 6.

#### **2.2.4 Direct Current earth relay circuit**

Supply and install the DC earth leakage relay. The DC earth leakage relay shall be mounted outside the control

panel at a position pointed out by Transnet Freight Rail. The relay shall be enclosed in a metal box.

The Contractor shall connect all existing checker plates as well as existing equipment (all indoor steelwork) to the DC earth leakage system. The Contractor shall also supply any missing checker plate.

The Contractor shall replace the DC earth leakage arrangement (system) as per drawing CEE TBD 0007 and enclosed in 25mm<sup>2</sup> PVC conduits against the walls. The crimping lugs of the interconnection cables shall be correspondingly marked with the busbar as shown on drawing CEE TBD 0007.

Only hexagon crimps will be accepted on all crimping lugs.

Resistance between the DC earth leakage busbar and the substation earth mat shall not be less than 25 Ohm.

### **2.2.5 Positive Isolator Panel**

- 2.2.5.1 Supply and install 3 kV DC positive isolator panels in accordance with the specification BBB 4724 version 4. The positive isolator shall be fitted with a 3 kV DC under voltage relays as per specification BBB 3005 version 1.
- 2.2.5.2 The entry position of the busbars into the panel shall be confirmed with Transnet Freight Rail before manufacturing of the panel. Contractor shall provide the required warning signs as per specification BBB 4724 version 4 on the positive isolator panel.
- 2.2.5.3 Supply and install a busbar from the reactor coil to the positive isolator. The busbar entering the positive isolator shall be 100 mm X 10 mm thickness.

### **2.2.6 3KV DC RECTIFIER**

- 2.2.6.1 Supply and mount the copper busbar on the substation wall inside the rectifier bay. The installation shall include the supply of all the required insulators, bolts and fasteners.
- 2.2.6.2 The Contractor shall then supply and install copper busbars, 50mm x 10mm thickness from the mounted copper busbars to the rectifier.
- 2.2.6.3 Supply and install 5 MW rectifiers complete with the diode monitoring system and fan control in accordance with the specification BBB 0496 version 14.
- 2.2.6.4 Supply and install copper busbar (100mm x 10mm thickness) between the rectifier and the negative bar. The negative copper busbar shall be painted black

### **2.2.7 AC PCB Control Panel and AC/DC Distribution Panel**

- 2.2.7.1 Remove the existing AC primary circuit breaker (PCB) and AC/DC distribution panels from site and transport them to Salt River Scrap Bank Infrastructure.
- 2.2.7.2 Supply and install AC PCB control panel and AC/DC distribution panels in accordance with the specification BBB 2721 version 10.
- 2.2.7.3 Supply and install 2 x Protection relays for main transformer, auxiliary supply, AC earth leakage protection.

- 2.2.7.4 The Contractor shall wire the tripping and lock out circuits in accordance with the drawings CEE TBK 0027 and CEE TBK 0028. The circuits shall be incorporated into the AC PCB control panel.
- 2.2.7.5 The Contractor shall wire all the track breaker cells inside the panel.
- 2.2.7.6 The panels shall cater for a 3 contactor changeover system to accommodate the supply from the isolating transformer as well as auxiliary LT supplies.
- 2.2.7.7 The Contractor shall rewire controls for the extractor fan and incorporate into the distribution panel.
- 2.2.7.8 Ensure room fan circuit is still working.
- 2.2.7.9 Transnet Freight Rail representative shall inspect all the panels on the Contractor's premises prior to delivery to site.
- 2.2.7.10 All direct current wiring shall be done in grey coloured wire.
- 2.2.7.11 Colour Red, White and Blue shall be used for AC circuits only. All alternating current wiring shall be colour coded using the standard colours red, white, blue and black for neutral.
- 2.2.7.12 Interior shall be done in gloss white and exterior shall be done in Eau- de- nil high gloss to SANS 1091 colour code no G22.
- 2.2.7.13 Panels shall be colour coated in accordance with SANS 1274.
- 2.2.7.14 Insulated lugs, of the crimp on type, shall be used to terminate wiring onto equipment, strip connectors and protection relays.
- 2.2.7.15 Screw on terminal lugs shall be used on all the protection relays.
- 2.2.7.16 All new and existing cables and wiring shall be clearly labeled by using an approved slide on wiring label system as described.
- 2.2.7.17 Where applicable, the Contractor will be responsible to connect and interconnect the control wiring and cabling of existing equipment to the new and old equipments.
- 2.2.7.18 The Contractor shall make provision for a connection strip in the AC/DC distribution panel and the primary circuit breaker control panel for remote tele-control operations.
- 2.2.7.19 The Contractor shall notify Transnet Freight Rail on completion of the panels in order to witness functional tests on the premises of the Contractor before delivery.
- 2.2.7.20 The Contractor shall incorporate all existing equipment functions into the schematic drawings as per specification CEE 0224 of 2002.
- 2.2.7.21 A copper busbar system consisting of a busbar for each phase red, white and blue shall be used, in the AC/DC panels and concealed behind perspex with warning signs and voltage identification labels.
- 2.2.7.22 A copper busbar system consisting of battery supply, holding coil volts and negative shall be used and covered with perspex with a warning signs and voltage labels.
- 2.2.7.23 The Contractor shall supply and install the auxiliary supply switches inside the AC/DC control panels.
- 2.2.7.24 Provision will be made in the primary circuit breaker control panel to install primary overload protection for the auxiliary supply.
- 2.2.7.25 All control panels shall be insulated from the substation floor.
- 2.2.7.26 The layout of the AC and DC equipment inside the control panels shall be done in such a way that the equipment is separated from each other.
- 2.2.7.27 Transnet Freight Rail shall inspect the layout of the equipment before wiring commences of the panels.

- 2.2.7.28 All equipment used in the primary circuit breaker control panels and the AC/DC distribution panels shall comply with the SANS 0142.
- 2.2.7.29 Contractor shall supply his/her own security for the duration of the contract.
- 2.2.7.30 Supply cables and redo a complete indoor substation earthing.
- 2.2.7.31 Supply paint, clean substation inside floor and paint red oxide.

## **2.2.8 Installation**

- 2.2.8.1 The Contractor shall be responsible for the transport to site, off-loading, handling, storage and security of all material required for the construction/execution of the works.
- 2.2.8.2 All fasteners on steelwork, components and electrical connections (nuts and bolts) shall be secured using flat as well as lock washers.
- 2.2.8.3 Contractor shall supply multi core cable and connect the tele-control. The substation shall not be switched on unless the tele-control is fully operational.

## **2.2.9 Earthing system for outdoor yards**

- 2.2.9.1 When doing any cabling the ballast stone shall be removed, trenching and laying of cable done and the soil shall be compacted back and the ballast cleaned and placed back neatly.
- 2.2.9.2 No joining of the cables or busbars will be accepted. The contractor shall provide cables or busbars that is long enough for the application (earthing, control circuit etc). No junction boxes shall be used underground.
- 2.2.9.3 The contractor shall be responsible for all necessary connections between the equipment supplied and other components in the substation including connection to the earth-mat.
- 2.2.9.4 Cables and earthing conductors connected to the equipment installed on steel support structures shall be supported on the steel structures vertically and horizontal by means of a cable trays.
- 2.2.9.5 The contractor shall supply any additional crusher stone required to restore the trenched area to its original condition.

## **2.2.10 Interconnection of equipment**

- 2.2.10.1 High conductive silicon grease shall be liberally applied to all the connections.
- 2.2.10.2 All dissimilar metal connections (Cu to Al) shall be made using bi-metallic clamps that are specifically designed and manufactured to make that particular connection (ad hoc fabricated clamps are not acceptable).
- 2.2.10.3 The contractor must make provision for any small steel parts, bolts and nuts if required. All fasteners (nuts & bolts) shall be secured using flat or beveled washers, as necessary as well as lock washers.

## **2.2.11 Site Tests**

- 2.2.11.1 The equipment shall be inspected or tested and approved by Transnet Freight Rail Quality Assurance at the Contractor's workshop prior to it being taken to site. Only once the approval has been granted can the equipment be taken to site for installation.

- 2.2.11.2 The Contractor shall be responsible for carrying out of on-site tests and commissioning of all equipment supplied and installed in terms of this specification and the contractual agreement.
- 2.2.11.3 Functional on-site tests shall be conducted on all items of equipment and circuitry to prove the proper functioning and installation thereof.
- 2.2.11.4 The Contractor shall submit a detailed list of on-site tests for the approval of the Project Manager or Supervisor.
- 2.2.11.5 The Contractor shall arrange for the Supervisor or his representative to be present to witness the on-site tests.
- 2.2.11.6 The on-site tests and subsequent commissioning **will not commence until ALL CONSTRUCTION** work has been completed. Construction staff, material and equipment shall be removed from site prior to the commencement of testing. Testing and commissioning of the power plants equipment will not be allowed to take place in a construction site environment.
- 2.2.11.7 The on-site tests shall include the following:
- i) Test for the functionality of all electrical circuitry
  - ii) Trip test on relays
  - iii) Test on equipment as per manufacturer's instructions
  - iv) Insulation tests
- 2.2.11.8 At the completion of the on-site tests, the Project Manager or Supervisor or his representative shall either sign the tests sheets (supplied by the Contractor) as having witnessed the satisfactory completion thereof, or hand to the Contractor a list of defects requiring rectification.
- 2.2.11.9 Upon rectification of defects, the Contractor shall arrange for the Project Manager or Supervisor or his representative to certify satisfactory completion of on-site tests.
- 2.2.11.10 Acceptance by the Project Manager or Supervisor of satisfactory completion of on-site tests in no way relieves the Contractor of his obligation to rectify defects which may have been overlooked or become evident at a later stage.

**2.2.12 Drawings, Instruction Manuals and Spare Part Catalogues**

- 2.2.12.1 All as built drawings shall be supplied in electronic format (Microstation/Acad).
- 2.2.12.2 The successful Contractor shall be required to submit all drawings (paper prints), within four weeks of award of tender, to the Project Manager or Supervisor for approval. No construction or manufacturing activity will be allowed prior to the associated drawings having been approved.
- 2.2.12.3 During the duration of the contract period, the successful Contractor will be required to inform the Project Manager or Supervisor of any changes to these drawings and will have to resubmit the affected drawings for approval prior to it being used on this contract.

- 2.2.12.4 All drawings, catalogues, instruction book and spares lists shall be in accordance with Transnet Freight Rail's specification CEE.0224.2002.
- 2.2.12.5 All final as built drawings shall be provided to Transnet Freight Rail within four weeks after commissioning.
- 2.2.12.6 Supply three sets of A3 schematic wiring diagrams in hard copy format and electronic format for approval.

### **2.2.13 Commissioning of equipment**

- 2.2.13.1 Commissioning will only take place after all defects have been rectified to the satisfaction of the Project Manager or Supervisor.
- 2.2.13.2 On completion of commissioning, the Contractor will hand the equipment over to the Project Manager or Supervisor in terms of the relevant instruction.
- 2.2.13.3 The commissioning of protection equipment by Transnet Freight Rail will in no way absolve the Contractor from any of his responsibilities during the guarantee period.
- 2.2.13.4 It is the Contractor's responsibility to satisfy himself or herself that the commissioning of the protection equipment has been carried out in a satisfactory manner, and in no way compromises the proper operation of the equipment supplied in terms of the contract.
- 2.2.13.5 The Contractor shall be present during the testing and setting of the protection to rectify any faults found.

### **2.2.14 Guarantee and defects**

- 2.2.14.1 The Contractor shall guarantee the satisfactory operation of the complete electrical installation supplied and erected by him and accept liability for maker's defects that may appear in design, materials and workmanship.
- 2.2.14.2 The Contractor shall be issued with a completion certificate with the list of all defects to be repaired within 14 working days after commissioning.
- 2.2.14.3 The guarantee period for these standby plants shall expire after: A period of 12 months commencing on the date of completion of the contract or the date the standby plant was handed over to Transnet Freight Rail.
- 2.2.14.4 Any defects that may become apparent during the guarantee period shall be rectified to the satisfaction of Transnet Freight Rail, and to the account of the Contractor.
- 2.2.14.5 The Contractor shall undertake work on the rectification of any defects that may arise during the guarantee period within 7-days of him being notified by Transnet Freight Rail of such defects.
- 2.2.14.6 Should the Contractor fail to comply with the requirements stipulated above, Transnet Freight Rail shall be entitled to undertake the necessary repair work or effect replacement of defective apparatus or materials, and the Contractor shall reimburse Transnet Freight Rail the total cost of such repair or replacements, including the labour costs incurred in replacing defective material.

- 2.2.14.7 Any specific type of fault occurring three times within the guarantee period and which cannot be proven to be due to other faulty equipment not forming part of this contract e.g., faulty locomotive or overhead track equipment, etc., shall automatically be deemed an inherent defect. Such inherent defect shall be fully rectified to the satisfaction of the Project Manager or Supervisor and at the cost of the Contractor.
- 2.2.14.8 If urgent repairs have to be carried out by Transnet Freight Rail staff to maintain supply during the guarantee period, the Contractor shall inspect such repairs to ensure that the guarantee period is not affected and should they be covered by the guarantee, reimburse Transnet Freight Rail the cost of material and labour.

### **2.2.15 QUALITY AND INSPECTION**

- 2.2.15.1 Transnet Freight Rail shall inspect the equipment under contract on the premises of the Manufacturer or successful Contractor.
- 2.2.15.2 The Contractor shall notify Transnet Freight Rail 14 days in advance of such an inspection date.
- 2.2.15.3 The Contractor shall apply 14 days in advance for the date of energizing and ensure that all work is completed before any commissioning can take place.
- 2.2.15.4 The Contractor shall be responsible to issue a compliance certificate in terms of SANS 0142 for each site before energizing of the equipment shall take place.

### **2.2.16 Scrap materials**

- 2.2.16.1 All redundant/old materials/equipment to be removed from site and transported to TFR Scrap Bank in Salt River

## **3. MEASUREMENTS AND PAYMENT**

- 3.1 Preliminary and general shall be measured and paid for as lump sum. Tendered rates must therefore include labour, site establishment, transport, civil works, soil testing, preparations and all necessary resources required to complete the works.
- 3.2 Dismantling, removal and transportation of old equipment from site to Salt River Scrap Bank shall be measured and paid for as lump sum. Tendered rates must therefore include delivery of equipment and all necessary resources to complete this item.
- 3.3 Supply and installation of copper busbars from the transformer to the Rectifiers, to Reactor coils, and to the positive isolators including negative busbar shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials and installation of all busbars including brackets, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.4 Supply and installation of Positive Isolators complete with fibre optic under voltage relays shall be measured and paid for per positive isolator installed. Tendered rates must therefore include supply, delivery of materials and installation including brackets, insulators, clamps, bolts, nuts, warning signs etc and all necessary resources and works to complete this item.



- 3.5 Supply and installation of 5 MW rectifiers complete with diode monitoring and fan control shall be paid for per rectifier. Tendered rates must therefore include supply, delivery of materials and installation including brackets, insulators, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.6 Supply and installation of auxiliary control cables (50 mm<sup>2</sup> x 4core) to the Auxiliary transformer and inside the control panel shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials, installation, trenching and laying of cable including brackets, clamps, joints, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.7 Relocation and installation of auxiliary isolating switches inside the substation control panels shall be measured and paid for per isolating switch. Tendered rates must therefore include relocation, installation, including brackets, clamps, bolts, nuts etc and all necessary resources and civil works to complete this item.
- 3.8 Supply of new mechanical interlocking sets shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials and installation including brackets, insulators, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.9 Supply of DC earth leakage relays outside the panels and its polycarbonate boxes shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials and installation including brackets, insulators, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.10 Supply of cables for the new DC earth leakage systems (Indoor earthing) and all control and power cables shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials and installation including brackets, insulators, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.11 Modification of Rectifier Bay Screens (Fence) and removal of old and unused control panels from the HT-Bay shall be measured and paid for as lump sum. Tendered rates must therefore include the modification and removal of fence and unused panels including materials, brackets, insulators, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.12 Supply, installation and black painting of checker plates where old control panels are currently located shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials and installation including brackets, painting, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.13 Supply and installation of AC/DC distribution panel shall be measured and paid for per control panel. Tendered rates must therefore include supply, delivery of materials and installation including brackets, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.14 Supply and Installation of charger shall be measured and paid for per charger installed. Tendered rates must therefore include supply, delivery of materials and installation including brackets, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.15 Supply and installation of all positive cables shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials and installation including brackets, insulators, clamps, bolts, nuts etc and all necessary resources and works to complete this item.



- 3.16 Supply and installation of earthing system for indoor yards shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials, installation, and laying of earthing cables including brackets, clamps, terminations, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.17 Supply of paint and painting of substation floors with red oxide shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of paint, painting of floor etc and all necessary resources and works to complete this item.
- 3.18 Rewiring of a room fan with adjustable temperature sensors or control in the panels shall be measured and paid for per rewiring installed. Tendered rates must therefore include rewiring, delivery of materials, cabling and all necessary resources and works to complete this item.
- 3.19 Supply and installation of low SF6 gas indication in control circuitry shall be measured and paid for per indication installed. Tendered rates must therefore include supply, delivery of materials and installation including, brackets, insulators, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.20 Supply and installation of AC Primary Circuit Breaker control panels shall be measured and paid for per control panel installed. Tendered rates must therefore include supply, delivery of materials and installation including brackets, clamps, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.21 Supply and installation of all control cables from PCB to AC control panels and AC Disconnects shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of materials, installation, and laying of control cables including brackets, clamps, terminations, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.22 Rewiring of the protection interlock in panels for phase failure and low SF6 gas with distribution switchgear shall be measured and paid for per protection interlock rewired. Tendered rates must therefore include supply, delivery of materials, installation, and laying of control cables including brackets, clamps, terminations, bolts, nuts etc and all necessary resources and works to complete this item.
- 3.23 Drawings and catalogues shall be measured and paid for as lump sum. Tendered rates must therefore include supply, delivery of all drawings and catalogues.

#### 4. SCHEDULE OF APPLICABLE SPECIFICATIONS, INSTRUCTIONS & DRAWINGS

**South African National Standards:**

SANS 1091	National Colour Standard
SANS 8528	Reciprocating internal combustion engine driven alternating current generating set.
SANS 10142	Wiring Code

**Transnet Freight Rail Specifications and drawings: Attached**

"PREVIEW COPY ONLY"

**Price Schedule**

**SCHEDULE OF PRICES AND QUANTITIES**

<b>PIETER MEINTJIES 3KV DC TRACTION SUBSTATION</b>						
<b>Item</b>	<b>DESCRIPTION</b>	<b>Qty</b>	<b>Unit</b>	<b>Installation Cost</b>	<b>Material Rate</b>	<b>Total</b>
5.1	Preliminary and General	sum	1			
5.2	Dismantle, remove and transport old equipment from site to Salt River Scrap Bank	sum	1			
5.3	Supply and install copper busbar from the transformer to the Rectifier, to Reactor coil, and to the positive isolator including negative bar	sum	1			
5.4	Supply and install the Positive Isolator complete with fibre optic under voltage relay	ea	2			
5.5	Supply and install 5 MW rectifier complete with diode monitoring and fan control	ea	2			
5.6	Supply and install Auxiliary control cable (50 mm <sup>2</sup> x 4core)	sum	1			
5.7	Relocate the auxiliary isolating switch inside the control panel	ea	2			
5.8	Supply and install new mechanical interlocking set	ea	2			
5.9	Supply and install DC earth leakage system, all control and power cables	sum	1			
5.10	Supply and install checker plates to be fitted where old control panels are currently sitting and paint them black	sum	1			
5.11	Modify Rectifier Bay Screens (Fence) – remove old and unused control panels from the HT-bay	sum	1			
5.12	Supply and install AC/DC distribution panel	sum	1			
5.13	Supply and Install battery charger	ea	1			
5.14	Supply and install all positive cables	ea	1			
5.15	Redo indoor earthing complete	sum	1			
5.16	Supply paint and paint substation floor red oxide	sum	1			
5.17	Rewire a room fan with adjustable temperature sensor or control into the panel	ea	2			
5.18	Supply and install low SF6 gas indication in control circuitry	ea	2			
5.19	Supply and install AC primary circuit breaker control panel	ea	2			
5.20	Supply and install all control cables from PCB to	sum	1			

Respondent's Signature

Date & Company Stamp

	panel and AC Disconnects					
5.21	Rewire the protection interlock in panel for phase failure and low SF6 gas with distribution switchgear	ea	1			
5.22	Supply and install the distribution board with all cabling	sum	1			
5.23	Remove negative busbar/shunt and relocate it inside the building(Including 2× new unit shunt and cables)	ea	1			
5.23	Fit in the Perspex window to the busbar chamber 400×400	sum	2			
5.24	Clean and paint the rectifier bay fence and the reactor coil	ea	2			
5.25	Supply drawings and catalogues	sum	3			
<b>Total (Exc. Vat)</b>				<b>R</b>		

Price in Words: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Notes to Pricing:**

- a) All Prices must be quoted in South African Rand, exclusive of VAT
- b) To facilitate like-for-like comparison bidders must submit pricing strictly in accordance with this price schedule and not utilise a different format. Deviation from this pricing schedule could result in a bid being disqualified.
- c) Please note that should you have offered a discounted price(s), Transnet will only consider such price discount(s) in the final evaluation stage if offered on an unconditional basis.

\_\_\_\_\_  
 Respondent's Signature

\_\_\_\_\_  
 Date & Company Stamp

### Section 3

#### STANDARD TERMS AND CONDITIONS FOR THE SUPPLY OF GOODS OR SERVICES TO TRANSNET

**A Supplier/Service Provider shall be obliged to adhere to the Standard Terms and Conditions for the Supply of Goods and Services to Transnet as expressed hereunder. Should the Respondent find any condition(s) unacceptable, it should indicate which condition(s) is/are unacceptable and offer an alternative(s). A Quotation submitted by a Respondent will be subjected to review and acceptance or rejection of its proposed contractual terms and conditions by Transnet's Legal Counsel, prior to consideration for an award of business.**

#### 1 SOLE AGREEMENT

Unless otherwise agreed in writing, these terms [Terms and each Term] and Transnet's purchase order(s) [Order or Orders] represent the only conditions upon which Transnet SOC Ltd [Transnet] procures goods [the Goods] or services [the Services] specified in the Order from the person to whom the Order is addressed [the Supplier/Service Provider]. Transnet does not accept any other conditions which the Supplier/Service Provider may specify, unless otherwise agreed to by Transnet in writing. In the event of any inconsistency between these Terms and any Order, these Terms shall take precedence.

#### 2 CONFORMITY WITH ORDER

Goods/Services shall conform strictly with the Order. The Supplier/Service Provider shall not vary the quantities specified and/or the specification, if any, stipulated in the Order, without the prior written consent of Transnet. The Supplier/Service Provider warrants that the Goods/Services shall be fit for their purpose and of satisfactory quality.

#### 3 DELIVERY AND TITLE

3.1 The delivery dates and addresses are those in the Order. Time shall be of the essence in respect of the Supplier's/Service Provider's obligations under the Order.

3.2 The Supplier/Service Provider will not be excused for delay in delivery or performance except due to circumstances outside its control and then only subject to the Supplier/Service Provider having notified Transnet in writing on becoming aware of such circumstances. Transnet may terminate an Order, in whole or in part, without incurring any liability to the Supplier/Service Provider if such a delay becomes, in Transnet's absolute opinion, significant.

3.3 If on delivery, the Goods/Services do not conform to the Order, Transnet may reject the Goods/Services and the Supplier/Service Provider shall promptly rectify any defects or in Transnet's opinion, supply appropriate replacement Goods/Services at the Supplier's/Service Provider's expense within the specified delivery times, without any liability due by Transnet.

#### 4 PRICE AND PAYMENT

4.1 Prices specified in an Order cannot be increased. Payment for the Goods/Services shall be made by Transnet against an original undisputed invoice(s) [a Tax Invoice], supporting documentation and month-end statement from the Supplier/Service Provider. Tax Invoices plus supporting documentation shall be posted to the address shown in the Order.

4.2 Payment of the Supplier's/Service Provider's valid Tax Invoice(s) will be made by Transnet in the South African currency and on the terms stated in the Order, the standard payment terms being 30 [thirty] days from date of receipt by Transnet of a month-end statement, unless otherwise agreed to in writing. Transnet shall arrange for payment of such Tax Invoices and any pre-authorised additional expenses incurred, provided that the authorised expenses are supported by acceptable documentary proof of expenditure incurred [where this is available]. Any amounts due in terms of these Terms shall be paid to the Supplier/Service Provider, taking into account any deduction or set-off and bank charges.

## **5 PROPRIETARY RIGHTS LIABILITY**

If any allegations should be made or any claim asserted against Transnet that ownership of, or any act or omission by Transnet in relation to Goods/Services or any written material provided to Transnet relating to any Goods/Services or pursuant to an Order being a violation or infringement of any third party's contractual, industrial, commercial or intellectual property rights including but not limited to any patent, registered design, design right, trade mark, copyright or service mark on any application thereof, the Supplier/Service Provider hereby indemnifies Transnet against and hold it harmless from any and all losses, liabilities, costs, claims, damages and expenses [including any legal fees] arising directly or indirectly from such allegation or claim provided that this indemnity shall not apply where the allegation or claim arises solely as a result of the Supplier/Service Provider following a design or process originated and furnished by Transnet. The Supplier/Service Provider shall either

- a) procure for Transnet the right to continue using the infringing Goods; or
- b) modify or replace the Goods/Services so that they become non-infringing,

provided that in both cases the Goods/Services shall continue to meet Transnet's requirements and any specifications stipulated in the Order. Should neither option be possible, the Supplier/Service Provider may remove, with Transnet's prior written consent, such Goods/Services and will pay to Transnet a sum equivalent to the purchase price. If Transnet refuses to give such consent, the Supplier/Service Provider shall have no liability in respect of any continued use of the infringing Goods/Services after Supplier's/Service Provider's prior written request to remove the same.

## **6 PROPRIETARY INFORMATION**

All information which Transnet has divulged or may divulge to the Supplier/Service Provider and any information relating to Transnet's business which may have come into the Supplier's/Service Provider's possession whilst carrying out an Order, and the existence of the Order, shall be treated by the Supplier/Service Provider as confidential information and shall not, without Transnet's prior written consent, be disclosed to any third party, or be used or copied for any purposes other than to perform the Order. This clause does not apply to information which is public knowledge or available from other sources other than by breach of this Term. Upon request by Transnet, the Supplier/Service Provider shall return all materials issued pursuant to the Order and, pending this, shall protect Transnet's rights in any such materials. Such confidential information shall at all material times be the property of Transnet.

If the production or provision of any Goods involves research and/or development which are wholly or partly funded by Transnet, then all intellectual property or other rights as a result thereof shall be the property of Transnet on creation.

## **7 PUBLICITY**

The Supplier/Service Provider shall not name Transnet or use its trademarks, service marks [whether registered or not] or Goods in connection with any publicity without Transnet's prior written consent.

## **8 TERMINATION OF ORDER**

8.1 Transnet may cancel an Order in whole or in part at any time upon at least 7 [seven] days' written notice to the Supplier/Service Provider, or when there is a change in control of the Supplier/Service Provider or the Supplier/Service Provider commits any serious breach or any repeated or continued material breach of its obligations under these Terms and/or Order or shall have been guilty of conduct tending to bring itself into disrepute, on written notice to the Supplier/Service Provider when such work on the Order shall stop.

8.2 Transnet shall pay the Supplier/Service Provider a fair and reasonable price for justified work in progress, where such price reflects only those costs not otherwise recoverable by the Supplier/Service Provider, at the time of termination, and the Supplier/Service Provider shall give Transnet full assistance to check the extent of such work in progress. Payment of such price shall be in full and final satisfaction of any claims arising out of such termination and upon such payment the Supplier/Service Provider shall deliver to Transnet all work, including any materials, completed or in progress. The sum payable to the Supplier/Service Provider under this clause will not in any event exceed the total amount that would have been payable to the Supplier/Service Provider had the Order not been terminated.

8.3 In the event of termination the Supplier/Service Provider must submit all claims within 2 [two] months of termination after which time claims will only be met in what Transnet considers exceptional circumstances.

8.4 If the Goods or Services are not provided in accordance with an Order, the Order shall be deemed terminated and the Supplier/Service Provider shall compensate Transnet for any costs incurred in obtaining substitute Goods or any damage caused due to the failure or delay in the delivery.

## **9 ACCESS**

The Supplier/Service Provider shall be liable for the acts, omissions and defaults of its personnel or agents who, for the purposes of the Order, shall be treated as if they are the Supplier's/Service Provider's employees. The Supplier/Service Provider shall ensure that any such personnel or agents, whilst on Transnet's premises, shall comply with Transnet's health and safety, security and system security rules and procedures as and where required.

## **10 WARRANTY**

The Supplier/Service Provider warrants that it is competent to supply the Goods/Services in accordance with these Terms to the reasonable satisfaction of Transnet and that all Goods/Services delivered under the Order: (a) conform and comply in all relevant legislation, standards, directives and orders related to

*[inter alia]* the Services in force at the time of delivery, and to any specifications referred to in the Order; (b) will not cause any deterioration in the functionality of any Transnet equipment; and (c) do not infringe any third party rights of any kind. The Supplier/Service Provider hereby indemnifies Transnet against all losses, liabilities, costs, claims, damages, expenses and awards of any kinds incurred or made against Transnet in connection with any breach of this warranty.

#### **11 INSOLVENCY**

If the Supplier/Service Provider shall have a receiver, manager, administrator, liquidator or like person appointed over all or any part of its assets or if the Supplier/Service Provider compounds with its creditors or passes a resolution for the writing up or administration of the Supplier/Service Provider, Transnet is at liberty to terminate the Order or Orders forthwith, or at its option, to seek performance by any such appointed person.

#### **12 ASSIGNMENT**

The Supplier/Service Provider shall not assign its obligations under an Order without Transnet's prior written consent, which consent shall not be unreasonably withheld or delayed.

#### **13 NOTICES**

Notices under these Terms shall be delivered by hand to the relevant addresses of the parties in the Order or may be served by facsimile or by email, in which event notice shall be deemed served on acknowledgement of receipt by the recipient.

#### **14 LAW**

Orders shall be governed by and interpreted in accordance with South African law and any disputes arising herein shall be subject to South African arbitration under the rules of the Arbitration Foundation of South Africa, which rules are deemed incorporated by reference in this clause. The reference to arbitration shall not prevent Transnet referring the matter to any South African courts, having jurisdiction, to which the Supplier/Service Provider hereby irrevocably submits but without prejudice to Transnet's right to take proceedings against the Supplier/Service Provider in other jurisdictions and/or obtaining interim relief on an urgent basis from a court of competent jurisdiction pending the decision in other courts or from instituting in any court of competent jurisdiction any proceedings for an interdict or any other injunctive relief. If the Supplier/Service Provider does not have a registered office in the South Africa it will at all times maintain an agent for service of process in South Africa and shall give Transnet the name and address of such agent as such may be amended, in writing, from time to time.

#### **15 GENERAL**

Completion or termination of an Order shall be without prejudice to any Term herein which by its nature would be deemed to continue after completion or termination. Headings are included herein for convenience only. If any Term herein be held illegal or unenforceable, the validity or enforceability of the remaining Terms shall not be affected. No failure or delay by Transnet to enforce any rights under these Terms will operate as a waiver thereof by Transnet. All rights and remedies available to either party under these Terms shall be in addition to, not to the exclusion of, rights otherwise available at law.



**16 COUNTERPARTS**

These Terms and conditions may be signed in any number of counterparts, all of which taken together shall constitute one and the same instrument. Any party may enter into this agreement by signing any such counterpart.

"PREVIEW COPY ONLY"

\_\_\_\_\_  
Respondent's Signature

\_\_\_\_\_  
Date & Company Stamp

**By signing this RFQ document, the Respondent is deemed to acknowledge that he/she has made himself/herself thoroughly familiar with all the conditions governing this RFQ, including those contained in any printed form stated to form part hereof and Transnet SOC Ltd will recognise no claim for relief based on an allegation that the Respondent overlooked any such condition or failed to properly take it into account for the purpose of calculating quoted prices or otherwise.**

SIGNED at \_\_\_\_\_ on this \_\_\_\_\_ day of \_\_\_\_\_ 2013

.....  
SIGNATURE OF RESPONDENT'S AUTHORISED REPRESENTATIVE

NAME: \_\_\_\_\_

DESIGNATION: \_\_\_\_\_

REGISTERED NAME OF COMPANY: \_\_\_\_\_

PHYSICAL ADDRESS:  
\_\_\_\_\_  
\_\_\_\_\_

**Respondent's contact person:** *[Please complete]*

Name	:
Designation	:
Telephone	:
Cell Phone	:
Facsimile	:
Email	:
Website	:

**Transnet urges its clients, suppliers and the general public  
to report any fraud or corruption to  
TIP-OFFS ANONYMOUS: 0800 003 056**

**Substance Abuse Testing**

The OHS Act (Act 85 of 1993) clearly states in the Safety Regulations no. **2A "INTOXICATION"** **An employer or user, as the case may be, shall not permit any person who appears to be under the influence of intoxicating liquor or drugs, to enter or remain at the workplace".** Transnet Freight Rail enforces this legislation by means of its Substance Abuse Policy, and therefore reserves the right to do substance abuse testing on anyone who enters their premises.

"PREVIEW COPY ONLY"

**Section 4**

**GENERAL BID CONDITIONS – SERVICES (Appendix (i))**

Copy attached.

*"It is the responsibility of the Bidder to ensure they are familiar with the General Bid Conditions."*

"PREVIEW COPY ONLY"

\_\_\_\_\_  
Respondent's Signature

\_\_\_\_\_  
Date & Company Stamp

**Section 5**  
**STANDARD TERMS AND CONDITIONS OF CONTRACT FOR THE PROVISION OF SERVICES**  
**TO TRANSNET (Appendix (ii))**

Refer Form ST&C - Copy attached.

*"It is the responsibility of the Bidder to ensure they are familiar with the Standard Terms and Conditions of Contract."*

**"PREVIEW COPY ONLY"**



## SECTION 6

### Transnet Supplier Declaration/Application

The Financial Director or Company Secretary

Transnet Vendor Management has received a request to load your company on to the Transnet vendor database. Please furnish us with the following to enable us to process this request:

1. Complete the "Supplier Declaration Form" (**SDF**) on page 2 of this letter
2. **Original** cancelled cheque **OR** letter from the bank verifying banking details (**with bank stamp**)
3. **Certified** copy of Identity document of Shareholders/Directors/Members (where applicable)
4. **Certified** copy of certificate of incorporation, CM29 / CM9 (name change)
5. **Certified** copy of share Certificates of Shareholders, CK1 / CK2 (if CC)
6. A letter with the company's letterhead confirming physical and postal addresses
7. **Original or certified** copy of SARS Tax Clearance certificate and Vat registration certificate
8. A signed letter from the Auditor / Accountant confirming most recent annual turnover and percentage black ownership in the company **AND/OR** BBBEE certificate and detailed scorecard from an accredited rating agency (SANAS member).

**NB:**

- **Failure to submit the above documentation will delay the vendor creation process.**
- *Where applicable, the respective Transnet business unit processing your application may request further information from you. E.g. proof of an existence of a Service/Business contract between your business and the respective Transnet business unit etc.*

#### **IMPORTANT NOTES:**

- a) **If your annual turnover is less than R5 million**, then in terms of the DTI codes, you are classified as an Exempted Micro Enterprise (EME). If your company is classified as an EME, please include in your submission, a signed letter from your Auditor / Accountant confirming your company's most recent annual turnover is less than R5 million and percentage of black ownership and black female ownership in the company **AND/OR** BBBEE certificate and detailed scorecard from an accredited rating agency (e.g. permanent SANAS Member), should you feel you will be able to attain a better BBBEE score.
- b) **If your annual turnover is between R5 million and R35million**, then in terms of the DTI codes, you are classified as a Qualifying Small Enterprise (QSE) and you claim a specific BBBEE level based on any 4 of the 7 elements of the BBBEE score-card, please include your BEE certificate in your submission as confirmation of your status.  
**NB:** BBBEE certificate and detailed scorecard should be obtained from an accredited rating agency (e.g. permanent SANAS Member).
- c) **If your annual turnover is in excess of R35million**, then in terms of the DTI codes, you are classified as a Large Enterprise and you claim a specific BEE level based on all seven elements of the BBBEE generic score-card. Please include your BEE certificate in your submission as confirmation of your status.  
**NB:** BBBEE certificate and detailed scorecard should be obtained from an accredited rating agency (permanent SANAS Member).
- d) **To avoid PAYE tax being automatically deducted from any invoices received from you**, you must also contact the Transnet person who lodged this request on your behalf, so as to be correctly classified in terms of Tax legislation.
- e) Unfortunately, **No payments can be made to a vendor** until the vendor has been registered, and no vendor can be registered until the vendor application form, together with its supporting documentation, has been received and processed.
- f) **Please return the completed Supplier Declaration Form (SDF) together with the required supporting documents mentioned above to the Transnet Official who is intending to procure your company's services/products in order that he/she should complete and Internal Transnet Departmental Questionnaire before referring the matter to the appropriate Transnet Vendor Master Office.**



**Supplier Declaration Form**

Company Trading Name							
Company Registered Name							
Company Registration Number Or ID Number If A Sole Proprietor							
Form of entity	CC	Trust	Pty Ltd	Limited	Partnership	Sole Proprietor	
VAT number (if registered)							
Company Telephone Number							
Company Fax Number							
Company E-Mail Address							
Company Website Address							
Bank Name				Bank Account Number			
Postal Address						Code	
Physical Address						Code	
Contact Person							
Designation							
Telephone							
Email							
Annual Turnover Range (Last Financial Year)		< R5 Million	R5-35 million		> R35 million		
Does Your Company Provide		Products	Services		Both		
Area Of Delivery		National	Provincial		Local		
Is Your Company A Public Or Private Entity		Public			Private		
Does Your Company Have A Tax Directive Or IRP30 Certificate		Yes			No		
Main Product Or Service Supplied (E.G.: Stationery/Consulting)							

**BEE Ownership Details**

% Black Ownership		% Black women ownership		% Disabled person/s ownership	
Does your company have a BEE certificate		Yes		No	
What is your broad based BEE status (Level 1 to 9 / Unknown)					
How many personnel does the firm employ		Permanent		Part time	

Transnet Contact Person					
Contact number					
Transnet operating division					

**Duly Authorised To Sign For And On Behalf Of Firm / Organisation**

Name			Designation	
Signature			Date	

**Stamp And Signature Of Commissioner Of Oath**

Name			Date	
Signature			Telephone No.	

"PREVIEW COPY ONLY"

---

Respondent's Signature

---

Date & Company Stamp





**Appendix (ii)**

**STANDARD TERMS AND CONDITIONS OF CONTRACT  
FOR THE PROVISION OF SERVICES TO TRANSNET**

**[April 2013]**

"PREVIEW COPY ONLY"

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## 1 INTRODUCTION

When an Agreement is entered into between Transnet SOC Ltd [**Transnet**] and the appointed supplier of Services to Transnet [**the Service Provider**], these Standard Terms and Conditions of Contract, the technical specifications for the Services, a Work Order including such special conditions as may be applicable, and any terms in the associated Bid Documents, exclusively govern the provision of Services by the Service Provider to Transnet.

## 2 DEFINITIONS

Where the following words or phrases are used in the Agreement, such words or phrases shall have the meaning assigned thereto in this clause, except where the context clearly requires otherwise:

- 2.1 **AFSA** means the Arbitration Foundation of South Africa;
- 2.2 **Agreement** means the Agreement and its associated schedules and/or annexures and/or appendices, including the Work Order(s), specifications for the Services and such special conditions as shall apply to the Agreement, together with the General Tender Conditions and any additional provisions in the associated bid documents tendered by the Service Provider [as agreed in writing between the Parties], which collectively and exclusively govern the provision of Services by the Service Provider to Transnet;
- 2.3 **Background Intellectual Property** means all Intellectual Property introduced and required by either Party to give effect to their obligations under the Agreement owned in whole or in part by or licensed to either Party or their affiliates prior to the Commencement Date or developed after the Commencement Date otherwise pursuant to the Agreement;
- 2.4 **Business Day(s)** means Mondays to Fridays between 07:30 and 16:00, excluding public holidays as proclaimed in South Africa;
- 2.5 **Commencement Date** means [●], notwithstanding the signature date of the Agreement;
- 2.6 **Confidential Information** means any information or other data, whether in written, oral, graphic or in any other form such as in documents, papers, memoranda, correspondence, notebooks, reports, drawings, diagrams, discs, articles, samples, test results, prototypes, designs, plans, formulae, patents, or inventor's certificates, which a Party discloses or provides to the other Party [intentionally or unintentionally, or as a result of one Party permitting the representative of the other Party to visit any of its premises], or which otherwise becomes known to a Party, and which is not in the public domain and includes, without limiting the generality of the term:
- a) information relating to methods of operation, data and plans of the disclosing Party;
  - b) the contents of the Agreement;
  - c) private and personal details of employees or clients of the disclosing Party or any other person where an onus rests on the disclosing Party to maintain the confidentiality of such information;
  - d) any information disclosed by either Party and which is clearly marked as being confidential or secret;
  - e) information relating to the strategic objectives and planning of the disclosing Party relating to its existing and planned future business activities;

- f) information relating to the past, present and future research and development of the disclosing Party;
  - g) information relating to the business activities, business relationships, products, services, customers, clients and Subcontractors of the disclosing Party where an onus rests on the disclosing Party to maintain the confidentiality of such information;
  - h) information contained in the software and associated material and documentation belonging to the disclosing Party;
  - i) technical and scientific information, Know-How and trade secrets of a disclosing Party including inventions, applications and processes;
  - j) Copyright works;
  - k) commercial, financial and marketing information;
  - l) data concerning architecture, demonstrations, tools and techniques, processes, machinery and equipment of the disclosing Party;
  - m) plans, designs, concepts, drawings, functional and technical requirements and specifications of the disclosing Party;
  - n) information concerning faults or defects in goods, equipment, hardware or software or the incidence of such faults or defects; and
  - o) information concerning the charges, Fees and / or costs of the disclosing Party or its authorised Subcontractors, or their methods, practices or service performance levels actually achieved;
- 2.7 **Copyright** means the right in expressions, procedures, methods of operations or mathematical concepts, computer program codes, compilations of data or other material, literary works, musical works, artistic works, sound recordings, broadcasts, program carrying signals, published editions, photographic works, or cinematographic works of the copyright owner to do or to authorise the doing of certain acts specified in respect of the different categories of works;
- 2.8 **Default** means any breach of the obligations of either Party [including but not limited to fundamental breach or breach of a fundamental term] or any Default, act, omission, negligence or statement of either Party, its employees, agents or Subcontractors in connection with or in relation to the subject of the Agreement and in respect of which such Party is liable to the other;
- 2.9 **Deliverable(s)** means any and all works of authorship, products and materials developed, written, prepared, assembled, integrated, modified or provided by the Service Provider in relation to the Services;
- 2.10 **Designs** mean registered Designs and/or Design applications and will include the monopoly right granted for the protection of an independently created industrial design including designs dictated essentially by technical or functional considerations as well as topographies of integrated circuits and integrated circuits;
- 2.11 **Fee(s)** shall mean the agreed Fees for the Services to be purchased from the Service Provider by Transnet, as detailed in the Work Order(s), issued in accordance with the Agreement, as amended by mutual agreement between the Parties and in accordance with the provisions of the Agreement from time to time;
- 2.12 **Foreground Intellectual Property** means all Intellectual Property developed by either Party pursuant to the Agreement;

- 2.13 **Intellectual Property** means Patents, Designs, Know-How, Copyright and Trade Marks and all rights having equivalent or similar effect which may exist anywhere in the world and includes all future additions and improvements to the Intellectual Property;
- 2.14 **Know-How** means all Confidential Information of whatever nature relating to the Intellectual Property and its exploitation as well as all other Confidential Information generally relating to Transnet's field of technology, including technical information, processing or manufacturing techniques, Designs, specifications, formulae, systems, processes, information concerning materials and marketing and business information in general;
- 2.15 **Materials** means the Deliverables, the Service Provider Materials and the Third Party Materials;
- 2.16 **Parties** mean the Parties to the Agreement together with their subsidiaries, divisions, business units, successors-in-title and their assigns;
- 2.17 **Party** means either one of these Parties;
- 2.18 Patents mean registered Patents and Patent applications, once the latter have proceeded to grant, and includes a right granted for any inventions, products or processes in all fields of technology;
- 2.19 **Permitted Purpose** means any activity or process to be undertaken or supervised by Personnel or employees of one Party during the term of the Agreement, for which purpose authorised disclosure of the other Party's Confidential Information or Intellectual Property is a prerequisite in order to enable such activity or process to be accomplished;
- 2.20 **Personnel** means any partner, employee, agent, consultant, independent associate or supplier, Subcontractor and the staff of such Subcontractor, or other authorised representative of either Party;
- 2.21 **Purchase Order(s)** means official orders issued by an operating division of Transnet to the Service Provider for the provision of Services;
- 2.22 **Service(s)** means [●], the Service(s) provided to Transnet by the Service Provider, pursuant to the Work Order(s) in terms of the Agreement;
- 2.23 **Service Level Agreement** or **SLA** means the processes, deliverables, key performance indicators and performance standards relating to the Services to be provided by the Service Provider;
- 2.24 **Subcontract** means any contract or agreement or proposed contract or agreement between the Service Provider and any third party whereby that third party agrees to provide to the Service Provider the Services or any part thereof;
- 2.25 **Subcontractor** means the third party with whom the Service Provider enters into a Subcontract;
- 2.26 **Service Provider Materials** means all works of authorship, products and materials [including, but not limited to, data, diagrams, charts, reports, specifications, studies, inventions, software, software development tools, methodologies, ideas, methods, processes, concepts and techniques] owned by, or licensed to, the Service Provider prior to the Commencement Date or independently developed by the Service Provider outside the scope of the Agreement at no expense to Transnet, and used by the Service Provider in the performance of the Services;
- 2.27 **Tax Invoice** means the document as required by Section 20 of the Value-Added Tax Act, 89 of 1991, as may be amended from time to time;

- 2.28 **Third Party Material** means software, software development tools, methodologies, ideas, methods, processes, concepts and techniques owned by, or licensed to a third party and used by the Service Provider in the performance of the Services;
- 2.29 **Trade Marks** mean registered Trade Marks and trade mark applications and includes any sign or logo, or combination of signs and/or logos capable of distinguishing the goods or services of one undertaking from those of another undertaking;
- 2.30 **VAT** means Value-Added Tax chargeable in terms of the Value-Added Tax Act, 89 of 1991, as may be amended from time to time; and
- 2.31 **Work Order(s)** means a detailed scope of work for a Service required by Transnet, including timeframes, Deliverable, Fees and costs for the supply of the Service to Transnet, which may be appended to the Agreement from time to time.

### 3 INTERPRETATION

- 3.1 Clause headings in the Agreement are included for ease of reference only and do not form part of the Agreement for the purposes of interpretation or for any other purpose. No provision shall be construed against or interpreted to the disadvantage of either Party hereto by reason of such Party having or being deemed to have structured or drafted such provision.
- 3.2 Any term, word, acronym or phrase used in the Agreement, other than those defined under the clause heading "Definitions" shall be given its plain English meaning, and those terms, words, acronyms, and phrases used in the Agreement will be interpreted in accordance with the generally accepted meanings accorded thereto.
- 3.3 A reference to the singular incorporates a reference to the plural and *vice versa*.
- 3.4 A reference to natural persons incorporates a reference to legal persons and *vice versa*.
- 3.5 A reference to a particular gender incorporates a reference to the other gender.

### 4 NATURE AND SCOPE

- 4.1 The Agreement is an agreement under the terms and conditions of which the Service Provider will arrange for the provision to Transnet of the Services which meet the requirements of Transnet, the delivery of which Services is controlled by means of Purchase Orders to be issued by Transnet and executed by the Service Provider, in accordance with the Agreement.
- 4.2 Such Purchase Orders shall be agreed between the Parties from time to time, subject to the terms of the relevant Work Order(s).
- 4.3 Each properly executed Purchase Order forms an inseparable part of the Agreement as if it were fully incorporated into the body of the Agreement.
- 4.4 During the period of the Agreement, both Parties can make written suggestions for amendments to the Work Order(s), in accordance with procedures set out in clause 28 [*Amendment and Change Control*] below. A Party will advise the other Party within 14 [fourteen] Business Days, or such other period as mutually agreed, whether the amendment is acceptable.
- 4.5 Insofar as any term, provision or condition in the Work Order(s) conflicts with a like term, provision or condition in the Agreement and/or a Purchase Order, or where the Agreement is silent on the matter, the term, provision or condition in this Master Agreement shall prevail, unless such term or provision or condition in this Master Agreement has been specifically revoked or amended by mutual written agreement between the Parties.

- 4.6 Time will be of the essence and the Service Provider will perform its obligations under the Agreement in accordance with the timeframe(s) [if any] set out in the relevant schedule, save that the Service Provider will not be liable under this clause if it is unable to meet such obligation within the time required as a direct result of any act or omission by Transnet and it has used its best endeavours to advise Transnet of such act or omission. In the event of such delay, any time deadlines detailed in the relevant schedule shall be extended by a period equal to the period of that delay.

## **5 AUTHORITY OF PARTIES**

- 5.1 Nothing in the Agreement will constitute or be deemed to constitute a partnership between the Parties, or constitute or be deemed to constitute the Parties as agents or employees of one another for any purpose or in any form whatsoever.
- 5.2 Neither Party shall be entitled to, or have the power or authority to enter into an agreement in the name of the other; or give any warranty, representation or undertaking on the other's behalf; or create any liability against the other or bind the other's credit in any way or for any purpose whatsoever.

## **6 WARRANTIES**

- 6.1 The Service Provider warrants to Transnet that:
- a) it has full capacity and authority to enter into and to perform the Agreement and that the Agreement is executed by a duly authorised representatives of the Service Provider;
  - b) it will discharge its obligations under the Agreement and any annexure, appendix or schedule hereto with all due skill, care and diligence;
  - c) it will be solely responsible for the payment of remuneration and associated benefits, if any, of its Personnel and for withholding and remitting income tax for its Personnel in conformance with any applicable laws and regulations;
  - d) it will procure licences for Transnet in respect of all Third Party Material detailed in the Work Order(s), and will procure the right for Transnet to take such copies [in whole or in part] of such Third Party Materials as it may reasonably require for the purposes of back-up for archiving and disaster recovery; and
  - e) the use or possession by Transnet of any Materials will not subject Transnet to any claim for infringement of any Intellectual Property Rights of any third party.
- 6.2 The Service Provider warrants that it will perform its obligations under the Agreement in accordance with the Service Levels as defined in the relevant schedule. Transnet may at its discretion audit compliance with the Service Levels, provided that any such audit is carried out with reasonable prior notice and in a reasonable way so as not to have an adverse effect on the performance of the Services. Without prejudice to clause 6.3 below, in the event that the Service Provider fails to meet the Service Levels, Transnet may claim appropriate service credits or invoke a retention of Fees as detailed in the relevant schedule and/or Work Order.
- 6.3 The Service Provider warrants that for a period of 90 [ninety] days from Acceptance of the Deliverables they will, if properly used, conform in all material respects with the requirements set out in the relevant schedule. The Service Provider will at its expense remedy any such non-conformance as soon as possible but in any event within 30 [thirty] days of notification by

Transnet. In the event that the Service Provider fails or is unable to remedy such non-conformance within such time-scale, Transnet will be entitled to employ a third party to do so in place of the Service Provider and any excess charges or costs incurred by Transnet as a result shall be paid by the Service Provider.

- 6.4 The Service Provider will remedy any defect within 30 [thirty] days of being notified of that defect by Transnet in writing.
- 6.5 The Service Provider will not be liable to remedy any problem arising from or caused by any modification made by Transnet to the Deliverables, or any part thereof, without the prior approval of the Service Provider.
- 6.6 The Service Provider shall advise Transnet of the effects of any steps proposed by Transnet pursuant to clause 6.5 above, including but not limited to any cost implications or any disruption or delay in the performance of the Services. The Parties agree that any changes to the Services, including the charges for the Services or any timetables for delivery of the Services, will be agreed in accordance with the change control procedure, as set out in clause 28 [*Amendment and Change Control*].
- 6.7 The Service Provider warrants that:
- a) it has, using the most up-to-date software available, tested for [and deleted] all commonly known viruses in the Materials and for all viruses known by the Service Provider at the date of the relevant Work Order; and
  - b) at the time of delivery to Transnet, the Materials do not contain any trojan horse, worm, logic bomb, time bomb, back door, trap door, keys or other harmful components.
- The Service Provider agrees that, in the event that a virus is found, it will at its own expense use its best endeavours to assist Transnet in reducing the effect of the virus and, particularly in the event that a virus causes loss of operational efficiency or loss of data, to assist Transnet to the same extent to mitigate such losses and to restore Transnet to its original operating efficiency.
- 6.8 The Service Provider undertakes to comply with South Africa's general privacy protection in terms of Section 14 of the Bill of Rights in connection with the Agreement and shall procure that its Personnel shall observe the provisions of Section 14 [as applicable] or any amendments and re-enactments thereof and any regulations made pursuant thereto.
- 6.9 The Service Provider warrants that it has taken all reasonable precautions to ensure that, in the event of a disaster, the impact of such disaster on the ability of the Service Provider to comply with its obligations under the Agreement will be reduced to the greatest extent possible, and that the Service Provider shall ensure that it has appropriate, tested and documented recovery arrangements in place.
- 6.10 In compliance with the National Railway Safety Regulator Act, 16 of 2002, the Service Provider shall ensure that the Services, to be supplied to Transnet under the terms and conditions of the Agreement, comply fully with the specifications as set forth in Schedule 1 hereto, and shall thereby adhere [as applicable] to railway safety requirements and/or regulations. Permission for the engagement of a Subcontractor by the Service Provider [as applicable] shall be subject to a review of the capability of the proposed Subcontractor to comply with the specified railway safety requirements and/or regulations. The Service Provider and/or its Subcontractor shall grant Transnet access, during the term of the Agreement, to review any safety-related activities, including the coordination of such activities across all parts of its organisation.



## **7 TRANSNET'S OBLIGATIONS**

- 7.1 Transnet undertakes to promptly comply with any reasonable request by the Service Provider for information, including information concerning Transnet's operations and activities, that relates to the Services as may be necessary for the Service Provider to perform the Services, but for no other purpose. However, Transnet's compliance with any request for information is subject to any internal security rules and requirements and subject to the observance by the Service Provider of its confidentiality obligations under the Agreement.
- 7.2 The Service Provider shall give Transnet reasonable notice of any information it requires in accordance with clause 7.1 above.
- 7.3 Subject to clause 13 [*Service Provider's Personnel*], Transnet agrees to provide the Service Provider or its Personnel such access to and use of its facilities as is necessary to allow the Service Provider to perform its obligations under the Agreement.

## **8 GENERAL OBLIGATIONS OF THE SERVICE PROVIDER**

- 8.1 The Service Provider shall:
- a) respond promptly to all complaints and enquiries from Transnet;
  - b) inform Transnet immediately of any dispute or complaint arising in relation to the provision of the Services;
  - c) conduct its business in a professional manner that will reflect positively upon the Service Provider and the Service Provider's Services;
  - d) keep full records clearly indicating all transactions concluded by the Service Provider relating to the performance of the Services and keep such records for at least 5 [five] years from the date of each such transaction;
  - e) obtain, and at all times maintain in full force and effect, any and all licences, permits and the like required under applicable laws for the provision of the Services and the conduct of the business and activities of the Service Provider;
  - f) observe and ensure compliance with all requirements and obligations as set out in the labour and related legislation of South Africa, including the Occupational Health and Safety Act, 85 of 1993;
  - g) comply with all applicable environmental legislation and regulations, and demonstrate sound environmental policies, management and performance; and
  - h) ensure the validity of all renewable certifications, including but not limited to its Tax Clearance Certificate and B-BBEE Verification Certificate, for the duration of the Agreement. Should the Service Provider fail to present Transnet with such renewals as they become due, Transnet shall be entitled, in addition to any other rights and remedies that it may have in terms of the Agreement, to terminate the Agreement forthwith without any liability and without prejudice to any claims which Transnet may have for damages against the Service Provider.
- 8.2 The Service Provider acknowledges and agrees that it shall at all times:
- a) render the Services and perform all its duties with honesty and integrity;
  - b) communicate openly and honestly with Transnet and demonstrate a commitment to performing the Services timeously, efficiently and to the required standards;

- c) endeavour to provide the highest possible standards of service and professionalism, with a reasonable degree of care and diligence;
- d) use its best endeavours and make every diligent effort to meet agreed deadlines;
- e) treat its own Personnel, as well as all Transnet's officers, employees, agents and consultants, with fairness and courtesy and respect for their human rights;
- f) practice and promote its own internal policies aimed at prohibiting and preventing unfair discrimination [as further referred to in clause 22 – *Equality and Diversity*];
- g) treat all enquiries from Transnet in connection with the Services with courtesy and respond to all enquiries promptly and efficiently. Where the Service Provider is unable to comply with the provisions of this clause, the Service Provider will advise Transnet of the delay and the reasons therefor and will keep Transnet informed of progress made regarding the enquiry;
- h) when requested by Transnet, provide clear and accurate information regarding the Service Provider's own policies and procedures, excluding Know-How and other Confidential Information, except where a non-disclosure undertaking has been entered into between the Parties;
- i) not allow a conflict of interest to develop between its own interests [or the interests of any of its other customers] and the interests of Transnet;
- j) not accept or offer, nor allow, induce or promote the acceptance or offering of any gratuity, enticement, incentive or gift that could reasonably be regarded as bribery or an attempt to otherwise exert undue influence over the recipient;
- k) not mislead Transnet or its officers, employees and stakeholders, whether by act or omission;
- l) not otherwise act in an unethical manner or do anything which could reasonably be expected to damage or tarnish Transnet's reputation or business image; and
- m) immediately report to Transnet any unethical, fraudulent or otherwise unlawful conduct of which it becomes aware in connection with Transnet or the provision of Services.

## **9 FEES AND EXPENSES**

- 9.1 In consideration of the provision of the Services, Transnet will pay to the Service Provider the Fees detailed in the relevant schedule or Work Order.
- 9.2 Transnet will not be invoiced for materials used in the provision of the Services save for those materials [if any] set out in the Work Order and accepted by Transnet or in any relevant Work Order [which will be invoiced to Transnet at cost].
- 9.3 Unless otherwise agreed in a schedule or Work Order, Transnet will reimburse to the Service Provider all reasonable and proper expenses incurred directly and solely in connection with the provision of the Services, provided that all such expenses:
  - a) are agreed by Transnet in advance;
  - b) are incurred in accordance with Transnet's standard travel and expenses policies;
  - c) are passed on to Transnet at cost with no administration fee; and
  - d) will only be reimbursed if supported by relevant receipts.

- 9.4 All Tax Invoices relating to Fees, out of pocket expenses and, if applicable, travel and accommodation costs, will provide the detail for each of the Personnel carrying out the Services and incurring the expenses, and the Tax Invoice will, where appropriate, include VAT as a separate item.

## **10 INVOICING AND PAYMENT**

- 10.1 Transnet shall pay the Service Provider the amounts stipulated in the relevant schedule or Work Order, subject to the terms and conditions of the Agreement.
- 10.2 Transnet shall pay such amounts to the Service Provider, upon receipt of a valid and undisputed Tax Invoice together with the supporting documentation as specified in the Work Order appended hereto, once the valid and undisputed Tax Invoices, or such portion of the Tax Invoices which are valid and undisputed become due and payable to the Service Provider for the provision of the Services, in terms of clause 10.4 below.
- 10.3 All Fees and other sums payable under the Agreement are exclusive of VAT, which will be payable at the applicable rate.
- 10.4 Unless otherwise provided for in the Work Order(s) appended to the Agreement, Tax Invoices shall be submitted together with a month-end statement. Payment against such month-end statement shall be made by Transnet within 30 [thirty] days after date of receipt by Transnet of the statement together with all valid and undisputed Tax Invoices and supporting documentation.
- 10.5 Where the payment of any Tax Invoice, or any part thereof which is not in dispute, is not made in accordance with this clause 10, the Service Provider shall be entitled to charge interest on the outstanding amount, at The Standard Bank of South Africa's prime rate of interest in force, for the period from the due date of payment until the outstanding amount is paid.

## **11 FEE ADJUSTMENTS**

- 11.1 Fees for Services rendered in terms of the Agreement shall be subject to review as indicated in the Work Order(s) annexed hereto from time to time.
- 11.2 No less than 2 [two] months prior to any proposed Fee adjustment, the Parties shall commence negotiations for Fees for the next period or as otherwise indicated and appended hereto.
- 11.3 Should Transnet and the Service Provider fail to reach an agreement on Fees for the successive period, either Party shall be entitled to submit this matter to dispute resolution in accordance with clause 25 of this Master Agreement [*Dispute Resolution*].

## **12 INTELLECTUAL PROPERTY RIGHTS**

### **12.1 Title to Confidential Information**

- a) Transnet will retain all right, title and interest in and to its Confidential Information and Background Intellectual Property and the Service Provider acknowledges that it has no claim of any nature in and to the Confidential Information and Background Intellectual Property that is proprietary to Transnet. For the avoidance of doubt, all the Service Provider's Background Intellectual Property shall remain vested in the Service Provider.
- b) Transnet shall grant to the Service Provider an irrevocable, royalty free, non-exclusive licence to use Transnet's Background Intellectual Property only for the Permitted Purpose. This license shall not permit the Service Provider to sub-license to other parties.

- c) The Service Provider shall grant to Transnet an irrevocable, royalty free, non-exclusive licence to use the Service Provider's Background Intellectual Property for the Permitted Purpose. This licence shall not permit Transnet to sub-license to other parties.
- d) The Service Provider shall grant Transnet access to the Service Provider's Background Intellectual Property on terms which shall be *bona fide* negotiated between the Parties for the purpose of commercially exploiting the Foreground Intellectual Property, to the extent that such access is required.

#### 12.2 **Title to Intellectual Property**

- a) All right, title and interest in and to Foreground Intellectual Property prepared, conceived or developed by the Service Provider, its researchers, agents and employees shall vest in Transnet and the Service Provider acknowledges that it has no claim of any nature in and to the Foreground Intellectual Property. The Service Provider shall not at any time during or after the termination or cancellation of the Agreement dispute the validity or enforceability of such Foreground Intellectual Property, or cause to be done any act or anything contesting or in any way impairing or tending to impair any part of that right, title and interest to any of the Foreground Intellectual Property and shall not counsel or assist any person to do so.
- b) Transnet shall be entitled to seek protection in respect of the Foreground Intellectual Property anywhere in the world as it shall decide in its own absolute discretion and the Service Provider shall reasonably assist Transnet in attaining and maintaining protection of the Foreground Intellectual Property.
- c) Where the Foreground Intellectual Property was created by the Service Provider or its researchers, agents and employees and where Transnet elects not to exercise its option to seek protection or decides to discontinue the financial support of the prosecution or maintenance of any such protection, Transnet shall notify the Service Provider who shall have the right of first refusal to file or continue prosecution or maintain any such applications and to maintain any protection issuing on the Foreground Intellectual Property.
- d) No consideration shall be paid by Transnet to the Service Provider for the assignment of any Foreground Intellectual Property from the Service Provider to Transnet, over and above the sums payable in terms of the Agreement. The Service Provider undertakes to sign all documents and do all things as may be necessary to effect, record and perfect the assignment of the Foreground Intellectual Property to Transnet.
- e) Subject to anything contrary contained in the Agreement and/or the prior written consent of Transnet [which consent shall not be unreasonably be withheld or delayed], the Service Provider shall under no circumstances be entitled as of right, or to claim the right, to use Transnet's Background Intellectual Property and/or Foreground Intellectual Property.

#### 12.3 **Title to Improvements**

Any improvements, developments, adaptations and/or modifications to the Foreground Intellectual Property, and any and all new inventions or discoveries, based on or resulting from the use of Transnet's Background Intellectual Property and/or Confidential Information shall be exclusively owned by Transnet. The Service Provider shall disclose promptly to Transnet all such improvements, developments, adaptations and/or modifications, inventions or discoveries. The

Service Provider hereby undertakes to sign all documents and do all things as may be necessary to effect, record and perfect the assignment of such improvements, developments, adaptations and/or modifications, inventions or discoveries to Transnet and the Service Provider shall reasonably assist Transnet in attaining, maintaining or documenting ownership and/or protection of the improved Foreground Intellectual Property.

**12.4 Unauthorised Use of Confidential Information**

The Service Provider shall not authorise any party to act on or use in any way any Confidential Information belonging to Transnet whether or not such party is aware of such Confidential Information, and shall promptly notify Transnet of the information if it becomes aware of any party so acting, and shall provide Transnet the information with such assistance as Transnet reasonably requires, at Transnet's cost and expense, to prevent such third party from so acting.

**12.5 Unauthorised Use of Intellectual Property**

- a) The Service Provider agrees to notify Transnet in writing of any conflicting uses of, and applications of registrations of Patents, Designs and Trade Marks or any act of infringement, unfair competition or passing off involving the Intellectual Property of Transnet of which the Service Provider acquires knowledge and Transnet shall have the right, as its own option, to proceed against any party infringing its Intellectual Property.
- b) It shall be within the sole and absolute discretion of Transnet to determine what steps shall be taken against the infringer and the Service Provider shall co-operate fully with Transnet, at Transnet's cost, in whatever measure including legal action to bring any infringement of illegal use to an end.
- c) The Service Provider shall cooperate to provide Transnet promptly with all relevant ascertainable facts.
- d) If proceedings are commenced by Transnet alone, Transnet shall be responsible for all expenses but shall be entitled to all damages or other awards arising out of such proceedings. If proceedings are commenced by both Parties, both Parties will be responsible for the expenses and both Parties shall be entitled to damages or other awards arising out of proceedings.

**13 SERVICE PROVIDER'S PERSONNEL**

13.1 The Service Provider's Personnel shall be regarded at all times as employees, agents or Subcontractors of the Service Provider and no relationship of employer and employee shall arise between Transnet and any Service Provider Personnel under any circumstances regardless of the degree of supervision that may be exercised over the Personnel by Transnet.

13.2 The Service Provider warrants that all its Personnel will be entitled to work in South Africa or any other country in which the Services are to be performed.

13.3 The Service Provider will ensure that its Personnel comply with all reasonable requirements made known to the Service Provider by Transnet concerning conduct at any Transnet premises or any other premises upon which the Services are to be performed [including but not limited to security regulations, policy standards and codes of practice and health and safety requirements]. The Service Provider will ensure that such Personnel at all times act in a lawful and proper manner in accordance with these requirements.

- 13.4 Transnet reserves the right to refuse to admit or to remove from any premises occupied by or on behalf of it, any Service Provider Personnel whose admission or presence would, in the reasonable opinion of Transnet, be undesirable or who represents a threat to confidentiality or security or whose presence would be in breach of any rules and regulations governing Transnet's Personnel, provided that Transnet notifies the Service Provider of any such refusal [with reasons why]. The reasonable exclusion of any such individual from such premises shall not relieve the Service Provider from the performance of its obligations under the Agreement.
- 13.5 The Service Provider agrees to use all reasonable endeavours to ensure the continuity of its Personnel assigned to perform the Services. If any re-assignment by the Service Provider of those Personnel is necessary, or if Transnet advises that any such Personnel assigned are in any respect unsatisfactory, including where any such Personnel are, or are expected to be or have been absent for any period, then the Service Provider will promptly supply a replacement of equivalent calibre and experience, and any such replacement shall be approved by Transnet prior to commencing provision of the Services, such approval not to be unreasonably withheld or delayed.

#### **14 LIMITATION OF LIABILITY**

- 14.1 Neither Party excludes or limits liability to the other Party for:
- a) death or personal injury due to negligence; or
  - b) fraud.
- 14.2 The Service Provider shall indemnify and keep Transnet indemnified from and against liability for damage to any Transnet property [whether tangible or intangible] or any other loss, costs or damage suffered by Transnet to the extent that it results from any act of or omission by the Service Provider or its Personnel in connection with the Agreement. The Service Provider's liability arising out of this clause 14.2 shall be limited to a maximum amount payable in respect of any one occurrence or a series of related occurrences in a single calendar year, such amount to be agreed in writing by the Parties.
- 14.3 Subject always to clauses 14.1 and 14.2 above, the liability of either the Service Provider or Transnet under or in connection with the Agreement, whether for negligence, misrepresentation, breach of contract or otherwise, for direct loss or damage arising out of each Default or series of related Defaults shall not exceed 100% [one hundred per cent] of the Fees paid under the schedule or Work Order to which the Default(s) relates.
- 14.4 Subject to clause 14.1 above, and except as provided in clauses 14.2 and 14.3 above, in no event shall either Party be liable to the other for indirect or consequential loss or damage or including indirect or consequential loss of profits, business, revenue, goodwill or anticipated savings of an indirect nature or loss or damage incurred by the other Party as a result of third party claims.
- 14.5 If for any reason the exclusion of liability in clause 14.4 above is void or unenforceable, either Party's total liability for all loss or damage under the Agreement shall be as provided in clause 14.3 above.
- 14.6 Nothing in this clause 14 shall be taken as limiting the liability of the Service Provider in respect of clause 12 [*Intellectual Property Rights*] or clause 16 [*Confidentiality*].

## 15 INSURANCES

- 15.1 Without limiting the liability of the Service Provider under the Agreement, the Service Provider shall take out insurance in respect of all risks for which it is prudent for the Service Provider to insure against, including any liability it may have as a result of its activities under the Agreement for theft, destruction, death or injury to any person and damage to property. The level of insurance will be kept under review by Transnet, on an annual basis, to ensure its adequacy, provided that any variation to the level of such insurance shall be entirely at the discretion of the Service Provider.
- 15.2 The Service Provider shall arrange insurance with reputable insurers and will produce to Transnet evidence of the existence of the policies on an annual basis within 30 [thirty] days after date of policy renewals.
- 15.3 Subject to clause 15.4 below, if the Service Provider fails to effect adequate insurance under this clause 15, it shall notify Transnet in writing as soon as it becomes aware of the reduction or inadequate cover and Transnet may arrange or purchase such insurance. The Service Provider shall promptly reimburse Transnet for any premiums paid provided such insurance protects the Service Provider's liability. Transnet assumes no responsibility for such insurance being adequate to protect all of the Service Provider's liability.
- 15.4 In the event that the Service Provider receives written notice from its insurers advising of the termination of its insurance cover referred to in clause 15.1 above or if the insurance ceases to be available upon commercially reasonable terms, the Service Provider shall immediately notify Transnet in writing of such termination and/or unavailability, whereafter either the Service Provider or Transnet may terminate the Agreement on giving the other Party not less than 30 [thirty] days prior written notice to that effect.

## 16 CONFIDENTIALITY

- 16.1 The Parties hereby undertake the following, with regard to Confidential Information:
- a) not to divulge or disclose to any person whomsoever in any form or manner whatsoever, either directly or indirectly, any Confidential Information of the other, without the prior written consent of such other Party, other than when called upon to do so in accordance with a statute, or by a court having jurisdiction, or by any other duly authorised and empowered authority or official, in which event the Party concerned shall do what is reasonably possible to inform the other of such a demand and each shall assist the other in seeking appropriate relief or the instituting of a defensive action to protect the Confidential Information concerned;
  - b) not to use, exploit, permit the use of, directly or indirectly, or in any other manner whatsoever apply the Confidential Information, disclosed to it as a result of the Agreement, for any purpose whatsoever other than for the purpose for which it is disclosed or otherwise than in strict compliance with the provisions in the Agreement;
  - c) not to make any notes, sketches, drawings, photographs or copies of any kind of any part of the disclosed Confidential Information, without the prior written consent of such other Party, except when reasonably necessary for the purpose of the Agreement, in which case such copies shall be regarded as Confidential Information;



- d) not to de-compile, disassemble or reverse engineer any composition, compilation, concept application, item, component de-compilation, including software or hardware disclosed and shall not analyse any sample provided by Transnet, or otherwise determine the composition or structure or cause to permit these tasks to be carried out except in the performance of its obligations pursuant to the Agreement;
- e) not to exercise less care to safeguard Transnet Confidential Information than the Party exercises in safeguarding its own competitive, sensitive or Confidential Information;
- f) Confidential Information disclosed by either Party to the other or by either Party to any other party used by such Party in the performance of the Agreement, shall be dealt with as "restricted" or shall be dealt with according to any other appropriate level of confidentiality relevant to the nature of the information concerned, agreed between the Parties concerned and stipulated in writing for such information in such cases;
- g) the Parties shall not make or permit to be made by any other person subject to their control, any public statements or issue press releases or disclose Confidential Information with regard to any matter related to the Agreement, unless written authorisation to do so has first been obtained from the Party first disclosing such information;
- h) each Party shall be entitled to disclose such aspects of Confidential Information as may be relevant to one or more technically qualified employees or consultants of the Party who are required in the course of their duties to receive the Confidential Information for the Permitted Purpose provided that the employee or consultant concerned has a legitimate interest therein, and then only to the extent necessary for the Permitted Purpose, and is informed by the Party of the confidential nature of the Confidential Information and the obligations of the confidentiality to which such disclosure is subject and the Party shall ensure such employees or consultants honour such obligations;
- i) each Party shall notify the other Party of the name of each person or entity to whom any Confidential Information has been disclosed as soon as practicable after such disclosure;
- j) each Party shall ensure that any person or entity to which it discloses Confidential Information shall observe and perform all of the covenants the Party has accepted in the Agreement as if such person or entity has signed the Agreement. The Party disclosing the Confidential Information shall be responsible for any breach of the provisions of the Agreement by the person or entity; and
- k) each Party may by written notice to the other Party specify which of the Party's employees, officers or agents are required to sign a non-disclosure undertaking.

16.2 The duties and obligations with regard to Confidential Information in this clause 16 shall not apply where:

- a) a Party can demonstrate that such information is already in the public domain or becomes available to the public through no breach of the Agreement by that Party, or its Personnel; or
- b) was rightfully in a Party's possession prior to receipt from the other Party, as proven by the first-mentioned Party's written records, without an infringement of an obligation or duty of confidentiality; or
- c) can be proved to have been rightfully received by a Party from a third party without a breach of a duty or obligation of confidentiality; or



d) is independently developed by a Party as proven by its written records.

16.3 This clause 16 shall survive termination for any reason of the Agreement and shall remain in force and effect from the Commencement Date of the Agreement and 5 [five] years after the termination of the Agreement. Upon termination of the Agreement, all documentation furnished to the Service Provider by Transnet pursuant to the Agreement shall be returned to Transnet including, without limitation all corporate identity equipment including dyes, blocks, labels, advertising matter, printing matter and the like.

## 17 TOTAL OR PARTIAL FAILURE TO PERFORM THE SCOPE OF SERVICES

Should the Service Provider fail or neglect to execute the work or to deliver any portion of the Service, as required by the terms of the Agreement or Work Order, Transnet may cancel the Agreement or Work Order in so far as it relates to the unexecuted work or rejected portion of the Service, and, in such event, the provision of any remaining commitment shall remain subject in all respects to these conditions.

## 18 TERM AND TERMINATION

18.1 Notwithstanding the date of signature hereof, the Commencement Date if the Agreement is [●] and the duration shall be for a [●] [[●]] year period, expiring on [●], unless:

- a) the Agreement is terminated by either Party in accordance with the provisions incorporated herein or in any schedules or annexures appended hereto, or otherwise in accordance with law or equity; or
- b) the Agreement is extended at Transnet's option for a further period to be agreed by the Parties.

18.2 Either Party may terminate the Agreement forthwith by notice in writing to the other Party where the other Party has committed a material Default and, where such Default is capable of remedy, has failed to remedy such Default within 30 [thirty] days of receiving notice specifying the Default and requiring its remedy.

18.3 Either Party may terminate the Agreement forthwith by notice in writing to the other Party when the other Party is unable to pay its debts as they fall due or commits any act or omission which would be an act of insolvency in terms of the Insolvency Act, 24 of 1936 [as may be amended from time to time], or if any action, application or proceeding is made with regard to it for:

- a) a voluntary arrangement or composition or reconstruction of its debts;
- b) its winding-up or dissolution;
- c) the appointment of a liquidator, trustee, receiver, administrative receiver or similar officer; or
- d) any similar action, application or proceeding in any jurisdiction to which it is subject.

18.4 Transnet may terminate the Agreement at any time within 2 [two] months of becoming aware of a change of control of the Service Provider by notice in writing to the Service Provider. For the purposes of this clause, "control" means the right to direct the affairs of a company whether by ownership of shares, membership of the board of directors, agreement or otherwise.

18.5 Transnet may cancel any schedule or Work Order hereto at any time on giving the Service Provider 30 [thirty] days' written notice.

18.6 Notwithstanding this clause 18, either Party may cancel the Agreement without cause by giving 30 [thirty] days prior written notice thereof to the other Party.

## 19 CONSEQUENCE OF TERMINATION

19.1 Termination in accordance with clause 18 [*Term and Termination*] shall not prejudice or affect any right of action or remedy which shall have accrued or shall thereafter accrue to either Party and all provisions which are to survive the Agreement or impliedly do so shall remain in force and in effect.

19.2 On termination of the Agreement or a Work Order, the Service Provider will immediately deliver up, and procure that its Personnel will immediately deliver up to Transnet, all Deliverables and property belonging to Transnet [or, in the event of termination of a Work Order, such as is relevant to that Work Order] which may be in the possession of, or under the control of the Service Provider, and certify to Transnet in writing that this has been done.

19.3 To the extent that any of the Deliverables and property referred to in clause 19.2 above are in electronic form and contained on non-detachable storage devices, the Service Provider will provide Transnet with unencrypted copies of the same on magnetic media and will irretrievably destroy and delete copies so held.

19.4 In the event that the Agreement is terminated by the Service Provider under clause 18.2 [*Term and Termination*], or in the event that a Work Order is terminated by Transnet under clause 18.5 [*Term and Termination*], Transnet will pay to the Service Provider all outstanding Fees [apportioned on a *pro rata* basis] relating to the work undertaken by the Service Provider up until the date of such termination. Transnet will also pay the costs of any goods and materials ordered by the Service Provider in relation to the such work for which the Service Provider has paid or is legally obliged to pay, in which case, on delivery of such goods or materials, the Service Provider will promptly deliver such goods and materials to Transnet or as it may direct.

19.5 The provisions of clauses 1 [*Definitions*], 6 [*Warranties*], 12 [*Intellectual Property Rights*], 14 [*Limitation of Liability*], 16 [*Confidentiality*], 19 [*Consequence of Termination*], 25 [*Dispute Resolution*] and 29 [*Governing Law*] shall survive termination or expiry of the Agreement.

19.6 If either Party [**the Defaulting Party**] commits a material breach of the Agreement and fails to remedy such breach within 30 [thirty] Business Days of written notice thereof, the other Party [hereinafter **the Aggrieved Party**], shall be entitled, in addition to any other rights and remedies that it may have in terms of the Agreement, to terminate the Agreement forthwith without any liability and without prejudice to any claims which the Aggrieved Party may have for damages against the Defaulting Party.

19.7 Should:

- a) the Service Provider effect or attempt to effect a compromise or composition with its creditors; or
- b) either Party be provisionally or finally liquidated or placed under judicial management, whether provisionally or finally; or
- c) either Party cease or threaten to cease to carry on its normal line of business or default or threaten to default in the payment of its liabilities generally, or commit any act or omission which would be an act of insolvency in terms of the Insolvency Act, 24 of 1936 [as may be amended from time to time];

then the other Party shall be entitled, but not obliged, to terminate the Agreement on written notice, in which event such termination shall be without any liability and without prejudice to any claims which either Party may have for damages against the other.

## **20 ASSIGNMENT**

Neither Party may assign the benefit of the Agreement or any interest hereunder except with the prior written consent of the other. Further, in the event that Transnet wishes to assign or novate the Agreement to any third party, the Service Provider agrees that it shall not unreasonably withhold or delay its consent to such assignment or novation and that it shall only be entitled to recover from Transnet any reasonable legal costs incurred by it as a direct result of such assignment or novation.

## **21 FORCE MAJEURE**

21.1 Neither Party shall have any claim against the other Party arising from any failure or delay in the performance of any obligation of either Party under the Agreement caused by an act of *force majeure* such as acts of God, fire, flood, war, strike, lockout, industrial dispute, government action, laws or regulations, riots, terrorism or civil disturbance, defaults, delays or discontinuance on the part of independent contractors, suppliers, or other circumstances or factors beyond the reasonable control of either Party, and to the extent that the performance of obligations of either Party hereunder is delayed by virtue of the foregoing, any period stipulated for any such performance shall be reasonably extended.

21.2 Each Party will take all reasonable steps by whatever lawful means that are available, to resume full performance as soon as practicable and will seek agreement to modification of the relevant provisions of the Agreement in order to accommodate the new circumstances caused by the act of *force majeure*. If a Party fails to agree to such modifications proposed by the other Party within 90 [ninety] days of the act of *force majeure* first occurring, either Party may thereafter terminate the Agreement with immediate notice.

## **22 EQUALITY AND DIVERSITY**

22.1 The Service Provider will not victimise, harass or discriminate against any employee of either Party to the Agreement or any applicant for employment with either Party to the Agreement due to their gender, race, disability, age, religious belief, sexual orientation or part-time status. This provision applies, but is not limited to employment, upgrading, work environment, demotion, transfer, recruitment, recruitment advertising, termination of employment, rates of pay or other forms of compensation and selection for training.

22.2 Both Parties to the Agreement undertake that they will not, and shall procure that its employees, agents and Subcontractors will not breach any applicable discrimination legislation and any amendments and re-enactments thereof.

## **23 NON-WAIVER**

23.1 Failure or neglect by either Party, at any time, to enforce any of the provisions of the Agreement, shall not, in any manner, be construed to be a waiver of any of that Party's rights in that regard and in terms of the Agreement.

23.2 Such failure or neglect shall not, in any manner, affect the continued, unaltered validity of the Agreement, or prejudice the right of that Party to institute subsequent action.

## 24 PARTIAL INVALIDITY

If any provision of the Agreement shall be held to be invalid, illegal or unenforceable, or shall be required to be modified, the validity, legality and enforceability of the remaining provisions shall not be affected thereby.

## 25 DISPUTE RESOLUTION

25.1 Should any dispute of whatsoever nature arise between the Parties concerning the Agreement, the Parties shall try to resolve the dispute by negotiation within 10 [ten] Business Days of such dispute arising.

25.2 If the dispute has not been resolved by such negotiation, either of the Parties may refer the dispute to AFSA and notify the other Party accordingly, which proceedings shall be held in Johannesburg.

25.3 Such dispute shall be finally resolved in accordance with the rules of AFSA by an arbitrator or arbitrators appointed by AFSA.

25.4 This clause constitutes an irrevocable consent by the Parties to any proceedings in terms hereof, and neither of the Parties shall be entitled to withdraw from the provisions of this clause or claim at any such proceedings that it is not bound by this clause 25.

25.5 This clause 25 is severable from the rest of the Agreement and shall remain in effect even if the Agreement is terminated for any reason.

25.6 This clause 25 shall not preclude either Party from seeking urgent relief in a court of appropriate jurisdiction, where grounds for urgency exist.

## 26 ADDRESSES FOR NOTICES

26.1 The Parties to the Agreement select the physical addresses and facsimile numbers, as detailed hereafter, as their respective addresses for giving or sending any notice provided for or required in terms of the Agreement, provided that either Party shall be entitled to substitute such other address or facsimile number, as may be, by written notice to the other:

a) **Transnet**

(i) For legal notices: [●]  
Fax No. [●]  
Attention: Legal Counsel

(ii) For commercial matters: [●]  
Fax No. [●]  
Attention: [●]

b) **The Service Provider**

(i) For legal notices: [●]  
Fax No. [●]  
Attention: [●]

(ii) For commercial matters: [●]

Fax No. [●]

Attention: [●]

26.2 Any notice shall be addressed to a Party at its physical address or delivered by hand, or sent by facsimile.

26.3 Any notice shall be deemed to have been given:

- a) if hand delivered, on the day of delivery; or
- b) if posted by prepaid registered post, 10 [ten] days after the date of posting thereof; or
- c) if faxed, on the date and time of sending of such fax, as evidenced by a fax confirmation printout, provided that such notice shall be confirmed by prepaid registered post on the date of dispatch of such fax, or, should no postal facilities be available on that date, on the next Business Day.

## **27 WHOLE AND ONLY AGREEMENT**

27.1 The Parties hereby confirm that the Agreement constitutes the whole and only agreement between them with regard to the subject matter of the Agreement.

27.2 The Parties hereby confirm that the Agreement replaces all other agreements which exist or may have existed in any form whatever between them, with regard to the subject matter dealt with in the Agreement, including any annexures, appendices, schedules or Work Order(s) appended hereto.

## **28 AMENDMENT AND CHANGE CONTROL**

28.1 Any requirement for an amendment or change to the Agreement or to a Work Order shall only be valid if it is in writing, signed by both Parties and added to the Agreement as an addendum hereto.

28.2 In the event the Parties cannot agree upon changes, the Parties shall in good faith seek to agree any proposed changes using the dispute resolution procedures in clause 25 [*Dispute Resolution*].

## **29 GOVERNING LAW**

The Agreement is exclusively governed by and construed in accordance with the laws of the Republic of South Africa and is subject to the jurisdiction of the courts of the Republic of South Africa.

### **29.1 Change of Law**

In the Agreement, unless the context otherwise requires, references to a statutory provision include references to that statutory provision as from time to time amended, extended or re-enacted and any regulations made under it, provided that in the event that the amendment, extension or re-enactment of any statutory provision or introduction of any new statutory provision has a material impact on the obligations of either Party, the Parties will negotiate in good faith to agree such amendments to the Agreement as may be appropriate in the circumstances. If, within a reasonable period of time, the Service Provider and Transnet cannot reach agreement on the nature of the changes required or on modification of Fees, Deliverables, warranties, or other terms and conditions, either Party may seek to have the matter determined in accordance with clause 25 [*Dispute Resolution*] above.

**30 COUNTERPARTS**

The Agreement may be signed in any number of counterparts, all of which taken together shall constitute one and the same instrument. Either Party may enter into the Agreement by signing any such counterpart.

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**TRANSNET**  
freight rail

**TECHNOLOGY MANAGEMENT.**  
**SPECIFICATION.**

**REQUIREMENTS FOR POSITIVE ISOLATOR FOR 3 kV DC  
TRACTION SUBSTATIONS**

Author: Chief Engineering Technician D.O.Schulz  
Technology Management  
Approved: Senior Engineer L.O.Borchard  
Technology Management  
Authorised: Principal Engineer W.A.Coetzee  
Technology Management

*[Signature]*  
.....  
*[Signature]*  
.....  
*[Signature]*  
.....  
PP

Date: 21<sup>st</sup> September 2009

Circulation Restricted To:

Transnet Freight Rail – Chief Engineer Infrastructure  
- Technology Management

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**1.0 SCOPE.**

- 1.1 The specification covers Transnet freight rail requirements for the design, manufacture, testing and supply of a 3kV DC positive isolator for traction substations.

**2.0 BACKGROUND.**

- 2.1 The positive isolator is an off-load isolating switch is installed between the 3kV DC reactor and the substation 3 kV DC positive busbar. The purpose of the positive isolator is to isolate and earth the 3kV DC output of the rectifier from the substation positive busbar that feeds via high-speed circuit breakers to the overhead track equipment.
- 2.2 The positive isolator switch combined with its earthing switch and control equipment is housed in a freestanding metal cubicle.

**3.0 STANDARDS, PUBLICATIONS AND DRAWINGS**

Unless otherwise specified all materials used and equipment developed and supplied shall comply with the current edition of the relevant SANS, NEMA and Transnet freight rail specifications which are referred to in this specification:

**3.1 SOUTH AFRICAN NATIONAL STANDARDS**

- SANS 1091: National Colour Standard.  
SANS 1274: Coatings applied by the powder-coating process.

**3.2 NATIONAL ELECTRICAL MANUFACTURING ASSOCIATION**

- NEMA GPO-3: For GPO-3 insulating material

**3.3 TRANSNET FREIGHT RAIL**

- CEE 0224: Drawings, Catalogues, Instruction manuals and spares lists for electrical equipment supplied under contract.  
BBB 3005: 3kV DC Undervoltage relay manufacturing specification.  
Transnet Freight Rail "Electrical Safety instructions".

**4.0 TENDERING PROCEDURE**

- 4.1 Tenderers shall indicate clause by clause compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.
- 4.2 A statement of non-compliance shall be motivated by the tenderer.
- 4.3 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 4.4 Failure to comply with clauses 4.1, 4.2, and 4.3 could preclude a tender from consideration.

**5.0 SERVICE CONDITIONS.****5.1 ATMOSPHERIC SERVICE CONDITIONS**

- Altitude: 0 to 1800m above sea level.  
Ambient temperature: -5°C to +45 °C.  
Relative humidity: 10% to 90%.  
Lightning Conditions: 12 ground flashes per square kilometre per annum.  
Pollution: Heavily salt laden or polluted with smoke from industrial sources.

**5.2 ELECTRICAL SERVICE CONDITIONS**

- 5.2.1 The nominal traction substation DC supply voltage is 3kV DC but can vary between 2,4kV and 3,9kV for sustained periods.
- 5.2.2 The positive isolator can be subjected to short circuit conditions up to 30kA for 200 milli seconds.

**5.3 MECHANICAL SERVICE CONDITIONS**

The 3kV DC traction substations are situated next to railway lines and the equipment will be subjected to vibration. The design must take appropriate counter measures to ensure reliability of equipment that is sensitive to vibration.

**6.0 GENERAL DESIGN**

- 6.1 The positive isolator comprises of an isolating and earthing switch complete with its operating mechanism. The equipment is housed in a metal cubicle with the required control circuitry for the 3kV DC Ampere and Voltage meters and the 3kV DC undervoltage relay protection (if required).
- 6.1.1 The isolating and earthing switch with its operating mechanism and shall be mounted on a metal frame.
- 6.1.2 The 3 kV DC voltmeter and DC ammeter and undervoltage relay (if specified) shall be fitted in the low voltage metering and calibration compartment and shall be totally isolated from the high voltage compartment.
- 6.2 The general design and layout of the positive isolator shall ensure that no access to the equipment is possible when the switch is in the closed position.

**ISOLATING SWITCH**

- 6.3 The isolating switch shall be a medium voltage, manually operated off load switch rated at a minimum for 3kV DC and 3000 Amperes continuous.
- 6.4 The isolating switch shall be designed to carry the continuous rectifier output current without overheating when switched on load.
- 6.5 The isolating switch shall comprise of a moving arm finger contact that engages smoothly and solidly with a fixed contact.
- 6.6 The isolating switch moving arm finger contact and fixed contact shall be manufactured from copper or phosphor bronze.
- 6.7 The minimum dimensions of the moving arm contact shall be 25mm thick X 80mm wide. The fixed contact shall be designed to accommodate the moving contact.
- 6.8 The contact surfaces of the isolating switch moving contact, fixed contact, and busbar joints in positive isolator cubicle shall be nickel-plated.

**EARTHING SWITCH**

- 6.9 The earthing switch shall comprise of a moving arm contact and a fixed contact into which the moving contact makes contact.
- 6.10 The earthing switch shall be a medium voltage, manually operated off load switch with minimum rating of 1500 Ampere.
- 6.11 The earthing switch moving and fixed contact shall be manufactured from copper or phosphor bronze.

**PANEL CONSTRUCTION**

- 6.12 The panel shall be constructed from steel sheeting of at least 2,5 mm thickness. The panel shall be of a rigid construction with facilities for lifting purposes.
- 6.13 The dimensions of the panel shall be in the order of
- |        |         |
|--------|---------|
| Height | 2000 mm |
| Width  | 800 mm  |
| Depth  | 1000 mm |
- 6.14 The removable covers shall be fitted with fasteners that require a special tool in order to remove the covers. Hinged covers are not acceptable.

- 6.15 The panel shall have a High Voltage and a Low Voltage compartment partitioned by a substantial metal sheet.
- 6.16 The front cover for the low voltage compartment shall be fitted with a window to give visibility to the indicating / measuring instruments.
- 6.17 A window shall be provided in the HV compartment to provide visibility of the position of the moving and fixed contacts of the positive isolator and earthing switch.
- 6.18 The windows shall be manufactured from clear polycarbonate, or non-shattering laminated glass or other approved material.
- 6.19 The interior and exterior surface of the panels shall be powder coated in accordance with SANS 1274. The coating shall be type 4 for corrosion-resistant coatings for interior use using thermosetting type high gloss coatings.  
The interior and exterior of the panel shall be Eau-de-Nil, colour code No H 43 in accordance with SANS 1091.

- 6.20 The frame of the metal cubicle that houses the positive isolator shall be fitted with support insulators to insulate the equipment from the floor.

#### **LOW VOLTAGE COMPARTMENT**

- 6.21 The 3kV DC voltmeter and DC ammeter and undervoltage relay (if specified) shall be fitted in the low voltage compartment and shall be totally isolated from the high voltage compartment.
- 6.22 The compartment shall be provided with a hinged plate on which the 3kV DC indicating/measuring instruments are mounted.
- 6.23 The hinge plate shall provide easy access to the under voltage relay transmitter and receiver in the LV compartment for calibration purposes.
- 6.24 The hinged plate shall be fitted behind the front cover of the low voltage compartment so that the front cover must first be removed before access can be gained to the low voltage compartment.
- 6.25 The supplier shall make provision for an electrical interlock to be fitted on the front cover of LV compartment which will cause the substation to trip and lockout in the event of the cover been removed while the traction substation is on load.

#### **HIGH VOLTAGE COMPARTMENT**

- 6.26 The HV compartment shall house the positive isolator switch combined with its earthing switch, all the 3kV DC busbars and 500mm<sup>2</sup> copper cables, the potential dividers and fuse for the metering equipment.
- 6.27 Provision shall be made for the rail connection for the negative connections of the 3 kV DC potential dividers for the undervoltage relay and voltmeter. The rail connection shall consist of a copper busbar mounted on an insulator.
- 6.28 The positive connections for the fuse and potential dividers for the 3 kV DC undervoltage relay and voltmeter shall be connected to the 3 kV DC positive busbar on the track breaker side of the positive isolator.
- 6.29 High voltage insulated cables shall be used for the fuses and positive and negative connections of the potential dividers.
- 6.30 A 6mm X 50mm copper busbar connected to the earthing switch be provided in the rear of the HV compartment for the termination of the cables of the traction substation DC earth leakage system and the earthing cable of the metal cubicle of the positive isolator.
- 6.31 All low voltage wiring in the high voltage compartment shall be run in metal trunking.

#### **CLEARANCES AND INSULATION**

- 6.32 The positive isolator switch 3kV insulation to earth shall be designed to withstand a test voltage of 10,5kV, 50 Hz AC for one minute.
- 6.33 The clearance of the positive isolating equipment at nominal 3kV DC and steelwork shall be not less than 150 mm.

6.34 The insulating material used in the construction of the positive isolator switch shall comply with NEMA standards for GP03 or better for satisfactory operation at coastal and other high humidity areas.

6.35 All insulation used for the construction of apparatus shall resist the effects of humidity, dust and temperature variations and shall not have a tendency to distort.

#### **MECHANICAL INTERLOCKING**

6.36 An externally mounted mechanical interlock shall be fitted to prevent the on load operation of the positive isolator switch or reconnection to the overhead track system while the rectifier bay is open.

6.37 The mechanical interlocking system for the positive isolator switch shall be of the key exchange type. The "Castell" key exchange system is preferred.

6.38 The switching operation of the opening and earthing of the positive isolator shall only be possible once the traction substation has been switched off load from the incoming AC supply.

### **7.0 METERING, UNDERVOLTAGE RELAY AND WIRING**

#### **7.1 METERING**

The 3 kV DC voltmeter and ammeter shall conform to the following requirements.

7.1.1 The 3 kV DC voltmeter shall be a moving coil type, 96mm X 96mm. The range shall be 0-4000V with a class of 1.5 accuracy.

7.1.1.1 The 3 kV DC voltmeter shall be provided with a high voltage fuse and potential divider consisting of not less than 10 vitreous enamel resistors in series and shall be installed in the HV compartment of the positive isolator panel.  
Epoxy sealed HV potential dividers may be offered subject to the approval of Transnet freight rail Technology Management.

7.1.1.2 The 3 kV DC voltmeter shall be labelled "Busbar Voltage"

7.1.1.2 The fuse and voltage divider shall be housed in the HV compartment of the panel. The fuse shall be connected by means of a single core HV conductor from the positive 3kV to the potential divider.

7.1.2 A moving coil DC Ampere meter 96mm X 96mm with range of 0 - 4000 amperes and accuracy class of 1.5 shall be supplied

7.1.2.1 The 3 kV DC Ampere meter shall be calibrated for 4000 amperes full scale with an input of 50mV obtained from a 4000 amperes 50 mV shunt, which shall be supplied by the tenderer.

#### **7.2 3 kV DC UNDERVOLTAGE RELAY**

7.2.1 Where specified the tenderer shall supply a 3kV DC undervoltage relay in accordance with Transnet freight rail's specification BBB 3005.

7.2.2 The potential divider and fuse shall be installed in the HV compartment of the positive isolator switch panel.

7.2.3 The transmitter and receiver of the undervoltage shall be mounted in the LV compartment.

7.2.4 Depending on space constraints in the LV compartment of the positive isolator switch panel, the 3kV DC undervoltage relay may be wall mounted in an easily accessible location.

#### **7.3 WIRING AND TERMINALS**

7.3.1 All terminal blocks and groups of terminal blocks shall be suitably numbered.

7.3.2 All wires shall be provided with identification tags at terminals and shall be marked as reflected on the panel-wiring diagram. The diagram markings and wire markings shall be the same.

#### **8.0 LABELLING**

8.1 All removable covers of the positive isolator shall be fitted with approved Transnet freight rail warning signs.

8.2 The warning signs and labelling shall be of the engraved type.

- 8.3 The warning signs shall read as follows  
**"CAUTION-HIGH VOLTAGE  
Do not open panel and work on this apparatus  
unless the substation is totally isolated and earthed."**
- 8.4 The lettering "CAUTION-HIGH VOLTAGE" shall be 15mm in size and the rest of the wording on the label 10mm. The lettering shall be red on a white background.
- 8.5 The labels shall be screwed or riveted to the panels.
- 9.0 INSPECTION AND TESTING.**
- 9.1 Transnet freight rail reserves the right to carry out inspections and any tests on the equipment at the works of the supplier/ manufacture.
- 9.2 Arrangements must be made with The Senior Engineer, Technology Management Transnet freight rail for inspections to be carried out before delivery of the equipment.
- 9.3 Routine test certificates shall be supplied for each positive isolator switch and undervoltage relay.
- 10.0 DRAWINGS, INSTRUCTION MANUALS AND SPARES LISTS**
- 10.1 Drawings, instruction manuals and spare parts catalogues shall be supplied in accordance with Transnet freight rail specification CEE.0224.
- 10.2 The tenderer shall supply three copies of an instruction/maintenance manuals and construction and schematic diagrams.
- 10.3 The contractor shall submit details of spares required in accordance with Transnet freight rail's specification CEE.0224.
- 11.0 GUARANTEE AND DEFECTS**
- 11.1 The contractor shall guarantee the satisfactory operation of the complete electrical installation supplied and installed by him and accept liability for maker's defects, which may appear in design, materials and workmanship.
- 11.2 The guarantee period for all substations shall expire after: -  
A period of 12 months commencing on the date of completion of the contract or the date the equipment is handed over to Transnet freight rail whichever is the later.
- 11.3 Any specific type of fault occurring three times within the guarantee period and which cannot be proven to be due to other faulty equipment not forming part of this contract e.g., faulty locomotive or overhead track equipment, etc., shall automatically be deemed an inherent defect. Such inherent defect shall be fully rectified to the satisfaction of the Maintenance manager and at the cost of the Contractor.
- 11.4 If urgent repairs have to be carried out by Transnet freight rail staff to maintain supply during the guarantee period the contractor shall inspect such repairs to ensure that the guarantee period is not affected and should they be covered by the guarantee, reimburse Transnet freight rail the cost of material and labour.

END





**TRANSNET**  
freight rail

**TECHNOLOGY MANAGEMENT.**

**SPECIFICATION.**

**REQUIREMENTS FOR BATTERY CHARGERS FOR 3kV DC TRACTION SUBSTATIONS.**

Author: Chief Engineering Technician D.O.Schulz  
Technology Management

Approved: Senior Engineer L.O.Borchard  
Technology Management

Authorised: Principal Engineer W.A.Coetzee  
Technology Management

Date: 21<sup>st</sup> September 2009

Circulation Restricted To:

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- Technology Management

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## 1.0 SCOPE.

- 1.1 This specification covers the requirements for the design, manufacture and supply of battery charger units used in 3 kV DC traction substations.

## 2.0 GENERAL.

- 2.1 The equipment is required to charge a 53 cell lead acid 3 kV DC substation or tie station battery bank. The ampere-hour rating of the battery bank may vary between 100 to 250 ampere hours. The charger must be able to supply the substation or tie station load as well as float charge the battery under normal conditions.
- 2.2 The battery could be subjected to momentary heavy discharges from 50 amperes to 250 amperes for a period of 1 to 3 seconds. The discharge current is for the closing coils of the 3 kV DC high-speed circuit breakers. The discharge current is dependent of the model of the circuit breaker used.
- 2.3 In addition to charging the battery bank the charger must supply a constant voltage to the high-speed circuit breaker's holding coils. As the trip calibration of the high-speed circuit breakers is dependent on the holding coil voltage, the voltage must be maintained at 110 volts by means of a suitably tapped diode string or other means. In the event of failure of the battery charger, the diode string shall be automatically short-circuited and the holding coils of the track breakers shall be fed directly from the battery.

## 3.0 STANDARDS.

The following latest editions of the following publications are referred to herein.

### 3.1 SOUTH AFRICAN NATIONAL STANDARDS

- SANS 1091: National colours standards for paint.
- SANS 1274: Coatings applied by the powder-coating process.
- SANS 1652: Battery chargers – Industrial type

### 3.2 TRANSNET FREIGHT RAIL.

- BBB0041: Preparation of drawings for Transnet Freight Rail infrastructure.
- CEE.0045: Painting of steel components of electrical equipment.
- CEE.0224: Drawings, catalogues, instruction manuals and spares lists for electrical equipment supplied under contract.

## 4.0 DEFINITIONS

- 4.1 **BOOST CHARGE:** A partial charge, generally at a high rate, for a short period. It is also known as a fast charge or a quick charge.
- 4.2 **FLOAT CHARGE:** A constant voltage charge ideally sufficient to maintain a cell or battery in a fully charged state.
- 4.3 **EQUALISING CHARGE:** An extended charge applied to correct relative density imbalance amongst the cells of a battery.
- 4.4 **INITIAL CHARGE:** An increased charge for new or uncharged battery cells.

## 5.0 TENDERING PROCEDURE

- 5.1 Tenderers shall indicate clause by clause compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.
- 5.2 A statement of non-compliance shall be motivated by the tenderer.



5.3 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.

5.4 Failure to comply with clauses 4.1, 4.2, and 4.3 could preclude a tender from consideration.

## 6.0 SERVICE CONDITIONS.

The battery charger shall be designed to operate under the following service conditions.

6.1	Altitude:	0 – 1800 meters above sea level.
6.2	Ambient Temperature Range:	-10°C to +45°C.
6.3	Relative Humidity:	10% to 90%
6.4	Lightning Conditions:	12 Ground flashes per square kilometre per annum.

## 7.0 ELECTRICAL REQUIREMENTS

### 7.1 INPUT VOLTAGE.

7.1.2 The charger must be capable of working off an auxiliary supply with a poor waveform, as a result of thyristor controlled locomotives, line switching and lightning induced surges. A total harmonic voltage distortion figure of 27% must be catered for.

7.1.3 Appendix 1 shows the Quality of Supply characteristics of a typical 230 Volt AC auxiliary supply of a 3 kV DC traction substation.

7.1.4 The battery charger output shall be fitted with low pass filtering to reduce the effect of harmonic frequencies and ripple on the battery and load circuits.

7.2 The following input supplies are available at the 3 kV DC traction substations.

1. Single phase 230 volts AC  $\pm 10\%$  (r.m.s)
2. Three phase 400 volts AC  $\pm 10\%$  (r.m.s)
3. Frequency 50Hz  $\pm 2\text{Hz}$ .

### 7.3 OUTPUTS.

7.3.1 The charger must be capable of driving varying loads and be unaffected by sudden changes in load current and transients generated by the load.

7.3.2 With no battery connected to the output, the charger must be capable of withstanding a short-circuit across its terminals, without any resultant component damage.

7.3.3 The conductors of the battery charger output must be rated to carry the maximum load current continuously. For a 100 ampere hour battery bank, 35 milli meter square conductors are recommended to make provision for short circuit ratings.

7.3.4 Upon switch on, the charger must incorporate a soft start feature, so that at no time either the DC output current or voltage exceeds their full load values.

7.3.5 The charger outputs shall be voltage and current limited for "float" and "boost" charging.

### 7.4 OUTPUT PARAMETERS.

The following parameters shall be complied with:

#### 7.4.1 SYSTEM DC VOLTAGE.

7.4.1.1 The nominal voltage shall be 110 volts.

7.4.1.2 The charging battery voltage shall be 110volts to 119.25volts for the automatic mode. (2.25volts per cell).

- 7.4.1.3 The charging battery voltage shall be 110 volts to 127.2 volts for the boost mode.  
(2.35 volts to 2.40 volts per cell)
- 7.4.2 TOTAL CURRENT**
- 7.4.2.1 The output current shall be 30 ampere (current limit in the automatic mode)
- 7.4.2.2 The current shall be 5 ampere to 25 ampere in the boost mode.
- 7.4.3 LINE REGULATION**
- 7.4.3.1 The line regulation shall be a maximum of 0.75% when the input varies  $\pm 10\%$ .
- 7.4.4 RIPPLE VOLTAGE**
- 7.4.4.1 For all output current up to 100% battery charger capacity into a resistive load:  
The maximum peak to peak ripple voltage at the charger output terminals (with resistive load coupled to the output terminals instead of the battery) shall not exceed 5% of the nominal battery voltage.
- 7.4.4.2 The peak to peak ripple voltage shall be measured at nominal input voltage.
- 7.4.5 RIPPLE CURRENT**
- 7.4.5.1 The maximum peak to peak ripple (AC) voltage measured across the shunt for the total current shall not exceed 5% of the nominal battery voltage.
- 7.4.5.2 The peak to peak ripple current shall be measured at nominal input voltage.
- 7.4.5.3 The maximum superimposed r.m.s value of the AC component shall always have a positive value even if it is very small i.e. 100 milli ampere. The AC ripple shall be limited to 5% of the ampere hour rating capacity expressed in amps for example 5 ampere or less for a 100 ampere hour battery bank.
- 7.4.5.4 The battery charger shall meet the requirement that the charging current never becomes negative (discharge) in value.
- 7.4.6 DC OUTPUT CHARGE VOLTAGE**
- 7.4.6.1 The DC output voltage must remain within  $\pm 1\%$  of the respective value for boost and float modes and within 5% for initial charge mode.
- 7.4.7 FLOAT MODE**
- 7.4.7.1 The output voltage shall be pre-set at 2,25 volts per cell but adjustable by  $\pm 5\%$ . For 53 cells the float voltage shall be 119,25 volts adjustable. The values shall be within 1% in the automatic mode.
- 7.4.8 BOOST MODE**
- 7.4.8.1 The output voltage shall be pre-set at between 2,35 volts to 2,40 volt – 5% per cell, adjustable. For 53 cells the boost voltage shall be set at 124,55 volts. (2,35 volts per cell) to 127.2 volts (2.40 volts per cell). The boost voltage shall remain within 1% of the required boost voltage. In automatic operational mode the battery charger shall revert back to float charge mode when the boost charge cycle is completed.
- 7.4.9 MANUAL BOOST MODE**
- 7.4.9.1 A push button is required to switch the charger to "boost mode" manually. The battery charger shall revert back to float charge mode when the boost charge cycle is completed i.e. when the set boost voltage is reached. (124.55 volts to 127.2 volts). An additional push button shall be provided to be able to cancel the boost mode when required.  
An adjustable 0-4 hour timer shall be installed to automatically switch off the manual boost in the event of the manual boost mode not being switched off by the technical staff.  
After the boost mode has being switched off, the charger shall remain in the trickle charge mode for a period of not less 30 minutes before changing back to automatic boost mode if the battery voltage has not reached the required float voltage.

**7.4.10. AUTOMATIC BOOST CHARGE.**

7.4.10.1 The battery charger shall initiate an automatic boost charge every 28 days to ensure maximum life and reliability of the battery. The battery charger shall revert back to float charge when the battery is fully charged.

**7.4.11 CURRENT LIMITING**

7.4.11.1 Current limiting is required for the battery charger current. In float and boost modes these limits must be downward adjustable by 25% of the maximum values. The charger shall control limits within  $\pm 5\%$  of the adjustable value.

**7.5 EFFICIENCY**

7.5.1 The efficiency shall not be less than 60% for single phase chargers at maximum charger output capacity.

7.5.2 The efficiency shall not be less than 70% for three phase chargers at maximum charger output capacity.

**7.6 INPUT TRANSFORMER.**

7.6.1 The main power transformer shall incorporate an electrostatic screen between the primary and secondary windings. The screen shall be connected to the frame.

**7.7 ELECTRONIC CIRCUITRY.****7.7.1 PRINTED CIRCUIT BOARDS**

Printed circuit boards shall comply with the following requirements in accordance to SANS 1652:

7.7.1.1 They shall be made of material similar to epoxy fibreglass laminate or better.

7.7.1.2 They shall be suitably protected from the effects of moisture and dust.

7.7.1.3 They shall be marked to allow the board type, and each individual component to be readily identified.

7.7.1.4 Printed circuit boards shall be provided with rigid and positive support and shall be easily replaceable.

7.7.1.5 The plug-in-boards shall be polarised to prevent the plug-in-boards being plugged into a wrong socket or being inserted upside down.

**7.8 CONTROL AND ALARM SETTINGS.**

The battery charger shall be fitted with the following alarms and alarm relays:

7.8.1 Charger low voltage alarm between 90 volts and 105 volts adjustable. Relay to be fitted for flag operation when relay is de-energised.

7.8.2 Charger high volt alarm. (Float). This alarm is pre-set just above normal float voltage. This alarm allows boost charging while providing protection against overcharging. Relay to be fitted. (127.2 volts).

7.8.3 Charger high volt alarm. (Boost). This alarm level is pre-set just above normal boost volts. When the normal boost voltage is exceeded the boost mode shall be terminated and a high volt alarm and relay contacts shall be initiated.

7.8.4 Battery charger input voltage mains failure relay and contacts.

**7.9 ILLUMINATED INDICATORS.**

7.9.1 Only Light Emitting Diodes (LED's) are to be used.

7.9.2 The following colours for the LED's shall be used:

- Green: Normal condition. Mains on.
- Red: Fault condltion. Battery voltage low, high volts etc.
- Amber: To indicate a specific status e.g. Boost charge, Initial charge.

**7.10 METERS.****7.10.1 VOLTMETER**

7.10.1.1 The digital Voltmeter shall be able to measure between 80 volts to 150 volts. The display shall be 3.5 digits, 12 milli meters high with an accuracy of  $\pm 0.5\%$ .

7.10.1.2 The digital Voltmeter shall be connected so that it can measure both the battery voltage and the high speed circuit breaker holding coil voltage. A high quality two-way selector switch shall be employed and mounted on the face of the battery charger.

**7.10.2 AMMETER**

7.10.2.1 The digital ammeter shall be 3.5 digits, 12 milli meters high with an accuracy of  $\pm 0.5\%$ , class 0.5. The ammeter shall measure the total charger current by means shunt sensing.

7.10.2.2 The ammeter shall be connected so that it can measure total current and battery charging current. A high quality two-way selector switch shall be employed and mounted on the face of the battery charger.

7.10.2.3 The markings for both voltage and current positions shall be by means of labels, which are riveted or screwed to the face of the panel.

7.10.2.4 Both Voltmeters and ammeters shall be protected against transients and surges. Suitable protection circuitry such as metal oxide varistors and resistance capacitance circuits shall be fitted to the input leads of the meter.

**7.11 LIGHTNING AND SURGE PROTECTION**

7.11.1 The equipment shall be fitted with surge and lightning protection on the input AC supply to the charger. The supplier shall provide circuitry or protection units for this purpose. Separate external modules are acceptable for protection. The protection circuitry shall consist of a combination of resistors, capacitors, metal oxide varistors and gas arresters. Dehnventile type or equivalent protection will be preferred.

**7.12 HIGH SPEED CIRCUIT BREAKER SERIES DROPPING DIODES.**

7.12.1 A regulated supply is required for the high speed circuit breaker holding coils. Suitably rated series dropping diodes shall be employed for this purpose. Refer to clause 2.3.

7.12.2 The charger shall be supplied with a suitably rated series diode dropping chain for the high-speed circuit breakers holding coils. The series diode dropping chain shall be able to be bridged out by means of electrical contactors for regulation purposes as required.

7.12.3 The charger shall be provided with a minimum of three output terminals namely, battery positive, holding coil positive and battery negative.

**8.0 CONSTRUCTURAL REQUIREMENTS**

8.1 The battery charger shall be a self-contained unit housed in a rigidly constructed sheet metal cubicle, suitable for floor or wall mounting.

8.2 The inside and outside of the cubicle shall be powder coated in accordance with SANS 1274. The coating shall be type 4 for corrosion-resistant coatings for interior use using thermosetting type high gloss coatings. The exterior finishing colour shall be Eau-de-Nil to SANS 1091 colour No H 43 and the interior high gloss white.

- 8.3 The cubicle shall be adequately ventilated to prevent overheating of the electrical equipment and be vermin-proof. Natural cooling shall be used. The use of cooling fans is not permissible.
- 8.4 The design and arrangement of the cubicle and equipment shall provide ease of inspection and maintenance.
- 8.5 The cubicle shall be provided with an earthing terminal welded to the frame to facilitate the connection of a 95mm<sup>2</sup> earthing cable using a M12 lug.
- 8.6 Provision shall be made for suitable cable or conduit entry for the incoming AC supply and DC output supplies.
- 8.7 The wiring shall be executed in a neat and orderly fashion and shall consist of PVC insulated stranded copper conductors to ensure flexibility and mechanical strength and be suitably rated for the current carrying capacity of the circuits.
- 8.8 The wiring shall be provided with identification tags at terminals and shall be marked in accordance with the wiring diagrams.
- 8.9 The control switches, m.c.b's etc mounted on the panel shall be suitably labelled to clearly indicate their function. The lettering of the labels shall consist of white lettering on a black background.
- 8.10 The labels shall be permanently fixed with screws, rivets or other approved method.
- 9.0 INSPECTION AND TESTING.**
- 9.1 Transnet Freight Rail reserves the right to carry out inspection and any tests on the equipment at the works of the supplier/ manufacture.
- 9.2 Arrangements must be made timeously for such inspections to be carried out before delivery of the equipment to the client.
- 10.0 DRAWINGS, INSTRUCTION MANUALS AND SPARES LISTS**
- 10.1 Drawings, instruction manuals and spare parts catalogues shall be supplied in accordance with Transnet Freight Rail's specification CEE.0224.
- 10.2 The preparation of the drawings shall comply with Transnet Freight Rail's specification BBB0041
- 10.3 The tenderer shall supply three copies of instruction/maintenance manuals, schematic diagrams, diode application notes and protection and filter ratings.
- 10.4 The contractor shall submit details of spares required in accordance with specification No. CEE.0224.
- 10.5 All spares recommended for normal maintenance purposes that are not available locally (requires importation) must be highlighted.
- 11.0 SPECIAL TOOLS AND/OR SERVICING AIDS**
- 11.1 Special tools or servicing aids necessary for the efficient maintenance, repair or calibration of the equipment shall be quoted for separately.
- 11.2 Tenderers shall submit detailed offers for special tools and servicing aids including all specialised equipment required for the servicing and maintenance of the equipment supplied.
- 12.0 TRAINING**
- 12.1 The tenderer shall submit details with the tender of the training courses, which will be conducted by the contractor for the training of Transnet Freight Rail's maintenance staff in the operation and maintenance of the equipment supplied. The courses shall include theoretical as well as practical tuition. The date and venue of this training course shall be arranged with the maintenance manager.
- 13.0 GUARANTEE AND DEFECTS**
- 13.1 The contractor shall guarantee the satisfactory operation of the complete electrical installation supplied and installed by him and accept liability for maker's defects, which may appear in design, materials and workmanship.

- 13.2 The guarantee period for all substations shall expire after: -  
A period of 12 months commencing on the date of completion of the contract or the date the equipment is handed over to Transnet Freight Rail whichever is the later.
- 13.3 Any specific type of fault occurring three times within the guarantee period and which cannot be proven to be due to other faulty equipment not forming part of this contract e.g., faulty locomotive or overhead track equipment, etc., shall automatically be deemed an inherent defect. Such inherent defect shall be fully rectified to the satisfaction of the Maintenance manager and at the cost of the Contractor.
- 13.4 If urgent repairs have to be carried out by Transnet Freight Rail's staff to maintain supply during the guarantee period the contractor shall inspect such repairs to ensure that the guarantee period is not affected and should they be covered by the guarantee, reimburse Transnet Freight Rail the cost of material and labour

END

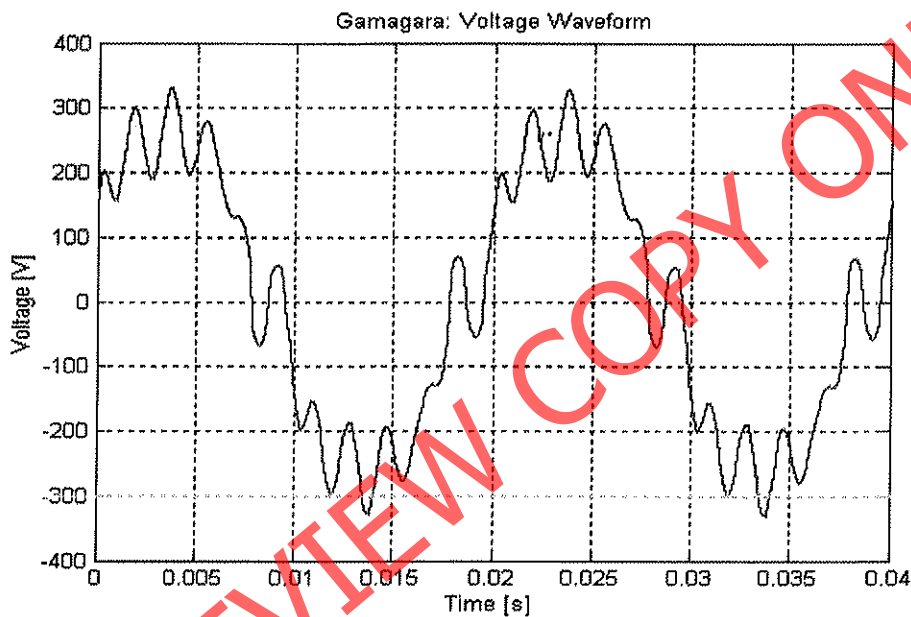
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## APPENDIX 1

**QUALITY OF SUPPLY CHARACTERISTICS OF A TYPICAL 230 VOLT AC AUXILIARY SUPPLY'S OF A 3 KV DC TRACTION SUBSTATION.****1. 230 VOLT AC AUXILIARY SUPPLY SERVICE CONDITION**

- 1.1 The auxiliary supply is derived from the tertiary windings within the traction transformer or from the secondary of the traction transformer by means of a step down transformer. Under traction load, i.e. an electric train drawing power from the substation the AC waveform is distorted due to harmonics created by the traction rectifier.
- 1.2 The Total Harmonic Distortion, which can be expected is up to 27 %.
- 1.3 A typical voltage waveform, which can be expected, is shown in figure 1 and its corresponding frequency spectrum (FFT) is shown in figure 2.



**Figure 1: Voltage waveform under traction load (traction = 3000A)**

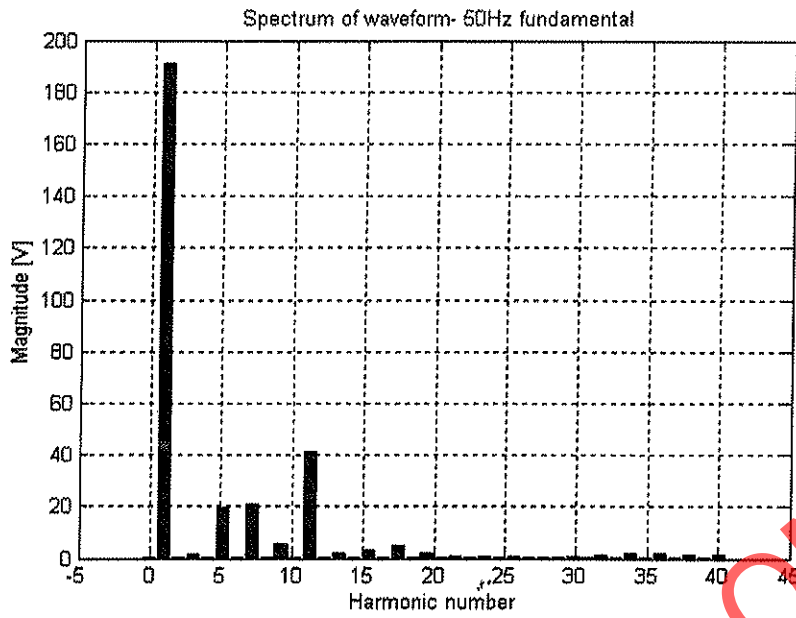


Figure 2: Frequency spectrum (FTT) of voltage waveform as shown in figure 1.

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APPENDIX 2

**TECHNICAL DATA SHEET.**  
(To be completed by client)

1.0 SUBSTATION NAME: \_\_\_\_\_

2.0 SUPPLY VOLTAGE: \_\_\_\_\_

3.0 AMPERE HOUR RATING: \_\_\_\_\_

4.0 CONSTRUCTION:

FLOOR MOUNTED: YES / NO

WALL MOUNTED: YES / NO

END

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**TECHNICAL  
RAILWAY ENGINEERING**

**SPECIFICATION CONTROL PAGE**

**3kV DC UNDER VOLTAGE RELAY MANUFACTURING  
SPECIFICATION.**

**Statement of authorisation:**

There is no SABS specification available for similar material / equipment and as far as can be ascertained no other specification/ standard suitably covers Spoornets requirements. The specification has been compiled in a manner which shall favour / encourage local manufacture of material / equipment to a maximum degree.

Author: Grade: Chief Engineering Technician. D.O. Schulz

Section: Traction Power Supply Technology

*[Signature]*

Approved: Grade: Chief Engineering Technician. J. Rothman.

Section: Traction Power Supply Technology

*[Signature]*

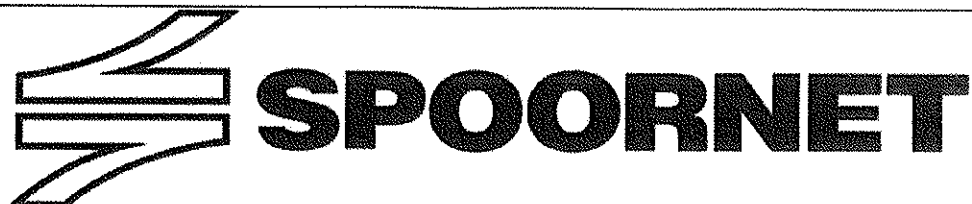
Authorised: Grade: Senior Engineer. L.O. Borchard.

Section: Traction Power Supply Technology

*[Signature]*

Date: 18<sup>TH</sup> Nov 2002

This page is for control purposes only and shall not be issued with the specification.



A division of Transnet limited

**TECHNICAL  
RAILWAY ENGINEERING**

**SPECIFICATION**

**3kV DC UNDER VOLTAGE RELAY MANUFACTURING  
SPECIFICATION.**

Circulation restricted to:

Technical: Maintenance (Infrastructure)

Technical: Maintenance

Technical: Resource Evaluation Acquisition & Review

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6.1 ENVIRONMENTAL

- 6.1.1 Altitude : 0-1800m above sea level.
- 6.1.2 Ambient temperature range : Minus 5°C to plus 50°C.
- 6.1.3 Relative humidity : 10% to 90%.
- 6.1.4 Lighting conditions : 12.0 flashes/km<sup>2</sup>/annum

6.2 ELECTRICAL SERVICE CONDITIONS

- 6.2.1 Nominal 3 kV DC busbar voltage : 3150 volts DC
- 6.2.2 Variable 3 kV DC busbar voltage : 2100V DC – 4000V DC

6.3 MECHANICAL SERVICE CONDITIONS

- 6.3.1 Vibration : Vibration can be expected as the Substations are next to the railway lines.

7.0 GENERAL REQUIREMENTS

- 7.1 Equipment supplied shall be in terms of this specification. Deviations from this specification will not be allowed without written consent of Spoornet's Traction Power Supply Technology staff.
- 7.2 Spoornet reserves the right to subject equipment offered to test or inspection to check compliance with clauses of this specification.
- 7.3 The onus to prove compliance with the manufacturing specification shall rest with the successful tenderer once the manufacturing contract has been awarded.
- 7.4 The successful tenderer will be responsible for all costs caused by modifying or replacing equipment accepted by Spoornet on the grounds of his statement of compliance and found by Spoornet not to comply.

8.0 TECHNICAL AND MANUFACTURING REQUIREMENTS

8.1 DESCRIPTION OF THE UNDERVOLTAGE RELAY

- 8.1.1 The main components of the 3kV DC undervoltage relay are as follows:

- 3kV Voltage divider.
- Optic fibre transmitter.
- Optic fibre receiver.
- Control circuit.

8.2 3kV VOLTAGE DIVIDER

- 8.2.1 The voltage divider shall consist of 9x22 kΩ, 50 watt and 3x8,2 kΩ, 50 watt aluminium housed resistors in series as shown in circuit diagram BBB 2932.
- 8.2.2 A 3 ampere 3.3 kV, minimum 5kA rated fuse shall be provided and connected on the 3 kV positive input side in series with the resistors as shown in circuit diagram BBB 2932.
- 8.2.3 The resistors shall be arranged on a celleron plate, which shall be fitted with stand off insulators for mounting on the wall in the busbar chamber. These insulators must provide a minimum allowable clearance of 100mm for 3kV potential.

**1.0 SCOPE**

This specification provides Spoornet's requirements for the manufacturing of the 3 kV DC Under Voltage Relay utilising optic fibre.

**2.0 BACKGROUND**

The 3kV DC under voltage relays are installed at Spoornet's 3kV DC traction substations and tie-stations. The purpose of the relay is to clear faults which occur whilst the feeding network is crippled. The relay is set to operate at the highest voltage (i.e. smallest volt drop) that can occur under crippling conditions with a fault in the section.

The under voltage relay trips the 3kV DC track breakers when the 3kV DC busbar voltage drops below the set value

This optic fibre relay is an alternative to the existing switching under voltage relay and other models of relays fitted in the 3 kV DC traction substations throughout Spoornet.

Spare parts for the switching under voltage relays and other models are difficult to obtain and are costly. The optic fibre under voltage relay is constructed from components, which can be locally sourced.

**3.0 STANDARDS AND PUBLICATIONS**

Unless otherwise specified all materials and equipment shall comply with the current edition of the relevant SABS or Spoornet publication where applicable.

**3.1 SOUTH AFRICAN BUREAU OF STANDARDS**

SABS 1091 : National Colour Standards for Paint

SABS 1274 : Coatings applied by Powder Coating Process

**3.2 SPOORNET DRAWINGS**

CEE- TBD-7 : Earthing arrangement for 3 kV DC traction substation.

**4.0 APPENDICES**

The following appendixes form an integral part of this specification,

Appendix 1: Circuit and manufacturing drawings

**5.0 TENDERING PROCEDURE**

6.1 Tenderers shall indicate clause by clause compliance with the specifications. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance. This document can be used by tenderers to elaborate on their response to a clause.

6.2 A statement of non-compliance shall be motivated by the tenderer.

6.3 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.

**6.0 SERVICE CONDITIONS**

The equipment shall be designed and rated for operation under the following service conditions.

- 8.2.4 If encapsulated voltage dividers are offered the successful tenderer shall supply Spoornet Electrical samples for inspection and acceptance.
- 8.2.5 The encapsulated voltage divider shall consist of the same amount of resistors and the ohmic values as the above divider.
- 8.2.6 Carbon resistors are not acceptable, as they are extremely temperature sensitive. Only high quality resistors such as metal oxide or vitreous enamel resistors may be used for the encapsulated voltage divider.
- 8.2.7 Suitable studs minimum 6mm shall be provided for the positive connection from the potential divider to the undervoltage relay and 10mm stud for the negative return circuit.

### 8.3 OPTIC FIBRE TRANSMITTER

- 8.3.1 The circuitry components for the optic fibre transmitter shall be in accordance with circuit diagram, drawing No BBB 2930 and printed circuit board layout, drawing No BBB 2935. These shall be housed in a high impact plastic /fibre box which is mounted on the 3kV voltage divider board.
- 8.3.2 The reference voltage of 0 to 400 volts is obtained from the voltage divider and is the operating voltage for the fibre optic transmitter unit.
- 8.3.3 The required reference voltages are obtained and generated from an integrated circuit, IC1 and a 24V Zener diode.
- 8.3.1 Voltage comparison is carried out by IC2 (LM 741). Pick up and drop out voltages are adjusted with potentiometers P2 and P3, which are multi turn top adjustable potentiometers.
- 8.3.2 The transmitter is mounted on a high quality fibreglass printed circuit and is populated by resistors (tolerance 2%) and capacitors.
- 8.3.3 The circuitry is protected by Metal Oxide Varistors (MOV'S).
- 8.3.4 The output of the optic fibre transmitter is connected to the optic fibre receiver.

### 8.4 OPTIC FIBER RECEIVER

- 8.4.1 The optic fibre receiver and control circuits shall be mounted in a metal enclosure with a hinged door to enable ease of maintenance.
- 8.4.2 The optic fibre printed board shall be manufacture according to circuit diagram BBB2929 and circuit board layout BBB2934.
- 8.4.3 The optic fibre isolation level for the transmitter and receiver shall not be less than 7 kV.
- 8.4.4 The operating voltage for the receiver is a 110 V DC voltage obtained from a voltage divider R1 and R2. Activating the optic fibre receiver results in the energising of a relay by means of a transistor on the fibre optic receiver printed circuit board.

### 8.5 CONTROL CIRCUIT

- 8.5.1 The control circuitry shall be mounted in same metal enclosure as the optic fibre receiver and shall consist of the components shown in drawing BBB2931.
- 8.5.2 The front door of the metal enclosure shall be fitted with a lamp which indicates that a trip has occurred as well as electrically actuates the trip counter which counts the number of trips.

- 8.5.3 The operating voltage for the control circuit is 110 V DC.
- 8.5.4 The input control signals as well as the output control signals shall be routed to a clearly marked terminal strip.
- 8.5.5 The internal wiring of the control circuit shall be wired with 1.0 mm<sup>2</sup> stranded copper wire.
- 8.5.6 The 110 V DC shall be protected by a 180 V MOV and a 4 ampere fuse.
- 8.5.7 If the line voltage is above the pick up voltage the optic fibre transmitter activates and the optic fibre receiver enables the switching transistor to energise relay 1 (R1) this retains the circuit breaker holding coil when timed contacts open.
- 8.5.8 If the line voltage drops below the drop out voltage the fibre optic transmission stops and relay 1 is de-energised.

The metal enclosure shall be power coated in accordance with SABS 1274 and the colour of the enclosure shall be light orange to SABS 1091 colour No. B26.

- 8.5.9 Provision shall be made for cable entry at the bottom of the metal enclosure.
- 8.5.10 A suitable earthing terminal for a 95mm<sup>2</sup> earth conductor shall be provide on the metal enclosure.

## 8.6 MODIFICATIONS AND IMPROVEMENTS

- 8.6.1 If the successful tenderer wishes to submit recommendations for modifications or improvements he shall first contact members of Spornet Engineering staff who will approve or reject them.
- 8.6.2 No additions, alterations or modifications shall be acceptable unless Spornet Traction Power Supply Technology staff is in agreement.

## 8.7 TEST METHOD

For testing of the operation of the undervoltage relay a variable 0 to 400V DC supply is required.

Inject 140V DC on the input side of the Optic Fibre transmitter and set the Trimpot P1 until a output voltage of 10V (reference voltage) is obtained at pin N06 on the output side of the reference IC1. Connect a temporary Optic Fibre cable between Optic Fibre transmitter and the receiver.

Supply the under voltage relay with 110VDC at terminals 1 (positive) and 2 (negative) and inject 250V to the transmitter. Adjust the Trimpot P2 until the undervoltage relay picks up. Reduce the voltage to the transmitter to 240V and adjust The Trimpot P2 until the relay drops out.

To set the pick up time, connected a positive 110V DC supply to terminal 7 of the fleeting timer relay and adjust until the require time setting is obtained.

END



APPENDIX 1

CIRCUIT AND MANUFACTURING DRAWINGS

DRAWING No	TITLE
BBB2929	Optic Fibre Receiver Circuit Diagram.
BBB2930	Optic Fibre Transmitter Circuit Diagram.
BBB2931	3kV Undervoltage Relay Circuit Diagram.
BBB2932	Voltage Divider Circuit Diagram.
BBB2934	Optic Fibre Receiver PC Board and component Layout.
BBB2935	Optic Fibre Transmitter PC Board and component Layout.
BBB2942	General arrangement of High Tension Divider Board.

END

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**ENGINEERING AND TECHNOLOGY  
TECHNOLOGY MANAGEMENT**

**SPECIFICATION**

**REQUIREMENTS FOR THE SUPPLY OF ELECTRIC  
CABLES**

(Appendix to be filled in by client)

Authors: Engineering Technician (level 1) B.L. Ngobeni  
Section: Technology  
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Approved: Engineering Technician (level 3) D.O. Schulz  
Section: Technology  
Management

Authorised: Senior Engineer L.O. Borchard  
Section: Technology  
Management

Date: 5 September 2005

Circulation restricted to:

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## 1.0 SCOPE

This specification covers Spoornet's requirements for cables used for:

- Medium voltage reticulation systems, distribution systems, traction substation supplies, and 3 kV DC feeder applications (3,3/3,3 kV to 19/33 kV).
- Cables used for fixed installations (300/500 V to 1900/3300 V).

## 2.0 STANDARDS

The following publications (latest version) are referred to herein.

### 2.1 SOUTH AFRICAN NATIONAL STANDARDS

- SANS 97 : Electric cables - Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3 kV to 19/33 kV (excluding pressure assisted cables).
- SANS 1339 : Electric cables – Cross-linked polyethylene (XLPE) insulated cables for rated voltages 3,8/6,6 kV to 19/33 kV.
- SANS 1507 : Electric cables with extruded solid dielectric insulation for fixed installations 300/500 V to 1900/3300 V,  
Part 1-General,  
Part 3-PVC Distribution cables,  
Part 4-XLPE distribution cables,  
Part 5-Halogen free distribution cables.

## 3.0 APPENDIX

The following appendix forms an integral part of this specification.

- 3.1 Appendix 1 : Schedule of Requirements: Details of the cable to be supplied.

## 4.0 TENDERING PROCEDURE

- 4.1 Tenderers shall indicate clause-by-clause compliance with the specification. They shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.
- 4.2 The tenderers shall motivate a statement of non-compliance.
- 4.3 The tenderer shall submit technical specifications of the cables offered.
- 4.4 Failure to comply with clauses 4.1, 4.2 and 4.3 could preclude a tender from consideration.

## 5.0 MEDIUM VOLTAGE CABLES

### 5.1 IMPREGNATED PAPER INSULATED.

- 5.1.1 Paper impregnated lead sheathed (PILC) cables used for reticulation systems and traction power supplies and other applications shall be in accordance with SANS 97.
- 5.1.2 The voltage range for the cables shall be between 3,3kV and 33kV.
- 5.1.3 The cables shall be three core with stranded copper conductors.
- 5.1.4 The cables shall be paper insulated, screened type, lead sheathed provided with an extruded PVC bedding.

- 5.1.5 The armouring shall be galvanised steel wire with outer extruded PVC over sheath over the armouring.
- 5.1.6 The cable shall be so manufactured that it is fully protected against the effect of electrolysis.
- 5.1.7 Single core cables used for 3 kV DC application shall withstand a test voltage of 10,5 kV for one minute.
- 5.1.8 Cables shall be suitable for laying directly in soil and concrete trenches.
- 5.1.9 The cables shall withstand exposure to water, corrosive conditions as well as high ultra violet conditions caused by direct sunlight.
- 5.1.10 The cables shall be tested in accordance with SANS 97. Type test certificates shall be submitted with the cables offered.
- 5.1.11 The packing, marking and sealing of cables and cable drums shall be in accordance with SANS 97.
- 5.2 CROSS – LINKED POLYETHYLENE INSULATED (XLPE).**
- 5.2.1 XLPE cables used for reticulation systems, 3kV DC traction feeders and traction power supplies and other applications shall be in accordance with SANS 1339.
- 5.2.2 The voltage range for the cables shall be between 3,8kV and 33kV.
- 5.2.3 Cables shall be single or three core with stranded copper conductors.
- 5.2.4 The cables shall be type A (armoured) for single and three core cables.
- 5.2.5 Single core type A cable shall be copper tape screened, aluminium wire armoured and provided with a PVC outer sheath.
- 5.2.6 Single core cables shall be rated for 3,8/6,6kV.
- 5.2.7 Single core cables used for 3 kV DC application shall withstand a test voltage of 10,5 kV for one minute.
- 5.2.8 Three core type A cable shall be copper tape screened, galvanised steel wire armoured and provided with a PVC outer sheath.
- 5.2.9 The manufacture of the single and three core cables shall be such that the cables are fully protected against the effect electrolysis.
- 5.2.10 The cables shall be suitable for laying directly in soil and concrete trenches.
- 5.2.11 The cables shall withstand exposure to water, corrosive conditions as well as high ultra violet conditions caused by direct sunlight.
- 5.1.12 The cables shall be tested in accordance with SANS 1339. Type test certificates shall be submitted with the cables offered.
- 5.2.12 Where specified flame-retardant and halogen free cables shall be in accordance with SANS 1339.
- 5.2.13 The packing, marking and sealing of cables and cable drums shall be in accordance with SANS 1339.
- 6.0 CABLES FOR FIXED INSTALLATIONS**
- 6.1 Unless otherwise specified single and multi-core, wire armoured, extruded PVC insulated cables shall be used for fixed installations. The cables shall be in accordance with SANS 1507 part 1 and part 3.
- 6.2 The voltage range is between 300/500 V to 1900/3300 V.
- 6.3 Cables shall have stranded annealed copper conductors.

- 6.4 The cables shall be marked according to SANS 1507 part 3. Core identification shall be by means of colour code or numbering of the insulation.
- 6.5 The cable shall be so manufactured that it is fully protected against the effect of electrolysis.
- 6.6 Where XLPE or halogen free cables are specified the cables shall be in accordance with SANS 1507 parts 4 and 5.
- 6.7 The cables shall be tested in accordance with SANS 1507 parts 3, 4 and 5. Type test certificates shall be submitted with the cables offered.
- 6.8 The packing, marking and sealing of cables and cable drums shall be in accordance with SANS 1507.

**7.0 QUALITY ASSURANCE**

- 7.1 Spoornet reserves the right to carry out inspection and tests on the equipment at the works of the supplier/manufacturer.
- 7.2 Arrangements must be made timeously for such inspections and type/routine tests in accordance with the cable specifications are carried out before delivery of the cables to the site.

**8.0 INSPECTION AND TESTING**

- 8.1 Spoornet reserves the right to carry out inspections and any tests on cables at the factory of the supplier/ manufacture.
- 8.2 Arrangements must be made with The Senior Engineer, Technology Management Spoornet for inspections to be carried out before delivery of the equipment.

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**SCHEDULE OF REQUIREMENTS**

(To be completed by the client)

**1.0 MEDIUM VOLTAGE CABLES**

**1.1 PAPER IMPREGNATED LEAD SHEATHED (PILC)**

1.1.1 Rated Voltage (V): .....

1.1.2 Number of cores: .....

1.1.3 Length of cables (m): .....

1.1.4 Size of conductors (mm<sup>2</sup>): .....

**1.2 CROSS LINKED POLYETHYLENE INSULATED (XLPE)**

(XLPE is recommended for 3 kV DC Applications)

1.2.2 Rated Voltage (V): .....

1.2.3 Number of cores: .....

1.2.4 Length of cables (m): .....

1.2.5 Size of conductors (mm<sup>2</sup>): .....

1.2.6 Flame retardant (required/not required): .....

**2.1 CABLES FOR FIXED INSTALLATIONS**

2.1.1 Type of cable required:

- PVC Distribution cables: (Yes/ No): .....
- XLPE Distribution cables: (Yes/No): .....

2.1.2 Rated Voltage (V): .....

2.1.3 Number of cores: .....

2.1.4 Length of cables (m): .....

2.1.5 Size of conductors (mm<sup>2</sup>): .....

END



**TRANSNET**  
freight rail

A Division of Transnet SOC Limited

## TECHNOLOGY MANAGEMENT

### SPECIFICATION

## 3kV RECTIFIER FOR TRACTION SUBSTATIONS

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Date: 02<sup>nd</sup> March 2012

Circulation Restricted To:

Transnet Freight Rail – Chief Engineer Infrastructure  
– Technology Management

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**1.0 SCOPE**

- 1.1 This specification covers Transnet Freight Rail's requirements for the design, manufacture, supply and installation of 3 kV Direct Current (DC) rectifier units for DC traction substations.

**2.0 STANDARDS AND PUBLICATIONS**

- 2.1 Unless otherwise specified all materials and equipment supplied shall comply with the current edition of the relevant SANS, IEC or Transnet Freight Rail's publication where applicable.

- 2.2 The following publications are referred to in this specification:

**2.2.1 INTERNATIONAL ELECTROTECHNICAL COMMISSION**

IEC 60051: Direct acting indicating analogue electrical-measuring Instruments and their accessories

IEC 60146-2: Semiconductor converters - Part 2: Self commutated semiconductor converters including direct dc converters.

**2.2.2 SOUTH AFRICAN NATIONAL STANDARDS**

SANS 1019: Standard voltages, currents and insulating levels for electrical supply

**2.2.3 TRANSNET FREIGHT RAIL**

CEE.0224. Drawings, catalogues, instruction book and spares lists for electrical equipment supplied under contract.

BBB 2721 AC Primary Circuit Breaker Control Panel and AC/DC Distribution Panel for 3kV Traction Substations.

BBB 5452 Transnet Freight Rail's Requirements for the Installation of Electrical Equipment for 3kV DC Traction Substations.

Transnet Freight Rail Electrical Safety Instructions.

- 2.3 Any items offered in accordance with other standards will be considered at the sole discretion of Transnet Freight Rail. The tenderer shall supply full details stating where the item differs from these specifications as well as supplying a copy (in English) of the recognised standard specification(s) with which it complies.

**3.0 TENDERING PROCEDURE**

- 3.1 Tenderers shall indicate clause by clause compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance. This document can be used by tenderers to elaborate on their response to a clause.

- 3.2 A statement of non-compliance shall be motivated by the tenderer.

- 3.3 Tenderer shall submit for each type of rectifier a filled in form as per Appendix 1.

- 3.4 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.

- 3.5 Failure to comply with clauses 3.1, 3.2, 3.3 and 3.4 could preclude a tender from consideration.

**4.0 SERVICE CONDITIONS****4.1 ATMOSPHERIC CONDITIONS**

The equipment shall be designed and rated for installation and continuous operation under the following conditions:

Altitude: 0 to 1800m above sea level.

Ambient temperature:	-10°C to +55 °C.
Relative humidity:	10% to 90%
Lightning Conditions:	12 ground flashes per square kilometre per annum.
Pollution:	Heavily salt laden or polluted with smoke from industrial sources.

## 4.2 MECHANICAL SERVICE CONDITIONS.

4.2.1 The rectifiers are installed in substations next to or within close proximity of railway tracks and will be subjected to vibration from the trains.

## 4.3 ELECTRICAL SERVICE CONDITIONS.

### 4.3.1 INPUT VOLTAGE

4.3.1.1 The rectifier AC input voltages for six-pulse configuration is in the order of 2450V AC per phase. For 12-pulse configuration the AC input voltages can be in the order of 1150V to 1375V phase to phase.

4.3.1.2 The rectifier receives its supply from a 3.3 MVA or 5 MVA rectifier transformers (and 6 MVA where transformers are replaced).

### 4.3.2 OUTPUT VOLTAGE.

4.3.2.1 The nominal busbar output voltage rating of the system is 3150 Volts but can vary between 2500 V DC and 3900V DC.

## 5.0 DESIGN OF EQUIPMENT

5.1 The rectifier unit and its associated control equipment should be built up to form an independent unit.

5.2 The rectifier design shall be suitable for operation for existing or new traction substations, the details of which shall accompany this specification.

5.3 For multiple unit substations it shall be possible for each unit to operate completely independently of each other.

5.4 For single transformer, multi-group arrangements, it shall be possible to isolate and switch off one group without affecting the other group.

5.5 Six or twelve pulse operation is used depending on the configuration of the transformers.

5.6 This specification includes all the required control and protection circuits which shall be installed and wired to existing substation control panels by the supplier.

5.7 The control circuitry for tripping and indication purposes shall operate at 110 volt DC.

## 5.8 RATINGS

5.8.1 The DC output of the equipment shall be rated at 3.3 MW, 4.5 MW, 5 MW or 6 MW full load continuously with overload ratings related to full load as follows:

- 2 x full load for 30 minutes
- 3 x full load for 1 minute
- 3.5 x full load for 10 seconds.
- 4.25 x full load instantaneous tripping.

5.8.2 The equipment shall withstand a short circuit for 200 milli-seconds.

5.8.3 The ratings of the rectifier with its configuration shall be displayed on a silkscreen label fixed on the rectifier unit.

5.9 The rectifiers and associated equipment shall be designed to minimise any tendency to resonate or to produce high voltage surges when operating in conjunction with DC smoothing equipment.

5.10 Lightning, transients, surges and tripping are present in the substation environment.

## 6.0 INSULATION LEVELS

6.1 Insulation levels for high voltage equipment shall be in accordance with the recommendations of SANS 1019.

6.2 The nominal 1.5kV and 3kV insulation to earth shall be so designed that the complete rectifier assembly shall be able to withstand a test voltage of 10.5kV 50Hz AC for one minute.

6.3 Where PVC trunking is used for the routing of cables it shall be so installed that there can be no danger of a flash over or tracking occurring between the trunking and high voltage circuitry.

## 7.0 CLEARANCES AND CREEPAGE DISTANCES

7.1 The following minimum safety clearances shall be maintained:

For the nominal DC system voltage, the minimum indoor clearance shall not be less than 150mm from any conductor or metal normally live and ground level.

7.2 Ribbed insulators and standoff bushings shall be used for 3kV DC and shall have a creepage distance of not less than 150mm.

## 8.0 RECTIFIER UNIT

### 8.1 RECTIFIER DESIGN REQUIREMENTS.

8.1.1 The silicon rectifier diode assemblies shall comply with SANS 60146-2.

8.1.2 The rectifier unit shall comprise silicon semiconductor diodes and be of the hockey puck capsule type.

8.1.3 All materials used shall be flame retardant.

8.1.4 To prevent flashovers no insulation material shall be used between rectifier branches. The minimum clearance of 150mm is required between diode modules as well as between diode modules and any earthed metal.

8.1.5 The minimum distance between the incoming supply phases to the rectifier shall not be less than 150mm

8.1.6 It is required that the equipment offered be designed to remain in service in the event of any individual diode in a branch becoming defective.

8.1.7 The rated repetitive peak reverse voltage of a series connected branch of diodes shall be such that should a diode in that branch become defective, the rated repetitive peak reverse voltage of the remaining diodes will be at least twice the value of the applied reverse voltage. The peak inverse voltage shall be not less than 4000V DC or higher for a 24 diode bank.

8.1.8 The creepage distance across the resistor capacitor (RC) circuit components shall be commensurate with the creepage distance across the diode insulation.

8.1.9 Tenderers shall provide a full description of the over voltage and surge protection circuits offered illustrating how this circuit has been designed.

8.1.10 Each rectifier unit shall be provided with a DC voltmeter, range 0-4 000 volts and a DC ammeter range 0-4000 amperes. These shall be mounted on the front of the rectifier unit.

8.1.11 The DC voltmeter shall be connected to the more negative side of the voltage divider.

8.1.12 For the DC ammeter a 4000 ampere 50 mV shunt shall be fitted on the negative busbar of the rectifier.

- 8.1.13 The DC voltmeter and ammeter shall be class 1.5 or better. The dimensions of the analogue face of the meters fitted on the rectifier unit shall not be less than 144mm x 144mm with a 90 degree display.
- 8.1.14 A high voltage fuse and potential divider shall be provided for the voltmeter.
- 8.1.14.1 The potential divider shall of the encapsulated type or consist of not less than ten separate vitreous enamel resistance elements connected in series. These shall be spaced to provide a clearance distance of not less than 150 mm to any earthed metal.
- 8.1.15 The DC output of the rectifier unit shall be protected from external voltage transients by means of fused resistance capacitance parallel metal oxide varistor circuitry. The fuse shall be fitted with a trip contact, which can be utilised for indication and control.
- 8.2 DIODES**
- 8.2.1 For 3.3 MW and 4.5 MW rectifiers the Westcode type W2899MC480 and INFINEON (EUPEC) D1809 N40 or N46 diodes (exact equivalent or approved types) shall be used.
- 8.2.2 For 5 MW and 6 MW rectifiers the Semikron 2P 3000/68 diodes (exact equivalent or approved types) shall be used.
- 8.2.3 Proof of origin of the diodes and certified test certificates shall be supplied with the diodes.
- 8.2.4 The forward voltage drop of the diodes shall be within  $\pm 5\%$  variations.
- 8.2.5 Tenderers shall submit fully detailed data sheets of the type of diode offered.
- 8.2.6 Each individual diode shall form an integrated module with its heatsink, snubber circuit and parallel voltage- equalising resistor circuit. The module shall contain no connection wires or lugs. All connections shall be made directly through the mounting of the snubber printed circuit board busbar terminations. The design of the module shall enable it to be removed within 10 minutes, without disturbing any other modules.
- 8.2.7 The pre-load pressure exerted by the fixing clamps or other methods must be easily checked. Fixed indicating torque washers or other methods of obtaining the correct pre-load pressure using torque wrench spanners must be used for assembly of the diode module.
- 8.2.8 The rectifier design shall be such that only the diode module securing bolts need to be removed for replacement of a module. No busbars or other parts shall obstruct the removal of the diode module.
- 8.2.9 For identification of the diode polarity, the rectifier symbol shall be clearly marked on the heatsink module and on the diode.
- 8.2.10 Tenderers shall indicate the recommended intervals between the testing of diodes and their RC snubber components so as to establish their soundness.
- 8.2.11 Where 3kV DC rectifiers are installed within a distance of 15km from the coast, the profile of the heat sinks shall be tapered by machining, to allow for easy access to remove any salt spray condensation formed on the diode.
- 8.3 SNUBBER (RC) AND VOLTAGE EQUALISING CIRCUITRY.**
- 8.3.1 The capacitors and resistors employed in the snubber RC circuits shall be of the highest quality and shall be suitably rated for high voltage applications encountered. Vitreous enamel wire wound resistors or similar shall be used and high voltage suitable capacitors shall be used.
- 8.3.2 If standoff posts are used to support sensing circuits they shall be securely fixed to the main diode module by means of lock washers and nuts to ensure that no sparking occurs due to poor contact.
- 8.4 DIODE MONITORING EQUIPMENT**
- 8.4.1 DIODE SENSOR TRANSMITTER MONITORING MODULE**
- 8.4.1.1 Sensing circuitry shall be incorporated to monitor each individual diode for open or short circuit conditions.

- 8.4.1.2 Specific attention shall be given to the protection of the diode monitoring circuit boards in the event of the diode going open circuit and destroying the monitoring modules.
- 8.4.1.3 Protection circuitry shall be provided for each sensor module.
- 8.4.1.4 The sensor module shall be powered from the snubber RC circuit of the diode and shall be designed so as not to change the characteristics of the RC circuit across which it is connected.
- 8.4.1.5 The snubber RC circuitry, and the diode sensing circuitry, shall be removable as a unit with the diode module when the diode module is removed for replacement or repair.
- 8.4.1.6 The components used to manufacture the diode sensor transmitter module shall be of the highest quality.
- 8.4.1.7 If resistors are employed they shall be vitreous enamel insulated or similar and shall withstand at least 700 volts across them.
- 8.4.1.8 The diode sensing circuit board shall be removable from the diode module as an individual circuit board for repair or replacement.
- 8.4.1.9 The diode sensing circuit board shall be so constructed that it will be protected against reverse polarity on installation after repair or replacement.
- 8.4.1.9.1 The output signal from the diode sensor transmitter board shall be fibre optic transmitted. Wire conductors are not acceptable.
- 8.4.1.9.2 Diode monitoring systems utilising Programmable Logic Controllers (PLC) is not acceptable.
- 8.4.2 RECTIFIER DIODE MONITORING PANEL AND DISPLAY.**
- 8.4.2.1 The rectifier unit shall be fitted with a diode monitoring panel for monitoring the condition of each diode.
- 8.4.2.2 Each diode shall be clearly numbered on the front display cover of the diode monitoring panel as well as on the diode module. The markings shall be silk screened engraved or similar.
- 8.4.2.3 The panel shall be fitted with Light Emitting Diodes (LED's) to indicate the condition of the diodes. The LED's shall be green for a healthy diode and red for an open circuit or short circuit diode.
- 8.4.2.4 A remote reset switch or button to reset the LED's and the diode monitoring panel shall be fitted in the primary circuit breaker control panel.
- 8.4.3 ELECTRONICS**
- 8.4.3.1 All printed circuit boards shall be constructed from high quality fibreglass material.
- 8.4.3.2 All printed circuit boards shall slide in high quality edge connectors and shall be easily removed for replacement or repairs.
- 8.4.3.3 All printed circuit boards with its components shall be coated for protection against moisture, corrosion and dust.
- 8.4.3.4 Each printed circuit board shall be polarised to prevent the card from being plugged into the wrong socket and to prevent the card from being inserted upside down.
- 8.4.3.5 The control unit shall be built into a rack mounted unit or similar and shall be able to be removed or installed as a unit.
- 8.4.3.6 The control unit shall be designed to fail to safe in the event of power supply failure or printed circuit board failure. Contacts shall be provided which can be utilised for lockout signals.
- 8.4.4 POWER SUPPLY SYSTEM.**
- 8.4.4.1 The power supply shall be of the switch mode design and shall be able to operate within the range of the voltages available in the substation.



- 8.4.4.2 The power supply as well as the remainder of the unit shall be extensively protected from lightning, transients and surges. Extensive use of gas arresters, inductors and capacitors will be required.
- 8.4.5 FIBRE OPTIC MONITORING BOARD.**
- 8.4.5.1 The annunciator shall be fitted with fibre optic receivers for signals transmitted from the diode sensor transmitter module.
- 8.4.6 INTERFACE INPUT-OUTPUT PRINTED CIRCUIT-BOARD**
- 8.4.6.1 The diode monitoring main board shall be able to communicate the condition of the diodes by means of relay contacts.
- 8.4.6.1.1 Provision shall be made for one diode failure to lockout the substation with a remote flag indication and give a signal to the telecontrol system.
- 8.4.6.2 The relays shall function in the fail safe mode, i.e. the relays will be energised and will de-energise under faulty conditions.
- 8.5 COOLING**
- 8.5.1 The rectifier unit shall be fitted cooling fans with temperature sensors for the control of the cooling fan, temperature monitoring and rectifier over-temperature protection.
- 8.5.2 The direct heat sink temperature sensing method shall be used with multiple sensors connected in series.
- 8.5.3 Two thermal control switches shall be fitted to the rectifier for the energising of the cooling fans at a temperature of 50°C. Provision shall be made to prevent the fan from cycling at the energising temperature.
- 8.5.3.1 Suitable fan control circuitry shall be provided by the supplier.
- 8.5.4 The rectifier unit shall be provided with two over temperature sensing switches which shall be set at 80°C.
- 8.5.5 The rectifier over temperature protection shall be used for tripping purposes. The circuitry shall be provided by the supplier.
- 8.5.6 The wiring from the sensors to the fan controller should be of the plastic fibre optic type and the sensors should obtain their supply from the RC circuit.
- 8.5.7 Fan airflow failure circuitry (vane switches) and relays shall be provided for control and indication purposes. A fan test switch which is spring loaded to the off position shall be provided and installed in the primary circuit breaker control panel.
- 8.5.8 Adequate measures shall be taken to ensure that the rectifier equipment does not overheat during periods of high loading. Details of the over temperature protective scheme shall be submitted with the tender.
- 8.5.9 Provision shall be made for adjustable current sensing to control the operation of the cooling fan(s). The fan(s) shall be energised when the main current reaches a value of 700 amps (adjustable.) The current sensing circuitry shall be sufficiently isolated and shall be installed in the primary circuit breaker control panel.
- 9.0 INSTALLATION.**
- 9.1 The contractor shall be responsible for the transport to site, off-loading, handling, storage and security of all material required for the installation of the rectifier unit.
- 9.2 The rectifier shall be installed within the substation building and shall be totally insulated from the floor by means of channel insulation or other high voltage insulating material.

## 10.0 EARTHING

- 10.1 The metal framework of the rectifier shall be connected to the existing DC earth leakage earthing system in accordance to drawing No. CEE-TBD-7. Should the existing earth strap not be suitable for re-use a new copper earth strap of least cross-section area or a stranded insulated copper conductor with a cross-sectional area of at least 95mm<sup>2</sup> shall be used.

## 11.0 CABLES

- 11.1 Armoured cables shall be used for the wiring of the cooling fans and any other external power circuitry.
- 11.2 All cables shall terminate in compression type glands. These glands shall be fitted with neoprene shrouds.
- 11.3 Screened cables and conductors shall be used for electronic screening and noise reduction techniques where required.
- 11.4 The fibre optic cables between the rectifier and the annunciator panel shall be protected from damage by means of conduit or trunking or other suitable means. Open fibre optic cables are not acceptable.
- 11.5 All cabling shall be clearly marked with high quality permanent markers. Sticker marking numbers will not be acceptable.

## 12.0 INTERCONNECTION OF EQUIPMENT

- 12.1 Suitably rated copper busbars shall be used for the interconnection of the rectifier to the secondary winding of the traction transformer. The busbars between separately mounted equipment shall incorporate a degree of flexibility to avoid any over stressing of these connections due to movement caused by conductor expansion/contraction and to facilitate alignment of equipment.
- 12.2 High conductive silicon grease shall be liberally applied to all connections.
- 12.3 All dissimilar metal connections copper to aluminium (Cu to Al) shall be made using bi-metallic clamps that are specifically designed and manufactured to make that particular connection (ad hoc fabricated clamps are not acceptable).
- 12.4 All copper connections to steel (galvanised) shall be tinned or silver coated.

## 13.0 INSPECTION, SITE TESTS AND COMMISSIONING.

- 13.1 Transnet Freight Rail reserves the right to carry out inspection and any tests on the equipment at the works of the supplier/ manufacture.
- 13.2 Arrangements must be made timeously for such inspections to be carried out before delivery of the equipment to the client.
- 13.3 The contractor shall be responsible for carrying out on-site functional tests before the commissioning of the rectifier unit.
- 13.4 The testing of the rectifier shall include type tests for new design of rectifier units and routine tests which shall be conducted on all units.
- 13.4.1 The testing shall include the following: -
- Insulation tests.
  - Light load tests.
  - Functional tests on the associated control equipment and circuitry of the rectifier.
  - Temperature rise tests i.e. temperature measurements on diode heatsinks. Maximum temperature rise shall not exceed 75° C.
  - Checking of auxiliary and protective devices and control equipment.



- Rated output tests.
  - Overcurrent capability test.
  - Measurement of output voltage
  - Power loss determination
- 13.4.2 Functional Acceptance by the Maintenance Manager of satisfactory completion of on-site tests in no way relieves the contractor of his obligation to rectify defects which may have been overlooked or become evident at a later stage.
- 13.5 Commissioning will only take place after all defects have been rectified to the satisfaction of the Maintenance Manager.
- 13.6 Commissioning will include the energising of equipment from the primary isolator to the track feeder circuits. The contractor must prove the satisfactory operation of equipment under live conditions.
- 13.7 On completion of commissioning the contractor will hand the equipment over to the Maintenance Manager in terms of the relevant engineering instructions.
- 14.0 DRAWINGS, INSTRUCTION MANUALS AND SPARES LISTS**
- 14.1 Drawings, instruction manuals and spare parts catalogues shall be supplied in accordance with Transnet Freight Rail's specification CEE.0224
- 14.2 All drawings (paper prints) shall be submitted to the technical officer for approval. No Construction or manufacturing activity will be allowed prior to the associated drawings having been approved by the technical officer.
- 14.3 The tenderer shall supply three copies of an instruction/maintenance manuals, schematic diagrams, diode application notes and protection and filter ratings.
- 14.4 The contractor shall submit details of spares required in accordance with specification No. CEE.0224.
- 14.5 All spares recommended for normal maintenance purposes that are not available locally (requires importation) must be highlighted.
- 15.0 SPECIAL TOOLS AND/OR SERVICING AIDS**
- 15.1 Special tools or servicing aids necessary for the efficient maintenance, repair or calibration of the equipment shall be quoted for separately.
- 15.2 Tenderers shall submit detailed offers for special tools and servicing aids including all specialised equipment required for the servicing and maintenance of the equipment supplied.
- 16.0 TRAINING**
- 16.1 The tenderer shall submit details with the tender of the training courses, which will be conducted by the contractor for the training of Transnet Freight Rail's maintenance staff in the operation and maintenance of the equipment supplied. The courses shall include theoretical as well as practical tuition. The date and venue of this training course shall be arranged with the maintenance manager.
- 17.0 GUARANTEE AND DEFECTS**
- 17.1 The contractor shall guarantee the satisfactory operation of the complete electrical installation supplied and installed by him and accept liability for maker's defects, which may appear in design, materials and workmanship.
- 17.2 The guarantee period for all substations shall expire after: -
- A period of 12 months commencing on the date of completion of the contract or the date the equipment is handed over to Transnet Freight Rail whichever is the later.

- 17.3 Any specific type of fault occurring three times within the guarantee period and which cannot be proven to be due to other faulty equipment not forming part of this contract e.g., faulty locomotive or overhead track equipment, etc., shall automatically be deemed an inherent defect. Such inherent defect shall be fully rectified to the satisfaction of the Maintenance manager and at the cost of the Contractor.
- 17.4 If urgent repairs have to be carried out by Transnet Freight Rail's staff to maintain supply during the guarantee period the contractor shall inspect such repairs to ensure that the guarantee period is not affected and should they be covered by the guarantee, reimburse Transnet Freight Rail the cost of material and labour

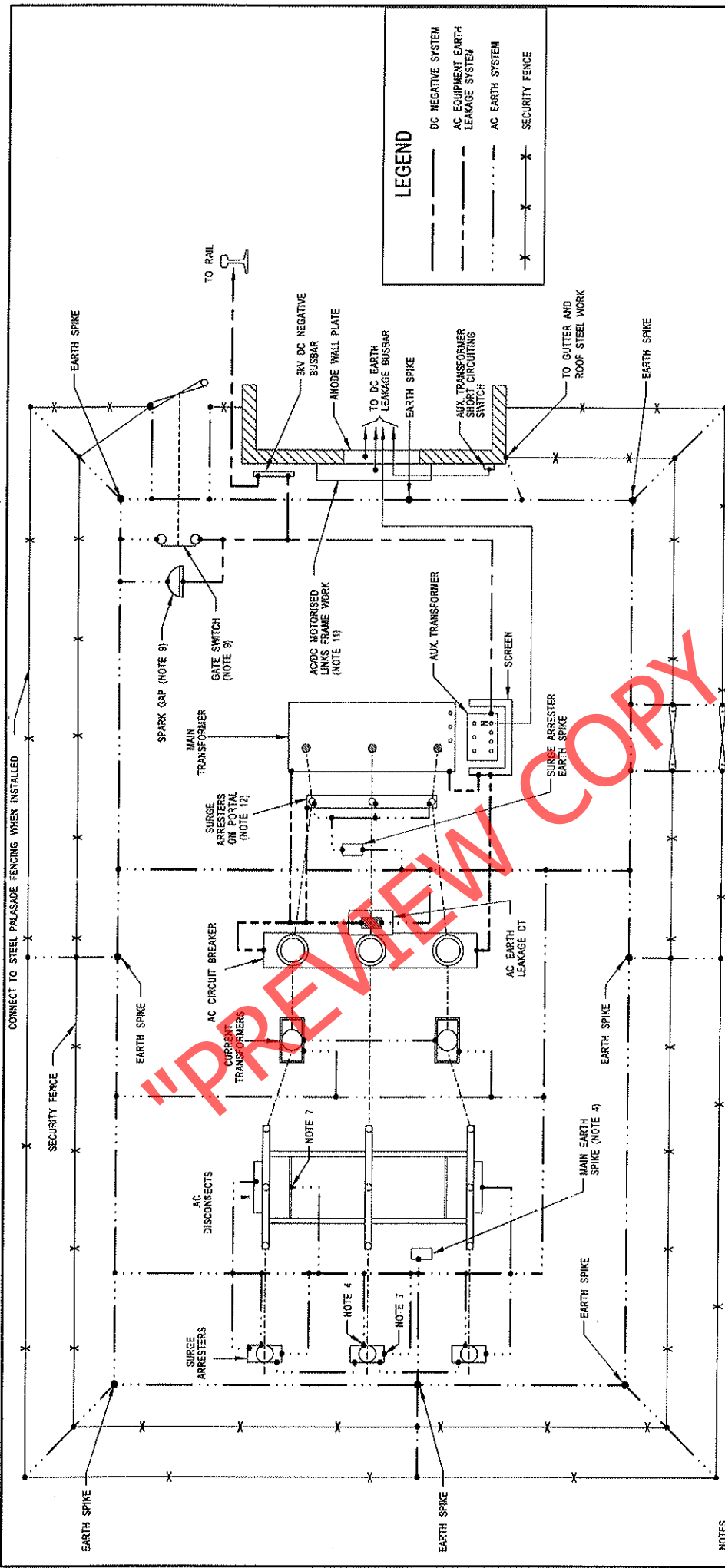
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## TECHNICAL DATA SHEET

(To be completed by Tenderer)

- 1.0 Rectifier ratings (MW): \_\_\_\_\_
- 2.0 Number of diodes per branch: \_\_\_\_\_
- 3.0 Type of Diode: \_\_\_\_\_
- 3.0 Full load current rating of diode.  $I_{FRMS}$ : \_\_\_\_\_
- 4.0 Average current rating of diode.  $I_{FAVM}$ : \_\_\_\_\_
- 4.0 Repetitive Peak Reverse Voltage of diode: \_\_\_\_\_
- 5.0 Surge forward current 10 milli second Sine Wave: \_\_\_\_\_
- 6.0 Method of cooling of rectifier: \_\_\_\_\_
- 7.0 Method of temperature sensing: \_\_\_\_\_
- 8.0 Type of insulation used for frame to floor: \_\_\_\_\_
- 9.0 Physical dimensions of rectifier unit:  
Height: \_\_\_\_\_ Breadth: \_\_\_\_\_ Width: \_\_\_\_\_
- 10.0 Name of suppliers where rectifier diodes can be sourced: \_\_\_\_\_  
\_\_\_\_\_
- 11.0 Method of correct torque adjustment for heat sinks: \_\_\_\_\_  
\_\_\_\_\_
- 12.0 Diode test certificate attached Yes/No: \_\_\_\_\_



**LEGEND**

---	DC NEGATIVE SYSTEM
- - -	AC EQUIPMENT EARTH LEAKAGE SYSTEM
.....	AC EARTH SYSTEM
✕	SECURITY FENCE

- NOTES**
- DRAWING MUST BE READ IN CONJUNCTION WITH SPECIFICATION 8883621.
  - DEEP EARTH OR TRENCH SYSTEM SEE CODE OF PRACTICE CEE/RT7 FOR 'EARTH SYSTEMS FOR ELECTRIC LIGHT AND POWER AND TRACTION INSTALLATIONS'.
  - THE OVERALL RESISTANCE OF THE AC EARTH SYSTEM MUST NOT EXCEED 5 OHMS.
  - UNNECESSARY BENDS IN THE DOWN LEADS FROM THE SURGE ARRESTERS TO THE AC EARTH SYSTEM SHALL BE AVOIDED.
  - THE INSTALLATION OF THE MAIN EARTH AND TEST SPIKE SHALL BE LOCATED AS CLOSE AS POSSIBLE TO THE INCOMING SUPPLY AC SURGE ARRESTERS.
  - ALL BURIED CONNECTIONS, CONNECTIONS TO THE SUPPORT STEEL STRUCTURES AND CONNECTIONS TO THE CORNER, INTERMEDIATE AND GATE POSTS OF THE SECURITY FENCES SHALL BE EXOTHERMIC WELDED.
  - THE EARTHING TALLS FROM THE SUPPORT STEEL STRUCTURES OF THE AC DISCONNECTS AND SURGE ARRESTERS TO THE AC EARTH SYSTEM SHALL BE LOOPED.
  - THE MINIMUM SIZE OF CABLE / CONDUCTOR USED FOR EARTHING SHALL BE 95mm<sup>2</sup> COPPER CONDUCTOR.
  - THE GATE SWITCH ATTACHED TO THE SUBSTATION OUTDOOR YARD GATE, THE 3kV DC OH FEEDER SECURITY AREA GATE AND THE REGEN RESISTANCE ENCLOSURE ARE TO BE SO MOUNTED THAT THE GATE SWITCH IS OPEN WHEN THE GATE IS CLOSED AND CLOSED WHEN THE GATE IS OPEN.
  - THE SPARK GAP USED WITH THE GATE SWITCH ASSEMBLY SHALL COMPLY WITH SPECIFICATION 8881616 AND DRG. 8883621.
  - SUPPORT STEEL STRUCTURES OF CURRENT TRANSFORMERS INSTALLED BETWEEN PRIMARY CIRCUIT BREAKER AND MAIN TRANSFORMER SHALL BE CONNECTED TO THE AC EARTH LEAKAGE SYSTEM.
  - ACDC MOTORISED LINKS FRAME WORK SHALL BE CONNECTED TO THE DC EARTH LEAKAGE BUSBAR.
  - FOR CONNECTION OF HIGH VOLTAGE SURGE ARRESTER INSTALLED ON CROSS ARM SEE DRG. NO. 8883633.

**TRANSNET**  
Freight cell  
BBB3620  
VERSION 5

**3kV DC EARTHING ARRANGEMENT SYSTEM  
FOR HIGH VOLTAGE OUTDOOR YARDS**

Digitally signed by Ludwig Borchard Date: 2011.02.01 12:22:28 +02:00 APPROVED	Digitally signed by Ludwig Borchard Date: 2011.02.01 12:23:10 +02:00 AUTHORISED
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DC REF : CDD/ 7245	DC REF : CDD/ 7245
ECP REF : 8883615 & 8883634	ECP REF : 8883615 & 8883634
DRAWN : D HATHIGH	DRAWN : D HATHIGH
DESIGNED : ..	DESIGNED : ..
CHECKED : H VAN VUUREN	CHECKED : H VAN VUUREN

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DIMENSIONS : mm	SCALE : NTS
TOLERANCE : UN ±	ITEM NO. : -
MATERIAL : ..	VERSION INFO : FRAME TITLE AND NOTE 3 CHANGED



**TRANSNET**  
freight rail

A Division of Transnet Limited

## TECHNOLOGY MANAGEMENT

### SPECIFICATION

# 3 KV DC TRACTION SUBSTATION EARTHING SYSTEM FOR HIGH VOLTAGE OUTDOOR YARDS

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Date: 27 August 2010

Circulation Restricted To:

Transnet Freight Rail

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"PREVIEW COPY ONLY"

**1.0 SCOPE**

- 1.1 This specification specifies Transnet freight rail's requirements for the design, supply, installation and testing of the earthing systems for new and existing 3kV DC traction substations.
- 1.2 This specification must be read in conjunction with Transnet freight rail's drawings BBB 3620 and CEE-TBD-7.

**2.0 STANDARDS AND PUBLICATIONS**

- 2.1 Unless otherwise specified all materials and equipment supplied shall comply with the applicable and latest editions of SANS and Transnet Freight Rail's publications.
- 2.2 The following publications (latest editions) are referred to in this specification:

**2.2.1 SOUTH AFRICAN NATIONAL STANDARDS**

- SANS 1063 Earth rods, couplers and connections.
- SANS 1507 -1-3 Electric cables with extruded solid dielectric insulation for fixed installations. (300/500V to 1900/3300V).
- SANS 2063 Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys.
- SANS 10199 The design and installation of earth electrodes.

**2.2.2 TRANSNET FREIGHT RAIL**

- CEE.0177 Code of Practice:  
Earth systems for electric light and power and traction installations.

**TRANSNET FREIGHT RAIL'S DRAWINGS.**

- BBB 3620 3kV DC earthing arrangement system for high voltage outdoor yards.
- CEE-TBD-7 3kV DC earthing arrangement system of traction substation.

**3.0 METHOD OF TENDERING**

- 3.1 Tenderers shall indicate clause by clause compliance with the specification. This shall take the form of a separate document listing all the specification's clause numbers indicating the individual statement of compliance or non-compliance.
- 3.2 A statement of non-compliance shall be motivated by the tenderer.
- 3.3 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 3.4 Failure to comply with clauses 3.1, 3.2, 3.3 could preclude a tender from consideration.

**4.0 DEFINITIONS**

Definitions are in accordance with SANS 10199.

**4.1 EARTH ELECTRODE**

One or more conductive parts embedded in the earth for the purpose of making effective electrical contact with the general mass of the earth, and to act as a path for the discharge of either lightning currents or fault currents.

**4.2 EARTHED**

So connected to the general mass of earth as to ensure at all times an immediate discharge of electrical energy without danger.

**4.3 EARTHING SYSTEM**

A system intended to provide at all times, by means of one or more earth electrodes, a low impedance path for the immediate discharge of electrical energy without danger into the general mass of earth.

**5.0 EARTHING SYSTEMS OF TRACTION SUBSTATIONS**

The earth leakage protection consists of an AC earth leakage and a DC earth leakage system as described below:

**5.1 AC EARTH LEAKAGE SYSTEM**

The AC earth leakage system is used to detect flashovers on high voltage HV outdoor yard equipment. The equipment in the outdoor yard is insulated from the substation earth mat and connected in parallel through a current transformer to earth mat. (Minimum resistance to earth mat is 10 Ohms). The output of the current transformer feeds to an earth leakage relay, which will trip and lock out the primary circuit breaker when operated.

**5.2 DC EARTH LEAKAGE SYSTEM**

The DC earth leakage system is used to detect 3kV DC and 380V AC insulation failures. The steelwork and panels inside the traction substation are bonded to a DC earth leakage busbar, which is insulated from earth mat. (Minimum resistance to earth mat is 25 Ohms). The DC earth leakage busbar is connected to the substation negative busbar through a DC earth leakage relay.

Operation of this relay will isolate the complete substation from all sources of supply and lock out the primary circuit breaker and all the 3kV DC high speed circuit breakers.

**6.0 SERVICE CONDITIONS**

**6.1 ATMOSPHERIC CONDITIONS:**

Altitude	:	0 to 1800m above sea level.
Ambient temperature	:	-10% to +50 °C.
Relative humidity	:	10% to 90% percent
Lightning Conditions	:	12 ground flashes per square kilometre per annum.
Pollution	:	Heavily salt laden or polluted with smoke from industrial sources.

**6.2 SOIL CONDITION:**

The soil resistivity can vary from 10 Ohmmeter to more than 5,000 Ohmmeter. Earth value enhancement methods will have to be used, where necessary to obtain the desired value of 5 Ohms or less.



**6.3 CORROSION:**

Buried conductors will be exposed to both severe galvanic and chemical corrosion. There is a high level of stray current in the vicinity of 3kV DC traction substations which will reduce the life of the earthing system.

**7.0 TECHNICAL REQUIREMENTS**

7.1 The design and installation of Transnet Freight Rail's earthing system for outdoor yards shall be in accordance with Transnet Freight Rail's drawings BBB 3620 and CEE-TBD-7.

7.2 A 5-second fault current duration shall be used for the rating of the earthing system. The earth down conductors and earth tails shall be able to withstand 6,2 kA for 5 seconds when exothermically welded. The rated AC fault level for 3kV DC traction substations shall be taken to be 16kA.

7.3 Deviation of the design shall be submitted to the project manager for approval.

**8.0 EARTHING LAYOUT**

8.1 The following electrical equipment in the outdoor yard shall be bonded directly to earth mat.

- The support steel structures for the surge arresters at the Eskom supply side.
- All high voltage surge arresters.
- The high voltage AC disconnects.
- Voltage transformer steel structures where applicable.
- Main Current transformers on Eskom side of primary circuit breaker in high voltage (HV) yard.
- The perimeter fence posts and gates.
- Substation metal roof.

8.2 The following electrical equipment forms part of the AC earth leakage system and shall be connected via a current transformer to earth.

- Main traction transformer.
- Primary circuit breaker.
- Main current transformers between primary circuit breaker and main traction transformer.
- The Auxiliary transformer's barrier screen.

8.3 The following electrical equipment is connected directly to the substation negative busbar.

- The auxiliary transformer tank.
- All spark gaps.

8.4 The following outdoor electrical equipment is connected directly to the DC earth leakage relay busbar.

- The Anode wall plate (Wall Bushings).
- The auxiliary transformer neutral point.
- AC / DC motorised link framework and structure where fitted.
- The auxiliary transformer short circuiting switch fitted on substation wall in the outdoor yard.

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**9.0 MATERIALS TO BE USED.****EARTHING**

9.1 Only copper rods of at least 70 mm<sup>2</sup> shall be used for earth electrodes in accordance to SANS 1063.

The length of the rods will be dependant on the application:

- Earth electrodes (earth spikes). Minimum length of 1.5 meters shall be used.
- Down conductors, earth tails and interconnecting conductors. Rods of varying lengths may be used.

9.2 The minimum size of cable/conductor used for the earthing system shall be 95 mm<sup>2</sup> copper.

9.3 For the installation or replacement of the main earth mat/earth electrode, Copper conductor of at least 16mm diameter shall be used and shall be buried at least 1,5 meters below the ground. The earth mat shall cover an area of at least 1,5 square metre.

9.4 The earth mat shall be provided with a test point connection for test purposes. This test point shall protrude a minimum of 100mm above ground level and shall be protected by means of a metal pipe or metal housing.

9.5 The location of the earth mat/earth spike shall be as close as possible to the main surge arresters support structures.

**AC EARTH LEAKAGE SYSTEM**

9.6 PVC insulated 95 mm<sup>2</sup> copper cable shall be used where insulated earthing conductors are required for the interconnecting of the high voltage equipment on the AC earth leakage system.

9.7 The resistance between the outdoor yard steelwork connected to AC earth leakage system and main earth electrode shall be a minimum of 10 Ohms.

**10.0 INSTALLATION OF EARTHING SYSTEM.****10.1 EARTHING SURVEY**

10.1.1 For new installations the contractor shall carry out an earthing survey in accordance with the method as described in specification CEE.0177 or SANS 10199 to determine the type of earthing system required. The contractor shall be required to submit a separate quotation for the survey.

10.1.2 For existing substations the contractor shall carry out earth resistance tests to establish the condition of the existing earth mat/earth spike and shall replace such earth mat/earth spike where required.

**10.2 TRENCHING**

10.2.1 Before any trenching commences the contractor shall consult with Transnet Freight Rail staff for approval with regard to the routing of the trenches in the outdoor yard.

10.2.2 Trenching shall include all trenches required for the installation of the earthing system.

10.2.3 The perimeter fence trenching shall be as close as possible to the perimeter fence on the inside of the HV yard.

- 10.2.4 The depth of trenches shall be at least 700 millimetres. Care must be taken not to damage existing cables in the high voltage outdoor yard during trenching operations.
- 10.2.5 Before the trenches are closed a representative from Transnet Freight Rail shall inspect the earthing system for correct installation procedure.

### 10.3 INSTALLATION PROCEDURES

- 10.3.1 Earth electrodes shall be driven into the ground in the perimeter fence trench at the corners of the outdoor yard and in between the corners.
- 10.3.2 In the case of double unit substations the number of earth electrodes between the corner electrodes shall be determined in consultation with Transnet Freight Rail.
- 10.3.3 The depth of the earth electrodes driven into the ground shall be such that the top of the earth electrode shall be a minimum of 700 mm below the surface of the ground.
- 10.3.4 The earthing of the support steel structures for the surge arresters, AC disconnects, voltage transformers (where installed) and current transformers shall be in accordance with Transnet Freight Rail's drawing BBB 3620.
- 10.3.5 The surge arresters base shall be connected directly to earth mat/spike.
- 10.3.6 Where surge arresters are fitted on the main transformer provision shall be made to install an earth electrode in close proximity to the transformer. The earth electrode shall be connected directly to the earth system as shown in drawing BBB3620.
- 10.3.7 All underground connections which include connections to the earth electrodes, the joints in the copper plated steel rods, connections to the perimeter fence posts, support steel structures and the connection to the new or existing earth mat shall be exothermic welded or crimped by means of tinned lugs or by means of brass clamping system.
- 10.3.8 Where exothermic welding cannot be carried out, galvanised or stainless steel grade S304 studs, nuts, tinned cable lugs and any other approved means may be used for the termination of the earthing conductors to the fence posts, surge arresters down leads, metal structure and other electrical equipment.
- 10.3.9 Exothermic welded joints and steel components exposed to corrosion shall be sealed with a durable waterproofing compound i.e. Bitumen, Denso tape or Noxide.
- 10.3.10 All crimped connections that are above ground level must be filled with an anti corrosive compound.
- 10.3.11 Where the exothermic welding is carried out on galvanised surfaces of the support steel structures, the galvanising must be removed and the surface cleaned. After completion of the exothermic weld, the surface area on the support steel structure where the galvanising was removed shall be treated in accordance with the requirements of SANS 2063.
- 10.3.12 Exothermic joints shall be hammer tested on recommendation of the manufacturer to ensure that the mechanical strength of the joints are adequate. The exothermic weld is tapped by a hammer and by sound it is determined whether the joints are solid or that there are voids in the joint.
- 10.3.13 Where two earthing conductors run parallel to each other, exothermic parallel joints shall be installed every 1,5 metres on all straight sections between these conductors.

### 10.4 CERTIFICATION OF CONTRACTORS (EXOTHERMIC WELDING)

- 10.4.1 Only Contractors who are certified and accredited by the exothermic welding industry shall be used for the installation.

**10.5 CRUSHER STONE**

**NEW SUBSTATIONS**

- 10.5.1 After completion of construction, installation of equipment, the laying of all cables and earthing conductors, a suitable weed killer approved by Transnet Freight Rail's Project Manager shall be applied in the outdoor yard unless otherwise specified.
- 10.5.2 The successful tenderer shall exercise the greatest care to avoid contaminating private property.
- 10.5.3 After treatment with the weed killer, a 100mm layer of 25mm to 37mm crusher stone shall be laid over the whole area of the Transnet Freight Rail high voltage outdoor yard (within the apron).

**EXISTING SUBSTATIONS**

- 10.5.4 The contractor shall remove the necessary crusher stone before any excavation commences.
- 10.5.5 The contractor shall restore the crusher stone to its original condition once the installation work has been completed.
- 10.5.6 The contractor shall supply any additional crusher stone required to restore the trenched areas to original condition.

**11.0 SPECIAL TOOLS (OPTIONAL)**

- 11.1 Tenderers shall furnish quotations for the special bending equipment, crimping tools and exothermic welding moulds required for the installation of the earthing system.
- 11.2 The price shall form a separate part of the quotation.

**12.0 TESTS AND ACCEPTANCE**

- 12.1 The contractor shall perform resistance measurement tests, which shall be witnessed by a representative of Transnet Freight Rail. The resistance measurements shall be entered into the substation station log book.
- 12.2 In the event of any dispute, Transnet Freight Rail reserves the right to make the final decision on the acceptance of the earthing system.

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