Part T2: Returnable Documents/Schedules

Contract
Agreement and Contract Data

TRANSNET

freight rail

PART T2: RETURNABLE DOCUMENTS / SCHEDULES

T2.1 LIST OF RETURNABLE DOCUMENTS

The tenderer must complete the following returnable documents:

1.0 Returnable documents required for tender evaluation purposes

No	Returnable Documents
1	Letter of Good Standing with the Compensation Commissioner
2	Safety Plan and Fall Protection Plan in accordance with the Construction Regulations of 2003 and Transnet's E4E
3	Quality Assurance/control Plan
4	Environmental Management Plan
5	Certified copy of CIDB certification
6	Proposed Organization and Staffing
7	Certified Copy of Share Certificates CK1 & CK2
8	Certified Copy of Certificate of Incorporation and CM29 and CM9
9	Certified Copy of Identity Documents of Shareholders / Directors / Members (where applicable)
10	Original or certified cancelled cheque **OR** original or certified letter from the bank verifying banking details (with bank stamp and signature)
11	Current and original or certified Tax Clearance Certificate
12	Certified VAT registration certificate
13	A signed letter from the Accountant/Auditor confirming most recent annual turnover and percentage black ownership in the company **AND/OR** certified BBBEE certificate and scorecard from an accredited rating agency
14	Programme and method statement
15	Statement of compliance or non-compliance with all clauses of the Scope of Works and all the technical specifications. The clause-by-clause statement of compliance shall take the form of a separate document listing all the clause numbers of all the above specifications indicating the individual statement of compliance or non-compliance. Tenderers shall motivate a statement of non-compliance.

T2.2 RETURNABLE SCHEDULES

The tenderer must complete the following returnable schedules:

2.0 Returnable Schedules required for tender evaluation purposes

No	Returnable schedules
1	Certificate of Attendance of Information Briefing Session or site inspection
2	Certificate of Authority for Signatory (Resolution by Board)
3	Schedule of Tenderers experience
4	Schedule of Subcontractors (where applicable)
5	Certificate of authority for joint ventures (where applicable)
6	Schedule of Plant and Equipment (Tools and Machinery)
7	Foreign Exchange Rate Information (where applicable)
8	Record of Addenda to Tender Document
9	Supplier declaration form Duly completed SDF (Supplier declaration form)
10	Compulsory enterprise Questionnaire
11	Approach paper, which responds to the proposed scope of works.
12	Experience of Key Staff in the form of Curriculum Vitae
13	Transnet SOC limited contractual safety clauses which will form part of any resulting contract.
14	Proposed amendments and qualifications
15	Labour Payment Schedule

3.0 Returnable Schedules that will be incorporated into the contract

3.1 Certificate of attendance of information briefing session/site inspection
3.2 Certificate of Authority for Signatory (Resolution by Board)
3.3 Schedule of Tenderers experience
3.4 Schedule of Sub-contractors
3.5 Certificate of authority for joint ventures (where applicable)
3.6 Schedule of Plant and equipment
3.7 Foreign Exchange Rate Information (where applicable)
3.8 Record of Addenda to Tender Document
3.9 Supplier declaration form duly completed (SDF)
3.10 Compulsory Enterprise Questionnaire
3.11 Approach paper, which responds to the proposed scope of works.
3.12 Experience of key staff in the form of Curriculum Vitae
3.13 Transnet SOC Limited contractual safety clauses which will form part of any resulting contract
3.14 Proposed amendments and qualifications.
3.15 Labour Payment Schedule.

CERTIFICATE OF ATTENDANCE AT INFORMATION BRIEFING SESSION/SITE INSPECTION

This is to certify that

_____
(Tenderer)
of

_____
(address)

_____

was represented by the person(s) named below at the compulsory site meeting held for all tenderers at _____ (location) on _____ (date), starting at_____ We acknowledge that the purpose of the meeting was to acquaint ourselves with the Site of the Works and/or matters incidental to doing the work specified in the tender documents in order for us to take account of everything necessary when compiling our rates and prices included in the tender.

Ireagh substation - Representative (TFR) - Signature _____

Date _____

Particulars of person(s) attending the meeting/site inspections:

Name: _____ Signature _____

Capacity: _____

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

Name: _____ Signature _____

Capacity: _____ Date and time _____

RESOLUTION OF BOARD OF DIRECTORS

Name of firm _____

It was resolved at a meeting of the Board of Directors held on _____ that

FULL NAME(S)	**SIGNATURE**
_____	_____
_____	_____
_____	_____

in his capacity of _____ is/are hereby authorised to enter into, sign and execute and complete any documents relating to Tenders and/or Contracts for the supply of goods and services.

Confirm: Date _____

FULL NAME _____ _____
CHAIRMAN

FULL NAME _____ _____
SECRETARY

Certified true copy:

SIGNED AT _____ ON THIS _____ DAY OF _____

20_____

SCHEDULE OF THE TENDERER'S EXPERIENCE

The following is a statement of similar work successfully executed by myself/ourselves:

Employer, contact person and telephone number	Description of contract	Value of work inclusive of VAT (Rand)	Date completed

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

SCHEDULE OF PROPOSED SUBCONTRACTORS

We notify you that it is our intention to employ the following Subcontractors for work in this contract.

If we are awarded a contract we agree that this notification does not change the requirement for us to submit the names of proposed Subcontractors in accordance with requirements in the contract for such appointments. If there are no such requirements in the contract, then your written acceptance of this list shall be binding between us.

We confirm that all subcontractors who are contracted to construct a house are registered as home builders with the National Home Builders Registration Council.

	Name and address of proposed Subcontractor	Nature and extent of work	Previous experience with Subcontractor.
1.			
2.			
3.			
4.			
5.			

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

CERTIFICATE OF AUTHORITY FOR JOINT VENTURES

This Returnable Schedule is to be completed by joint ventures.

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

NAME OF FIRM	ADDRESS	DULY AUTHORISED SIGNATORY
Lead partner		Signature. . . . . . Name …….. Designation
		Signature. . . . . . Name …….. Designation
		Signature. . . . . . Name …….. Designation
		Signature. . . . . . Name …….. Designation

SCHEDULE OF PLANT AND EQUIPMENT

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

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

Quantity	Description, size, capacity, etc.

Attach additional pages if more space is required.

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

Quantity	Description, size, capacity, etc.

Attach additional pages if more space is required.

Signed ..... Date .....

Name ..... Position .....

Tenderer .....

FOREIGN EXCHANGE RATE INFORMATION REQUIRED TO BE FURNISHED BY TENDERERS.

1. Particulars of the exchange rate on which prices are based:

_____ (Foreign currency) equals R_____(South African currency)

Note: Tenderers who offer imported material shall base their tenders on the selling rate of exchange that ruling on the last working day of the month prior to the closing date of tenders.

2. The percentage of the tender prices which is to be remitted by the Tenderers from South Africa to another country is _____% of the f.o.b./c. and f./f.o.r. in bond price (delete those not applicable).

Note: (1) The percentage quoted above will be deemed to apply even though a portion only of the item(s) tendered for is accepted.

(2) Adjustment in respect of variation in exchange rate will be allowed only on the percentage of the tendered price quoted above.

3. The tendered price shall be computed at the rate of exchange stated by the Tenderer in paragraphs **1** and **2** above as applied to the percentage of the tendered price quoted.

4. Transnet Freight Rail will accept for its account, in respect of such percentage of the tendered price as will be affected by the rate of exchange, any variation between the rate mentioned in paragraph **1** above, and the rate ruling at the date when payment for the goods is made by Transnet Freight Rail; provided that if the Contractor is required to remit the whole or portion of the contract price to another country in payment for goods or portion thereof prior to receiving payment from Transnet Freight Rail, the date(s) of such remittance(s) shall be deemed to be the date(s) of payment by Transnet Freight Rail for the purposes of this paragraph.

5. In the absence of a specific indication by the Contractor at the time of tendering that the proviso to paragraph **3** will apply, it will be assumed that the Contractor desires the adjustment to be effected by reference to the date on which actual payment is made by Transnet Freight Rail.

6. (a) The Contractor shall, if so required, furnish documentary proof to establish that the percentage of the contract price specified by him in paragraph **2** has actually been remitted to another country and the rate of exchange at which that was done.

(b) Whenever the Contractor is required to remit the whole or portion of the contract price, to another country as contemplated in the proviso to paragraph **2** above, he shall notify Transnet Freight Rail forthwith and furnish documentary evidence of such remittance and of the rate of exchange at which that was done.

7. Invoices in respect of goods supplied must reflect the amount remitted or to be remitted to another country and the amount to be retained in South Africa.

8. **The Contractor shall take out forward cover for all imported materials and services within 14 days of award of the contract. Proof shall be submitted to the Project Manager of the contract. The cost of forward cover shall be invoiced separate from the contract invoices and shall not be included in the tender price.**

_____

SIGNATURE OF TENDERER

DATE:_____

WITNESSES:

1._____

2._____

ADDRESS: _____

_____

_____

_____

RECORD OF ADDENDA TO TENDER DOCUMENTS

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

	Date	Title or Details
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Attach additional pages if more space is required.

Signed ..... Date .....

Name ..... Position .....

Tenderer .....

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.

Regards,
Transnet Vendor/Supplier Management *[please substitute this with your relevant Transnet department before sending this document out]*

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.				

NB: 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.

2. VENDOR TYPE OF BUSINESS

(Please tick as applicable) **(* - Minimum requirements)**

2.1	Indicate the business sector in which your company is involved/operating:

Agriculture		Mining and Quarrying			
Manufacturing		Construction			
Electricity, Gas and Water		Finance and Business Services			
Retail, Motor Trade and Repair Services		Wholesale Trade, Commercial Agents and Allied Services			
Catering, accommodation and Other Trade		Transport, Storage and Communications			
Community, Social and Personal Services		Other (Specify)			
Principal Business Activity *					
Types of Services Provided					
Since when has the firm been in business?					

2.2	What is your company's annual turnover (excluding VAT)? *								
<R20k	>R20k <R0.3m	>R0.3m <R1m	>R1m <R5m	>R6m <R10m	>R11m <R15m	>R16m <R25m	>R26m <R30m	>R31m <R34m	>R35 m

2.3	Where are your operating/distribution centres situated *

3. VENDOR OWNERSHIP DETAIL

(Please tick as applicable) (* - Minimum requirements)

3.1	Did the firm previously operate under another name? *

YES		NO	

3.2	If Yes state its previous name:*

Registered Name	
Trading Name	

3.3	Who were its previous owners / partners / directors?*

SURNAME & INITIALS	ID NUMBERS

3.4	List Details of current partners, proprietors and shareholders by name, identity number, citizenship, status and ownership as relevant: *

SURNAME & INITIALS	IDENTITY NUMBER	CITI-ZENSHIP	HDI	DIS - ABLED	GENDER	DATE OF OWNERSHIP	% OWNED	% VOTING

3.5	List details of current directors, officers, chairman, secretary etc. of the firm: *

SURNAME & INITIALS	IDENTITY NUMBER	TITLE	DIS - ABLED	GENDER	% OF TIME DEVOTED TO THE FIRM	CONTACT NUMBER

3.6	List details of firms personnel who have an ownership interest in another firm: *

SURNAME	IDENTITY	NAME &	TITLE IN	%	TYPE OF

TRANSNET
freight rail

& INITIALS	NUMBER	ADDRESS OF OTHER FIRM	OTHER FIRM	OWNED	BUSINESS OF OTHER FIRM

4. VENDOR DETAIL

(Please tick as applicable) (* - Minimum requirements)

4.1	How many personnel does the firm employ? *					
	BLACK	WHITE	COLOURED	INDIAN	OTHER	TOTAL
Permanent						
Part Time						

4.1.1	In terms of above kindly provide numbers on women and disabled personnel? *					
	BLACK	WHITE	COLOURED	INDIAN	OTHER	TOTAL
Women						
Disabled						

4.2	Provide Details of Contact Person/s Responsible for Broad Based Black Economic Empowerment (BBBEE) in the Company *		
SURNAME	INITIALS	DESIGNATION	TELEPHONE NO.

4.2.1	Is your company a value adding supplier (i.e. registered as a vendor under the VAT Act of 1991, where NPAT + total labour cost > 25% of total revenue)?		
YES		NO	

4.2.2	Is your company a recipient of Enterprise Development Contributions?*		
YES		NO	

4.2.3	May the above mentioned information be shared and included in Transnet Supp Database for future reference? *		
YES		NO	

4.2.4	If you are successful in the tender/contract (where applicable) and this is awarded to your company / organisation, will this have a positive impact on your employment plans? *		
YES		NO	

4.2.5	If yes (above) kindly provide the following information:					
	BLACK	WHITE	COLOURED	INDIAN	OTHER	TOTAL
Permanent						
Part Time						

4.2.6	In terms of above kindly provide numbers on woman and disabled personnel:					
	BLACK	WHITE	COLOURED	INDIAN	OTHER	TOTAL
Women						

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Disabled						

4.2.7	**Are any of your members/shareholders/directors ex employees of Transnet**		
YES		**NO**	
4.2.8	**Are any of your family members employees of Transnet?**		
YES		**NO**	

4.2.9	**If Yes to points 4.2.7 & 4.2.8, list details of employees/ex-employees**

SURNAME & INITIALS	IDENTITY NUMBER	NAME & ADDRESS OF OTHER FIRM	TITLE IN OTHER FIRM	% OWNED	TYPE OF BUSINESS OF OTHER FIRM

Internal Transnet Departmental Questionnaire (for office use only)

Section 1: To be completed by the Transnet Requesting / Sourcing Department											
TFR		TRE		TPT		TPL		TNPA		TRN	
Creat		Amen		Block		Unbloc		Once-Off / Emergency			
Exten		Delete		Undel							

Supplier's trading name				
Supplier's registered name				
Please indicate if the Supplier has a contract with sourcing Transnet OD	Yes		No	
If yes please submit a copy of the letter of award				

a) What is being procured from the supplier?				
i. Products only	Yes		No	
ii. Services only	Yes		No	
iii. Labour only	Yes		No	
iv. Mix of services and products	Yes		No	
v. Mix of services and labour	Yes		No	

b) If your answer is **YES** to questions II, III, IV or V in paragraph **a)** above, please indicate whether the relevant **PAYE questionnaires** have been forwarded to the appropriate **Transnet Operational Divisions'** decision making bodies **/ Strategic Supply Management** team for a directive /decision on tax withholding from payments to this supplier.

Yes		No	

c) If your reply to (**b**) is "**NO**", please furnish

d) Certification and Approval of proposed Vendor Creation/Unblocking/Other Changes by Transnet Official with Appropriate Delegated Authority :

I HEREBY CERTIFY THAT THE TRANSNET DETAILED PROCUREMENT PROCESS (DPP) / PROCUREMENT MECHANISM HAS IN ALL RESPECTS BEEN ADHERED TO AND I THEREFORE APPROVE THE PROPOSED VENDOR CREATION/APPROVAL/OTHER CHANGES TO BE EFFECTED ON THE VENDOR MASTER

	Grade	Date	Signature
		Y Y Y Y M M D D	
Tel No:		**Fax**	

Section 2: To be completed by the BEE Department (this section is for

NARROW BASED (NB)				BROADBASED (BBBEE)				
BEE C	BWBE	DPBE	MR	CONTB. LEVEL	EME: <R5m	QSE: >R5m <R35m	LARGE: >R35m	VALIDITY DATE

	Grade	Date	Signature
		Y Y Y Y M M D D	
		Y Y Y Y M M D D	

COMPULSORY ENTERPRISE QUESTIONNAIRE

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

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

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

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

Section 4: Particulars of sole proprietors and partners in partnerships

Name*	Identity number*	Personal income tax number*

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

Section 5: Particulars of companies and close corporations

Company registration number . . . . . .

Close corporation number . . . . . .

Tax reference number . . . . . .

Section 6: Record in the service of the state

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

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

If any of the above boxes are marked, disclose the following:

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

*insert separate page if necessary

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

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

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

Name of spouse, child or parent	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

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

Signed ..... Date .....

Name ..... Position .....

Enterprise name .....

EVALUATION SCHEDULE: APPROACH PAPER

The approach paper must respond to the scope of work and outline the proposed approach / methodology including that relating to health and safety. The approach paper should articulate what value add the tenderer will provide in achieving the stated objectives for the project.

The tenderer must as such explain his / her understanding of the objectives of the assignment and the Employer's stated and implied requirements, highlight the issues of importance, and explain the technical approach they would adopt to address them. The approach paper should explain the methodologies which are to be adopted, demonstrate the compatibility of those methodologies with the proposed approach. The approach should also include a quality plan which outlines processes, procedures and associated resources, applied by whom and when, to meet the requirements and indicate how risks will be managed and what contribution can be made regarding value management.

The tenderer must attach his / her approach paper to this page. The approach paper should not be longer than 8 pages.

The scoring of the approach paper will be as follows:

	Technical approach and methodology
Poor (score 40)	The technical approach and / or methodology is poor / is unlikely to satisfy project objectives or requirements. The tenderer has misunderstood certain aspects of the scope of work and does not deal with the critical aspects of the project.
Satisfactory (score 70)	The approach is generic and not tailored to address the specific project objectives and methodology. The approach does not adequately deal with the critical characteristics of the project. The quality plan, manner in which risk is to be managed etc is too generic.
Good (score 90)	The approach is specifically tailored to address the specific project objectives and methodology and is sufficiently flexible to accommodate changes that may occur during execution. The quality plan and approach to managing risk etc is specifically tailored to the critical characteristics of the project.
Very good (score 100)	Besides meeting the "good" rating, the important issues are approached in an innovative and efficient way, indicating that the tenderer has outstanding knowledge of state-of-the- art approaches. The approach paper details ways to improve the project outcomes and the quality of the outputs

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ---------- Date ----------

Name ---------- Position ----------

Tenderer ----------

CURRICULUM VITAE OF KEY PERSONNEL

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	
Professional registration number:	
Name of employer (firm):	
Current Position:	**Years with the firm:**
Employment record: (list in chronological order starting with earliest work experience)	
Experience record pertinent to required service	

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

_____ _____

[Signature of person named in schedule] Date

TRANSNET SOC LIMITED / CONTRACTORS / SUB-CONTRACTORS

CONTRACTUAL SAFETY CLAUSES WHICH WILL FORM PART OF ANY RESULTING CONTRACT

The parties agree on the following arrangements according to section 37 (2) of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) to ensure compliance by the mandatory with provisions of the Act.

1) That the Contractor is an "employer" in his own right as defined in section 1 of Act 85 of 1993 and that he must fulfil all his obligations as an employer in terms of the Act.

2) The Contractor shall comply with the requirements of Act 85 of 1993 in its entirety.

3) Where special permits are required, such as electrical switching, hot work permits, etc. the Contractor shall obtain them from a person designated by Transnet SOC Limited for this purpose, and all requirements of the Contractor must rigidly comply with the permit.

4) The Contractor shall conduct a risk assessment of the work to be performed by a competent person prior to the commencement of work, to identify risks and hazards that persons may be exposed to, analyse and evaluate identified hazards.

5) The Contractor shall have a documented Health and Safety Plan based on the risks and hazards identified before commencement of work.

6) The Health and Safety Plan shall include the following:

   6.1 The safety management structure to be instituted with all appointments in terms of the Act and Regulations
   6.2 The safe working methods and procedures to be implemented to ensure work are performed in compliance to the Act.
   6.3 The safety equipment, devices and clothing to be made available by the Contractor to his employees.
   6.4 The site access control measures pertaining to health and safety to be implemented.
   6.5 Control measures for ensuring that the Health and Safety Plan is maintained and monitored for the duration of the contract.

7) The Contractor shall ensure that all work is performed under the close supervision of a person trained to understand the hazards associated with the work performed and who has authority to ensure that the necessary precautionary measures are implemented.

8) The Contractor must appoint a Health and Safety Co-ordinator to liaise with Transnet SOC Limited on matters pertaining to occupational health and safety.

9) The appointed Safety Co-ordinator must liaise at least once a week with the* Health and Safety Section / Risk Manager /Occupational Risk Manager of Transnet SOC Limited.

10) The Contractor shall furnish the* Health and Safety Section/ Risk Manager/ Occupational Risk Manager of Transnet SOC Limited immediately with full particulars of any sub-Contractor which he may involve in the contract in order that the sub-

Contractor himself can be made aware of all the clauses in this contract pertaining to health and safety.

11) The Contractor shall stop any sub-contractor from executing work which is not in accordance with the Health and Safety Plan or which poses a threat to health and safety of persons.

12) The Contractor shall ensure that all his employees and visitors undergoes health and safety induction pertaining to the hazards prevalent, proof of such training must be kept on file.

13) In the event where the risk assessment reveals the risk relating to working from an elevated position the Contractor shall cause the designation of a competent person, responsible for the preparation of a Fall Protection Plan.

14) The Fall Protection Plan shall include:

14.1 A risk assessment of all work carried out from an elevated position
14.2 Procedures and methods to address all the identified risks per location
14.3 Evaluation of employee's physical and psychological fitness necessary to work at elevated position.
14.4 The training of employees working from an elevated position.
14.5 Procedure addressing the inspection, testing and maintenance of all fall protection equipment.

15) The Contractor shall advise the * Health and Safety Section / Risk Manager/ Occupational Risk Manager of Transnet SOC Limited of any hazardous situations which may arise from work being performed either by the Contractor or his sub-Contractor.

16) Copies of all appointments required by the act must be given to * Health and Safety Section / Risk Manager / Occupational Risk Manager of Transnet SOC Limited.

17) The Contractor shall ensure that a Health and Safety File is available which shall include all documentation as required by the Act, copy of his and his Sub-Contractors Risk Assessment and Health and Safety Plan.

18) All incidents referred to in Section 24 of the Act involving the Contractor and his Sub-Contractor on Transnet Ltd premises, shall be reported as prescribed. Transnet Ltd hereby obtains an interest in the issue of any investigation, formal inquiry conducted in terms of Section 31 and 32 of the Act into any incident involving the Contractor, his Sub-Contractor, any person or machinery under his control on Transnet Ltd premises.

19) No alcohol or any other intoxicating substance shall be allowed on Transnet Ltd premises. The Contractor shall not allow anyone under or suspected to be under the influence of alcohol or any other intoxicating substance on Transnet Ltd premises.

20) Contractor to ensure its employees undergo medical surveillance as required by legislation

21) Contractor will be required to provide monthly safety performance reports and statistics

22) A letter of good standing in terms of Section 80 (Employer to register with the Compensation Commissioner) of the Compensation for Occupational Injuries and Disease Act 1993 (Act 130 of 1993) must also be furnished.

23) All clauses in the contract pertaining health and safety form an integral part of the contract and if not complied with may be construed as breach of contract.

*As applicable

Tenderer OH & S Management System Questionnaire

This questionnaire forms part of TFR tender evaluation process and is to be completed by all Tenderer's and submitted with their tender offer. The objective of the questionnaire is to provide an overview of the status of the Tenderer's OH&S management system. Tenderers will be required to verify their responses noted in their questionnaire by providing evidence of their ability and capacity in relevant matters. **TFR will verify accuracy of this information during the physical visit as part of the tender evaluation**.

The information provided in this questionnaire is an accurate summary of the company's occupational health and safety management system.		
Company Name:		
Signed:	Name:	
Position:	Date:	
Tender Description:		
Tender Number:		
Tenderer OH&S Management System Questionnaire	**Yes**	**No**
1. OH&S Policy and Management		
- ***Is there a written company health and safety policy?*** - If yes provide a copy of the policy		
- ***Does the company have an OH&S Management system e.g NOSA, OHSAS, IRCA System etc*** - If yes provide details		
- ***Is there a company OH&S Management System, procedures manual or plan?*** - If yes provide a copy of the content page(s)		
- ***Are health and safety responsibilities clearly identified for all levels of Management and employees?*** - If yes provide details		
2. Safe Work Practices and Procedures		
- **Are safe operating procedures or specific safety instructions relevant to its operations available?** - If yes provide a summary listing of procedures or instructions		
- **Is there a register of injury document?**		

TRANSNET
freight rail

If yes provide a copy		
- **Are Risk Assessments conducted and appropriate techniques used?** - If yes provide details		
3. OH&S Training		
Describe briefly how health and safety training is conducted in your company:		
- **Is a record maintained of all training and induction programs undertaken for employees in your company?** - If yes provide examples of safety training records		
4. Health and Safety Workplace Inspection		
- **Are regular health and safety inspections at worksites undertaken?** -If yes provide details		
- **Is there a procedure by which employees can report hazards at workplaces?** - If yes provide details		
5. Health and Safety Consultation		
- **Is there a workplace health and safety committee?**		
- **Are employees involved in decision making over OH&S matters?** - If yes provide details		
- **Are there employee elected health and safety representatives?** - Comments		
6. OH&S Performance Monitoring		
- **Is there a system for recording and analysing health and safety performance statistics including injuries and incidents?** - If yes provide details		
- **Are employees regularly provided with information on company health and safety performance?** - If yes provide details		

Is company registered with workmen's compensation and up to date? - If yes provide proof of letter of good standing		
- **Has the company ever been convicted of an occupational health and safety offence?** - If yes provide details		

Safety Performance Report

Monthly DIFR for previous months

Previous Year	**No of Disabling Injuries**	**Total Number of employees**	**DIFR per month**
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

DIFR = Number of Disabling injuries x 200000 divided by number of man hours worked for the period

Signed
(Tenderer)

PROPOSED AMENDMENTS AND QUALIFICATIONS

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

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

Page	Clause or item	Proposal

Signed ..... Date .....

Name ..... Position .....

Tenderer .....

TRANSNET SOC LIMITED
(REGISTRATION No. 1990/000900/06)
TRADING AS
TRANSNET FREIGHT RAIL

LABOUR PAYMENT SCHEDULE

TENDERERS ARE REQUIRED TO COMPLETE THE FOLLOWING SCHEDULE:

DAY LABOUR (IF REQUIRED)

Skilled Rate/Hour _____

Unskilled Rate/Hour _____

Labourer Rate/Hour _____

Driver/Operator Rate/Hour _____

% Profit on Material _____

TRANSPORT AND MACHINERY	STANDING	RUNNING
1. Light vehicle up to 1 ton	_____	_____
2. 5 Ton vehicle	_____	_____
3. 10 Ton vehicle with crane	_____	_____
4. Crane	_____	_____
5. Scaffolding	_____	_____
6. Generator	_____	_____

7. Other equipment:

_____

_____

_____

8. Full details of any other charges:

_____

_____

_____

TENDERER: _____

DATE: _____

Part C1:
Agreement and Contract Data

Contract Data

The Employer is

Name	**Transnet SOC Limited, Trading as Transnet Freight Rail**
Address	**C/o Paul Kruger & Minnaar streets, Nzasm Building, Pretoria**
Telephone	**(012) 315 2137/2 Fax No. (012) 315 2138**
E-mail	**Nico.swart3@transnet.net**

The works is	The design, manufacture, supply, install, test and commission of 5MW rectifiers, AC/DC distribution panels with DC earth leakage relays, primary circuit breaker control panels, AC earth leakage positive isolators, modular steel HSCB and all associated cables at Ireagh 3kV DC traction substation.
The site is	Ireagh 3kV DC traction substation
The starting date is	to be advised.....
The completion date is	to be advised.....
The reply period is	two weeks
The defects date is	fifty two weeks after completion
The defect correction period is	48 hours
The delay damages are	R5,000.00 per day
The assessment day is the	13th (thirteen) of each month
The retention is	10 %(ten)

Does the United Kingdom Housing Grants, Construction and Regeneration Act (1996) applies? **No**

The Adjudicator is

Name: To be advised if disputes arise.....

Address:.....

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

E-mail:.....

Contract Data

The interest rate on late payment is 2% per complete week of delay.

The *Contractor* is not liable to the *Employer* for loss of or damage to the *Employer*'s property in excess of R2m (two million) for any one event.

The *Employer* provides this

Insurance: Transnet Principal Control Insurance

The minimum amount of cover for the third insurance stated in the Insurance Table is

> R25,000.00 (Limited to R10, 000, 000.00. for any one event)

The minimum amount of cover for the fourth insurance stated in the Insurance Table is:

Not applicable .....

The adjudicator nominating body is: **The Chairman of the Association of Arbitrators (Southern Africa)**

The tribunal is: **Arbitration** .....

If the tribunal is arbitration, the arbitration procedure is: **The rules for the Conduct of Arbitrators of the Association of Arbitrators (Southern Africa)** .....

The *conditions of contract* are the NEC3 Engineering and Construction Short Contract (June 2005) and the following additional conditions:

As mentioned in paragraph 1.0 (Contractual obligations)

1.0 CONTRACTUAL OBLIGATIONS

1.1 This project specification covers Transnet Freight Rail's requirements for the design, manufacture, supply, install, test and commission of 5MW rectifiers, AC/DC distribution panels with DC earth leakage relays, primary circuit breaker control panels, AC earth leakage positive isolators, modular steel HSCB and all associated cables at Ireagh 3kV DC traction substation. The Contractor shall not make use of any sub-Contractor to perform the works or parts thereof without prior permission from the Employer.

1.2 The Contractor shall ensure that a safety representative is at site at all times.

1.3 The Contractor shall comply with all applicable legislation and Transnet safety requirements adopted from time to time and instructed by the Employer / Employer's Deputy. Such compliance shall be entirely at his own cost, and shall be deemed to have been allowed for in the rates and prices in the contract.

1.4 The Contractor shall, in particular, comply with the following Acts and Transnet Specifications:-

1.4.1 The Compensation for Occupational Injuries and Diseases Act, No. 130 of 1993. The Contractor shall produce proof of his registration and good standing with the Compensation Commissioner in terms of the Act.

1.4.2 The Occupational Health and Safety Act (Act 85 of 1993).

1.4.3 The explosive Act No. 26 of 1956 (as amended). The Contractor shall, when applicable, furnish the Employer / Employer's Deputy with copies of the permits authorising him or his employees, to establish an explosives magazine on or near the site and to undertake blasting operations in compliance with the Act.

1.4.4 The Contractor shall comply with the current Transnet Specification E.4E, Safety Arrangements and Procedural Compliance with the Occupational Health and Safety Act, Act 85 of 1993 and Regulations and shall before commencement with the execution of the contract, which shall include site establishment and delivery of plant, equipment or materials, submit to the Employer / Employer's Deputy.

1.4.5 The Contractor shall comply with the current Specification for Works On, Over, Under or Adjacent to Railway Lines and near High Voltage Equipment – E7/1, if applicable, and shall take particular care of the safety of his employees on or in close proximity to a railway line during track occupations as well as under normal operational conditions.

1.5 The Contractor's Health and Safety Programme shall be subject to agreement by the Employer / Employer's Deputy, who may, in consultation with the Contractor, order supplementary and/or additional safety arrangements and/or different safe working methods to ensure full compliance by the Contractor with his obligations as an employer in terms of the Act.

1.6 In addition to compliance with clause 1.4 hereof, the Contractor shall report all incidents in writing to the Employer / Employer's Deputy. Any incident resulting in the death of or injury to any person on the works shall be reported within 24 hours of its occurrence and any other incident shall be reported within 48 hours of its occurrence.

1.7 The Contractor shall make necessary arrangements for sanitation, water and electricity at these relevant sites during the installation of the equipments.

1.8 A penalty charge of **R5,000** per day will be levied for late completion of the project.

1.9 10% retention money will be retained and will be released 12 months after the completion date of the contract.

1.10 The Contractor shall supply a **site diary** (with triplicate pages). This book shall be used to record any unusual events during the period of the work. Any delays to the work shall also be recorded such as delays caused by poor weather conditions, delays caused by permits being cancelled etc. The appointed Employer or Employer's Deputy must countersign such delays. Other delays such as non-availability of equipment from 3rd party suppliers must be communicated to the Employer or Employer's Deputy in writing.

1.11 The Contractor shall supply a **site instruction book** (with triplicate pages). This book shall be used to record any instructions to the Contractor regarding problems encountered on site – for example the quality of work or the placement of equipment. This book shall be filled in by the Employer or Employer's Deputy and must be countersigned by the Contractor.

1.12 Both books mentioned in 1.10 and 1.11 shall be the property of Transnet Freight Rail and shall be handed over to the Employer or Employer's Deputy on the day of energising or handing over.

1.13 All processes or the manufacture and assembly of the product components must be subjected to a quality assurance system.

1.14 The Contractor will assume full responsibility for assuring that the products purchased meet the requirements of Transnet Freight Rail for function, performance, and reliability, including purchased products from 3rd part suppliers/Manufacturers.

1.15 The Contractor shall prove to Transnet Freight Rail that his equipment or those supplied from 3rd party suppliers/manufacturers confirms to Transnet freight rail specifications.

1.16 The Contractor will remain liable for contractual delivery dates irrespective of deficiencies discovered during workshop inspections.

1.17 The successful Contractor shall provide a Gantt or a similar chart showing when the works will be done and energised. A final chart should be submitted to the Employer or Employer's Deputy within 14 days after the award has been made to the successful Contractor.

1.18 The onus is on the manufacturer to prove the effectiveness of their system to Transnet Freight Rail during the production of the prototype.

1.19 ISO.9000 to 9004 inclusive (SABS 0157 parts 1 to 4) must be regarded as a guideline, where applicable.

2.0 INSTALLATION

2.1 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 The Contractor shall be responsible for all necessary (as decided by the Transnet Freight Rail Employer or Employer's Deputy) connections between the equipment supplied and other components in the substation including connections to the earth-mat.

2.3 The 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.

3.0 INTERCONNECTION OF EQUIPMENT

3.1 All fasteners on steelwork, components and electrical connections (nuts and bolts) shall be secured using flat as well as lock washers.

3.2 All HT electrical equipment interconnections shall be done using conductors similar to that being used in the existing substation yard.

3.3 Conductors between separately mounted outdoor equipment shall incorporate a degree of flexibility to avoid any over-stressing of these connections due to the foundation movement or conductor expansion/contraction and to facilitate alignment of equipment.

3.4 High conductive silicon grease shall be liberally applied to all the connections.

3.5 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).

4.0 DRAWINGS, INSTRUCTION MANUALS AND SPARE PART CATALOGUES

4.1 All as built drawings shall be supplied in electronic format (Microstation/Acad).

4.2 The successful Contractor will be required to submit all drawings (paper prints), within four weeks of award of tender, to the Employer or Employer's Deputy for approval. No construction or manufacturing activity will be allowed prior to the associated drawings having been approved.

4.3 During the duration of the contract period, the successful Contractor will be required to inform the Employer or Employer's Deputy of any changes to these drawings and will have to resubmit the affected drawings for approval prior to it being used on this contract.

4.4 All drawings, catalogues, instruction book and spares lists shall be in accordance with Transnet Freight Rail's specification CEE.0224.2002.

4.5 All final as built drawings shall be provided to Transnet Freight Rail within four weeks after commissioning.

4.6 Supply three sets of A3 schematic wiring diagrams in hard copy format and electronic format for approval.

5.0 SITE TESTS

5.1 The equipment shall be inspected/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.

5.2 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.

5.3 Functional on-site tests shall be conducted on all items of equipment and circuitry to prove the proper functioning and installation thereof.

5.4 The Contractor shall submit a detailed list of on-site tests for the approval of the Employer or Employer's Deputy.

5.5 The Contractor shall arrange for the Employer's Deputy or his representative to be present to witness the on-site tests.

5.6 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 substation equipment will not be allowed to take place in a construction site environment.

5.7 The on-site tests shall include the following:

5.7.1 Test for the functionality of all electrical circuitry.
5.7.2 Trip tests on relays.
5.7.3 Test on equipment as per manufacturer's instructions.
5.7.4 Insulation tests.

5.8 At the completion of the on-site tests, the Employer or Employer's Deputy 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.

5.9 Upon rectification of defects, the Contractor shall arrange for the Employer or Employer's Deputy or his representative to certify satisfactory completion of on-site tests.

5.10 Acceptance by the Employer or Employer's Deputy 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.

6.0 COMMISSIONING OF EQUIPMENT

6.1 Commissioning will only take place after all defects have been rectified to the satisfaction of the Employer or Employer's Deputy.

6.2 Commissioning will include energising of equipment from the primary isolator to the track feeder circuits. The Contractor must prove the satisfactory operation of all equipment under live conditions.

6.3 On completion of commissioning, the Contractor will hand the equipment over to the Employer or Employer's Deputy in terms of the relevant instruction.

6.4 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. 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.

6.5 The Contractor shall be present during the testing and setting of the protection to rectify any faults found.

7.0 GUARANTEE AND DEFECTS

7.1 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.

7.2 The Contractor shall be issued with a completion certificate with the list of all defects to be repaired within 14 working days after commissioning.

7.3 The guarantee period for these substations shall expire after:

7.3.1 A period of 12 months commencing on the date of completion of the contract / sub-order or the date the substation is handed over to Transnet Freight Rail whichever is the earliest.

7.4 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.

7.5 The Contractor shall undertake work on the rectification of any defects that may arise during the guarantee period within 7-days of his being notified by Transnet Freight Rail of such defects.

7.6 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.

7.7 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 Employer or Employer's Deputy and at the cost of the Contractor.

7.8 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.

8.0 QUALITY AND INSPECTION

8.1 Transnet Freight rail shall inspect the equipment under contract on the premises of the Manufacturer or successful Contractor.

8.2 The Contractor shall notify Transnet Freight Rail 14 days in advance of such inspection date.

8.3 The Contractor shall apply 14 days in advance for the date of energising and ensure that all work is completed before any commissioning can take place.

8.4 The Contractor shall be responsible to issue a compliance certificate in terms of SANS 0142 for each site before energising of the equipment shall take place.

Contract Data

The *Contractor*'s Offer

The Contractor is

Name .....

Address .....

.....

Telephone ..... **Fax No.** .....

E-mail .....

The percentage for overheads and profit added to the Defined Cost for people is.....%.

The percentage for overheads and profit added to other Defined Cost is..... %.

The *Contractor* offers to Provide the Works in accordance with the *conditions of contract* for an amount to be determined in accordance with the *conditions of contract.*

The offered total of the Prices is:.....

.....

Signed on behalf of the Contractor

Name .....

Position .....

Signature..... Date .....

The *Employer*'s Acceptance

The *Employer* accepts the *Contractor*'s Offer to Provide the Works

Signed on behalf of the *Employer*

Name .....

Position .....

Signature..... Date .....

Part C2:
Pricing Data

Contract
Agreement and Contract Data

TRANSNET

freight rail

Part C2.1: Pricing Data
Price Instructions

2.0 PRICING INSTRUCTIONS

2.1. The agreement is based on the NEC Engineering and Construction Short Contract 3. The contract specific variables are as stated in the contract data. Only the headings and clause numbers for which allowance must be made in the Price list are recited.

2.2. Preliminary and General Requirements are based on part 1 of SANS 1921, 'Construction and Management Requirements for Works Contracts'. The additions, deletions and alterations to SANS 1921 as well as the contract specific variables are as stated in the contract data. Only the headings and clause numbers for which allowance must be made in the Price list are recited.

2.3. It will be assumed that prices included in the Price list are based on Acts, Ordinances, Regulations, By-laws, International Standards and National Standards that were published 28 days before the closing date for tenders.

2.4. Reference to any particular trademark, name, patent, design, type, specific origin or producer is purely to establish a standard for requirements. Products or articles of an equivalent standard may be substituted.

2.5. The Price list is not intended for the ordering of materials. Any ordering of materials, based only on the Price list, is at the Contractor's risk.

2.6. The amount of the Preliminaries to be included in each monthly payment certificate shall be assessed as an amount prorated to the value of the work duly executed in the same ratio as the preliminaries bears to the total of prices excluding any contingency sum, the amount of the Preliminaries and any amount in respect of contract price adjustment provided for in the contract.

2.7. The amount or items of the Preliminaries shall be adjusted to take account of the theoretical financial effect which changes in time or value (or both) have on this section. Such adjustments shall be based on adjustments in the following categories as recorded in the Price list:

a) An amount which is not to be varied, namely Fixed (F).
b) An amount which is to be varied in proportion to the contract value, namely Value Related (V).
c) An amount which is to be varied in proportion to the contract period as compared to the initial construction period, excluding revisions to the construction period for which no adjustment the Contractor is entitled to in terms of the contract, namely Time Related (T).

2.8. The following abbreviations are used in the Price list:

Ea	=	Each
Quant	=	Quantity
Sum	=	Sum

2.9 The prices and rates in these Price list are fully inclusive prices for the work described under the items. Such prices and rates cover all costs and expenses that may be required in and for the execution of the work described in accordance with the provisions of the scope of work and shall cover liabilities and obligations set forth or implied in the Contract data, as well as profit.

2.10 Where the scope of work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amount tendered for such items.

2.11 Where no quantity has been provided against an item in the Price list, the Contractor shall use their discretion and provide the quantity.

2.12 The quantities set out in these Price list are approximate and do not necessarily represent the actual amount of work to be done. The quantities of work accepted and certified for payment will be used for determining payments due and not the quantities given in these Price list.

2.13 The short descriptions of the items of payment given in these Price list are only for purposes of identifying the items. More details regarding the extent of the work entailed under each item appear in the Scope of Work.

2.14 Tenderer shall ensure that provision (financial as well as time) for excavations in a range of soil types is made for in their tenders.

2.15 For each item in the Price list, including Preliminaries, the Contractor shall provide in the appropriate column the portion of the tendered sum (inclusive of labour and material) which has been sourced locally (Republic of South Africa).

2.16 The Contractor shall also arrange forward cover within two weeks after contract award on all imported items.

2.17 The Contractor shall provide information related to imported content, i.e. equipment to be imported, value and applicable exchange rates. This information shall be provided as an Annexure to the Price list.

2.18 The total in the Price list shall be exclusive of VAT.

Contract Data
Price List

Item	Description	Unit	Qty	Rate	Price
A1: Ireagh 3kV traction substation					
1	Dismantle, remove and transport old equipment to Nelspruit Infra Depot	sum	1		
2	Supply and install busbars from the wall bushings to rectifiers	sum	1		
3	Supply and install 4.5MW rectifier complete with diode monitoring and fan control.	Ea	1		
4	Supply and install busbars to and from the rectifier, re-actor coil, positive isolator incl. negative bar.	sum	1		
5	Supply and install positive isolator with built in 3kV under voltage relay.	ea	1		
6	Supply all cable connections to the negative bar	sum	1		
7	Dismantle and redo indoor earthing according to specification.	ea	1		
8	Supply and install DC earth leakage relay outside the panel and its polycarbonate box.	sum	1		
9	Supply checker plates where necessary	sum	1		
10	Supply and install AC/DC control panel, supply with all protection relays and associated cables.	ea	1		
11	Supply and install AC primary circuit breaker control panel with all protection relays.	ea	1		
12	Supply and install all control cables and power cables to and from all the equipment including the telecontrol	sum	1		
13	Supply and install track feeder high speed circuit breakers.	ea	1		
14	Supply material inter-locking keys.	sum	1		
15	The provision of drawings, instruction manuals and catalogues.	sum	1		
16	P's and G's	sum	1		
17	Testing and commissioning	sum	1		
	Total Price (Excl. VAT) =		**R**		

Part C3:
Scope of Work

TRANSNET

freight rail

9.0 **Description of work**

9.1 **SUPPLY AND INSTALLATION OF CABLES**

9.1.1 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.

9.1.2 The Contractor shall supply and connect the 95mm^2 PVC insulated welding cable to interconnect all new and existing equipment to the DC earth leakage relay system.

9.2 **MECHANICAL INTERLOCKING DEVICES AND CHECKER PLATES**

9.2.1 Supply and install an interlocking mechanism complete (similar to existing) 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 2.

9.3 **DIRECT CURRENT EARTH RELAY CIRCUIT**

9.3.1 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 polycarbonate box.

9.3.2 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.

9.3.3 The Contractor shall replace the DC earth leakage arrangement (system) as per drawing CEE TBD 0007 and enclosed in 25 mm² 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.

9.3.4 Only hexagon crimps will be accepted on all crimping lugs.

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

9.4 **3KV DC RECTIFIER**

9.4.1 Supply and mount the copper/aluminium busbar on the substation wall inside the rectifier bay. The installation shall include the supply of all the required insulators, bolts and fasteners.

9.4.2 The Contractor shall then supply and install copper/aluminium busbars from the wall bushing to the rectifier unit.

9.4.3 Supply and install 5 MW rectifier complete with the diode monitoring system and fan control in accordance with the specification BBB 0496 version 10.

9.4.4 Supply and install Aluminium/copper busbar between the rectifier and the negative bar. The negative busbar shall be painted black

9.5 AC PCB CONTROL PANEL AND AC/DC DISTRIBUTION PANEL

9.5.1 Remove the existing AC/DC distribution panels, AC PCB panels from site and transport them to Nelspruit Infrastructure depot.

9.5.2 Supply and install AC PCB control panel and AC/DC distribution panels in accordance with the specification BBB 2721 version 9.

9.5.3 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.

9.5.4 The Contractor shall rewire controls for the extractor fan and incorporate into the distribution panel.

9.5.5 Ensure room fan circuit is still working.

9.5.6 Transnet Freight Rail representative shall inspect all the panels on the Contractor's premises prior to delivery to site.

9.5.7 All direct current wiring shall be done in grey coloured wire.

9.5.8 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.

9.5.9 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.

9.5.10 Panels shall be colour coated in accordance with SANS 1274.

9.5.11 Insulated lugs, of the crimp on type, shall be used to terminate wiring onto equipment, strip connectors and protection relays.

9.5.12 Screw on terminal lugs shall be used on all the protection relays.

9.5.13 All new and existing cables and wiring shall be clearly labelled by using an approved slide on wiring label system as described.

9.5.14 Where applicable, the Contractor will be responsible to connect and interconnect the control wiring and cabling of existing equipment to the new and old equipment.

9.5.15 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.

9.5.16 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.

9.5.17 The Contractor shall incorporate all existing equipment functions into the schematic drawings as per specification CEE 0224 of 2002.

9.5.18 A copper busbar system consisting of a busbar for each phase red, white and blue shall be used, in the AC/DC panel and concealed behind Perspex with warning sign and voltage identification label.

9.5.19 A copper busbar system consisting of battery supply, holding coil volts and negative shall be used and covered with Perspex with a warning sign and voltage labels.

9.5.20 The Contractor shall supply and install the auxiliary supply switch inside the AC/DC control panel.

9.5.21 Provision will be made in the primary circuit breaker control panel to install primary overload protection for the auxiliary supply.

9.5.22 All control panels shall be insulated from the substation floor.

9.5.23 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.

9.5.24 Transnet Freight Rail shall inspect the layout of the equipment before wiring commences of the panels.

9.5.25 All equipment used in the primary circuit breaker control panel and the AC/DC distribution panel shall comply with the SANS 0142.

9.5.26 Clean substation inside floor.

9.6 POSITIVE ISOLATOR PANEL

9.6.1 Supply and install 3 kV DC positive isolator panels in accordance with the specification BBB 4724 version 2. The positive isolator shall be fitted with a 3 kV DC under voltage relay as per specification BBB 3005version 1.

9.6.2 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 2 on the positive isolator panel.

9.6.3 Supply and install a busbar from the reactor coil to the positive isolator. The busbar entering the positive isolator shall be 100mm X 10mm thickness.

10.0 **Specifications**

10.1 **South African National Standards:**

10.1.1	SANS 1091	National colour standard.
10.1.2	SANS 763	Hot dip galvanised zinc coating.
10.1.3	SANS 121	Hot Dip Galvanised Coating for Fabricated Iron or Steel Article.
10.1.4	SANS 8528	Reciprocating internal combustion engine driven alternating current generating set.
10.1.5	SANS 10142	Wiring Code.

10.2 **Transnet Freight Rail**:

10.2.1	BBB 0496 version 13	Specification for 3kV rectifier for traction substations.
10.2.2	BBB 1267 version 10	Specification for outdoor high voltage alternating current circuit breaker in accordance with SANS 62271.
10.2.3	BBB 5452 version 4	Transnet freight rail requirements for installation of electrical equipment for 3 kV DC substations.
10.2.4	BBB 2721 version 10	AC Primary Circuit Breaker Control Panel and AC/DC distribution Panel for 3kV DC Traction substation.
10.2.5	CEE-TBD-0007	Earthing arrangement for traction substations.
10.2.6	CEE TBK 0027	Control circuit diagrams – NO volt operation.
10.2.7	CEE TBK 0028	Trip, lockout and indication circuit diagram.
10.2.8	BBB 4724 version 4	Positive Isolator switch for 3 kV DC Traction substations.
10.2.9	BBB 3005 version 1	3 kV DC under voltage relay manufacturing specification.
10.2.10	BBC 0198 version 1	Specifications for the supply of cables.
10.2.11	CEE.0023.90	Specifications for installation of cables.
10.2.12	CEE.0045.2002/1	Painting of steel Components of Electrical Equipment.
10.2.13	CEE.0183.2002	Hot dip galvanising and painting of electrical equipment.
10.2.14	CEE.0224.2002	Drawings, catalogues, instruction manuals and spares list for electrical equipment supplied under contract.
10.2.15	CEE.0099	3kv DC high speed circuit breaker for traction substation

NOTE: Any other specifications referenced in the above mentioned specification, will be for information purposes and may be provided on request.

10.3 Occupational Health and Safety Act No. 85 of 1993 (Available at depot for referral)

11.0 **Constraints on how the *Contractor* Provides the Works**

11.1 The constraints shall be as specified in the specifications of the particular equipment.

12.0 **Requirements for the programme**

12.1	Programme of work	: To be submitted by successful Contractor
12.2	CIDB rating	: 4EP and above
12.3	Format	: Any
12.4	Information	: How work is going to be executed and commissioned
12.5	Submission	: 1 weeks after the award of contract
12.6	Site diary	: Successful Contractor to supply in triplicates carbon copies
12.7	Site instruction book	: Successful Contractor to supply in triplicates carbon copies

TRANSNET
freight rail

TECHNOLOGY MANAGEMENT

SPECIFICATION

3kV RECTIFIER FOR TRACTION SUBSTATIONS

Authors:	Chief Engineering Technician Technology Management	D.O. Schulz	.....
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Date: 29th March 2010

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

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 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 and 3.3 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:	-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.

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 it supply from a 3.3 MVA or a 5.0 MVA rectifier transformer.

4.3.2 OUTPUT VOLTAGE.

4.3.2.1 The nominal DC output voltage rating of the system is 3150 Volts but can vary between 2400 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 or 5 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 puk capsule type.

8.1.3 All materials used shall be flame retarded.

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.

Overcurrent fuse protection

8.1.16 The supplier shall supply overcurrent fuse protection on the input side of the rectifier.

8.1.16.1 The fuses shall be rated for AC input voltage and the current rating shall be able to withstand the overload conditions as specified in clause 5.8.1 of the specification.

8.1.16.2 The rating of the fuses is dependant on the output rating of the traction transformer supplying the rectifier. The rectifiers may be rated for 3,0 MW or 4,5 MW and in some cases 6,0 MW.

8.1.16.3 Operation of the fuses under overload or fault conditions shall protect and isolate the rectifier from the AC input side and the 3 kV DC output side.

8.1.16.4 The overcurrent fuse protection shall trip and lock out the traction substation when one or more fuses operate. The trip and lockout signal shall be transmitted by means of fibre optics from the fuse control circuitry to the control panel.

8.1.16.5 The fuse shall be of the strike pin type and shall be fitted on each AC input phase to the rectifier unit.

8.1.16.6 The manufacturer shall submit to Transnet Freight Rail the designs for the installation and the wiring circuitry for the fuse protection.

8.2 DIODES

8.2.1 The tenderer shall supply the Westcode type W2899MC480 diode that is manufactured in the "United Kingdom" or the INFINEON (EUPEC) D1809 N40 or N46 diode. Proof of origin of the diodes and certified test certificates shall be supplied with the diodes

8.2.2 The forward voltage-drop of the diodes shall be within ± 5%variations.

8.2.3 Tenderers shall submit fully detailed data sheets of the type of diode offered.

8.2.4 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.

8.2.5 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.

8.2.6 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.

8.2.7 For identification of the diode polarity, the rectifier symbol shall be clearly marked on the heatsink module and on the diode.

8.2.8 Tenderers shall indicate the recommended intervals between the testing of diodes and their RC snubber components so as to establish their soundness.

8.2.9 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 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 ^{2} 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 (adhoc 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

END

TECHNICAL DATA SHEET
(To be completed by Tenderer)

1.0 Number of diodes per branch: _____

2.0 Type of Diode: _____

3.0 Full load current rating of diode. $I_{FRMS:}$ _____

4.0 Average current rating of diode. $I_{FAVM:}$ _____

3.0 Repetitive Peak Reverse Voltage of diode: _____

4.0 Surge forward current 10 milli second Sine Wave: _____

5.0 Method of cooling of rectifier: _____

6.0 Method of temperature sensing: _____

7.0 Type of insulation used for frame to floor: _____

8.0 Physical dimensions of rectifier unit:

Height: _____ Breadth: _____ Width: _____

9.0 Name of suppliers where rectifier diodes can be sourced: _____

_____

10.0 Method of correct torque adjustment for heat sinks: _____

_____

TRANSNET
freight rail

TECHNOLOGY MANAGEMENT.

SPECIFICATION.

REQUIREMENTS FOR OUTDOOR ALTERNATING-CURRENT CIRCUIT BREAKERS FOR TRACTION AND DISTRIBUTION SUBSTATIONS

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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 requirements for the design, manufacture, testing and supply of outdoor Alternating Current (AC) circuit breakers in accordance to SANS 62271-100.

1.2 The alternating current circuit breakers shall be suitable rated for nominal phase to phase r.m.s voltages ranging from 22 kV to 220 kV.

2.0 STANDARDS, PUBLICATIONS AND DRAWINGS

2.1 Unless otherwise specified all materials and equipment supplied shall comply with the applicable and latest editions of SANS or Transnet freight rail publication.

2.2 The following publications are referred to in this specification:

2.2.1 SOUTH AFRICAN NATIONAL STANDARDS

SANS 121:	-	Hot-dip Galvanized coatings for fabricated iron or steel articles.
SANS 1431:	-	Weldable structural steels.
SANS 60529:	-	Degrees of protection provided by enclosures (IP code).
SANS 60694:	-	Common Specifications for high-voltage switchgear and controlgear standards.
SANS 60815	-	Guide for the selection of insulators in respect of polluted conditions
SANS 62271-100:	-	High Voltage Alternating Current Circuit Breakers.

2.2.2 TRANSNET FREIGHT RAIL SPECIFICATIONS.

CEE.0045:	Painting of Steel Components of Electrical Equipment.
CEE.0224:	Drawings, Catalogues, Instruction Manuals and Spares.

2.2.3 Occupational Health and Safety Act No 85 of 1993.

2.2.4 TRANSNET FREIGHT RAIL DRAWINGS

CEE-TBK-0027:	-	Control circuit diagram. No-volt coil protection.

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 this specification as well as the relevant equipment specifications. This shall take the form of a separate document listing all the specifications clause numbers indicating on individual statement of compliance or non-compliance.

3.2 The tenderer shall motivate a statement of non-compliance.

3.3 Tenderers shall complete Appendix 2. " Information to be provided by tenderers".

3.4 Tenderers shall submit detailed technical literature of the current transformers offered together with drawings showing, general constructional details and principal dimensions.

3.5 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 specification(s) with which it complies.

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

4.0 APPENDICES

The following appendices form an integral part of this specification and shall be read in conjunction with it.

4.1 Appendix 1 -"Schedule of Requirements".

This appendix details the specific requirements for this application.

4.2 Appendix 2 - " Information to be provided by tenderers".

This appendix calls for specific technical information to be furnished by tenderers.

5.0 SERVICE CONDITIONS.

The current circuit breaker shall be designed to operate under the following conditions.

5.1 ATMOSPHERIC CONDITIONS

5.1.1	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 CONDITIONS

5.2.1	Supply voltage:	The incoming AC voltage can vary ± 5% of the nominal system r.m.s voltage.
5.2.2	Frequency:	Frequency of the supply voltage is 50 ± 2.5 Hz.

6.0 REQUIREMENTS FOR ALTERNATING CURRENT CIRCUIT BREAKERS.

6.1 The AC circuit breakers shall be designed, manufactured and tested in accordance with the requirements of specifications SANS 62271-100 and SANS 60694.

6.2 The circuit breakers shall be of the outdoor type suitable for operation under the nominal phase to phase voltages or phase to neutral voltages specified in Appendix 1.

6.3 The insulating medium of the primary circuit breakers shall be SF6 gas or vacuum, depending on the supply voltage. (Refer to Appendix 1)

6.3.1 Vacuum circuit breakers may be used for voltages ranging from 22 kV up to 33 kV

6.4 The AC circuit breakers used on Transnet freight rail may the single, double or triple pole type.

6.4.1 Double or triple pole type circuit breakers shall be ganged operated.

6.5 The circuit breakers shall be rated at the highest r.m.s. voltage for equipment operating at the nominal system voltage specified in Appendix 1.

6.6 The minimum rupturing capacities for the respective voltages and current ratings for the circuit breakers shall be in accordance to the SANS 62271-100. The rated short–circuit breaking current shall be at least 20kA.

6.7 The circuit breakers shall be rated for a continuous current of at least 1250 Ampere

6.8 The circuit breakers shall have a first pole to clear factor of 1.5.

6.9 The circuit breakers shall have a making time not greater than 1 second.

6.10 The circuit breakers shall be capable of twice rupturing the specified fault current at the specified voltages, with a one minute interval between operations and then shall be in a condition to be closed and carry the rated current without it being necessary to inspect or make adjustments.

6.11 The circuit breaker shall be electrically operated from a nominal 110 Volt DC control voltage unless otherwise specified in Appendix 1.

6.12 It shall be possible to close the circuit breaker only when the control voltage is above 85% of the nominal voltage. The circuit breaker shall trip automatically when the control voltage falls below 70% of the nominal voltage.

6.13 The circuit breaker shall have a motor wound spring operating mechanism.

6.14 The operating mechanism shall be provided with shunt release for both opening and closing.

6.15 Pneumatic, hydraulic or gas control for tripping and closing the primary circuit breakers are not acceptable.

6.16 The operating mechanism shall be so designed so that the breaker may be closed manually from ground level by means of a suitable detachable handle.

6.17 The operating mechanism shall be constructed of non-ferrous material.

6.18 The operating springs shall recharge automatically after the completion of a closing operation.

6.19 The circuit breaker shall be of the trip-free type.

6.20 A visual mechanical indicating device shall be provided to indicate the state of the spring and shall be inscribed "Spring Charged" when the mechanism is in the condition to close the circuit breaker and "Spring Free" when it is in any other condition.

6.20.1 One pair of normally open and normally closed contacts shall be provided for the indication circuitry to the substation control panel for indication of the "Spring Charged" and "Spring Discharged" conditions.

6.21 Auxiliary contacts shall be provided for operation in conjunction with the protection and other auxiliary circuits specified. At least one spare pair of normally open and one spare pair of normally closed contacts shall be provided.

6.22 Circuit breaker control switches shall be provided on the circuit breaker mechanism. They shall return automatically to the neutral position when the handle is released after being turned to either the "close" or "trip" positions.

6.23 Local/Remote selector switches shall be provided on the circuit breaker mechanism and shall be of the two-position type. The switch shall have no "off" or "neutral" position.

6.23.1 Provision shall be made that when the circuit breaker is switched to the local position, the protection and trip circuitry to the circuit breaker shall not in any way be by-passed.

6.24 Mechanical operation shall be provided on the circuit breaker for any closing or trip release, which is normally electrically operated.

6.25 The circuit breaker shall be provided with a no volt coil with a mechanical latching mechanism, which will trip, lockout and inhibit the circuit breaker from closing when the no volt coil is de-energised. Refer to Transnet Freight Rail's drawing No. CEE-TBK-27 which forms part of this specification, for details of the control circuitry for the no volt protection.

6.25.1 The no volt coil circuitry with its associated mechanical latching mechanism shall operate separately from the trip coil circuitry.

6.26 A counter shall be provided on the circuit breaker to indicate the total number of operations of the breaker.

6.27 Tenderers shall advise the number of circuit breaker operations under full load and fault conditions, after which maintenance and/or measurement of contact wear is recommended.

6.28 The circuit breaker operating mechanism including its controls and relays shall be housed in a metal enclosure.

6.29 The enclosure housing shall be manufactured from stainless steel or hot dipped galvanised steel.

6.30 The coating of the enclosure if galvanised shall comply with the requirements of Transnet freight rail's specification CEE.0045.

6.31 The degree of protection of the enclosure shall be in accordance with SANS 60529 and shall be IP 55.

6.32 Provision shall be made for the enclosure to be pad-lockable.

6.33 The enclosure shall be provided with a gland plate for bottom entry of the control cables.

6.34 VACUUM CIRCUIT BREAKERS.

6.34.1 Vacuum switching devices shall be evacuated and sealed in accordance with the latest technology and accepted practice.

6.34.2 The pre striking and chopping current shall be kept below 5 amperes. Tenderers shall give full details regarding these characteristics.

6.34.3 Where vacuum circuit breakers are specified in Appendix 1 they shall be either of the motor wound spring operating mechanism or magnetic actuator operating mechanism type.

6. 35 SULPHUR HEXAFLOURIDE CIRCUIT BREAKERS. (SF6)

6.35.1 The SF6 circuit breaker shall be fitted with a pressure gauge/densiometer to monitor the gas pressure.

6.35.2 The pressure gauge/densiometer circuit shall be provided with a minimum of two sets of contacts for alarm and indication for the substation's annunciator or flag circuit.

6.35.3 The supplier shall wire the SF6 circuit breaker local control circuit, such that in the event of a gas leakage or drop in gas pressure, the SF6 circuit breaker will trip and lockout.

6.35.4 A set of normally closed contacts shall be provided in the circuit breaker mechanism control box for the low gas trip circuitry.

6.35.5 The SF6 circuit breaker shall trip and lockout before the minimum safe SF6 gas pressure is reached.

6.35.6 In terms of the Occupational Health and Safety Act No 85 of 1993. Code 1704 (pressure vessels) the successful tenderer shall furnish a certificate of manufacture complying with the terms of the Act for the circuit breakers.

6.36 INSULATION LEVELS, CREEPAGE DISTANCES AND CLEARANCES

6.36.1 INSULATION LEVELS

The rated insulation levels of the AC circuit breakers shall comply with the requirements specified in Table 1.

6.36.1.1 Table 1 lists the nominal system voltages present on Transnet freight rail and the required insulation levels as specified in accordance with SANS 1019.

Highest phase-to-phase r.m.s voltage for equipment. (Um)	Nominal system phase-to-phase r.m.s. voltage	Rated lightning impulse withstand voltage peak.	Rated short duration power- frequency withstand r.m.s voltage.
24 kV	22 kV	150kV	50 kV
36 kV	33 kV	200 kV	70 kV
52 kV	44 kV	250 kV	95 kV
72,5 kV	66 kV	350 kV	140 kV
100 kV	88kV	380 kV 450 kV	150 kV 185 kV
145 kV	132 kV	550 kV 650kV	230 kV 275 kV
245 kV	220 kV	850 kV 950 kV	360 kV 395 kV
Insulation levels for highest voltage for equipment U_m < 100 kV are based on an earth fault factor equal to $\sqrt{3}$ and for U_m > 100 kV an earth fault factor equal to $0{,}8\sqrt{3}$. Where more than one insulation level is given per voltage system, the higher level is appropriate for equipment where the earth fault factor is greater than 1,4			

TABLE 1: Standard Voltages and insulation levels in accordance with SANS 1019:2008 [1]

6.36.1.2. For the 25 kV and 50kV single phase ac traction systems the ac high voltage circuit breakers shall be designed to the following nominal system phase to phase r.m.s voltages and withstand insulation levels:

- For the 25 kV (phase to earth) ac traction systems the ac high voltage circuit breakers current transformer shall be rated for a nominal system phase to phase r.m.s voltage of at least 44 kV and designed to withstand the required insulation level for that nominal system voltage.
- For the 50 kV (phase to earth) ac traction systems the ac high voltage circuit breakers shall be rated for a nominal system phase to phase r.m.s voltage of at least 88 kV and designed to withstand the required insulation level for that nominal system voltage.

6.36.2 CREEPAGE DISTANCES

6.36.2.1 The standard creepage distance between phase and earth shall be in accordance with table ii of SANS 60815.

6.36.2.2 For coastal areas and very heavy polluted inland areas the standard creepage distance shall be the very heavy polluted level, i.e. 31mm/kV of the highest r.m.s phase to phase voltage U_m for equipment.

6.36.2.3 For inland areas the standard creepage distance shall be the heavy polluted level, i.e. 25mm/kV of the highest r.m.s phase to phase voltage U_m for equipment.

6.36.3 CLEARANCES

6.36.3.1 The following minimum safety outdoor earth clearances shall be maintained between any live conductor or metal and earthed metal: -

Highest phase to phase r.m.s voltage for equipment.	24kV	36kV	48kV	72kV	100kV	145kV	245kV
Outdoor distance	320mm	430mm	540mm	770mm	1000mm	1450mm	1850mm

6.36.3.2 The following minimum safety clearances shall be maintained between any live conductor or metal and ground surface level: -

Highest phase to phase r.m.s voltage for equipment.	24kV	36kV	48kV	72.5kV	100kV	145kV	245kV
Nominal phase to phase r.m.s system voltage	22kV	33kV	44kV	66kV	88Kv	132kV	220kV
Within security fence. (Restricted access way)	2820mm	2930mm	3040mm	3270mm	3500mm	3950mm	4350mm
Outside security fence but within Transnet freight rail's reserve	5200mm	5300mm	5400mm	5700mm	5900mm	6300mm	6700mm
Outside Transnet freight rail's reserve	5500mm	5500mm	5500mm	5700mm	5900mm	6300mm	6700mm

6.37 SUPPORT STEELWORK.

6.37.1 The circuit breaker shall be provided with its own support steelwork, which shall be hot- dip galvanised in accordance with specification SANS 121 and shall comply to requirements of SANS 1431: for weldable structural steels.

6.37.2 Support steelwork exposed to a high pollution/corrosive atmosphere shall be painted in accordance with specification CEE.0045.

7.0 SPECIAL TOOLS, SERVICING AIDS AND MANUALS AND SPARES LISTS.

7.1 The tenderers shall submit a separate offer for special tools and servicing aids necessary for the servicing and maintenance of SF6 circuit breakers.

7.2 Three copies of instruction/maintenance manuals, spares list's and wiring diagrams of the circuit breakers in accordance with Transnet freight rail's specification CEE.0224. shall be supplied upon delivery.

8.0 TRAINING.

8.1 The tenderer shall submit details with the tender of the training courses, which will be conducted by the supplier for the training of Transnet freight rail maintenance staff in the operation and maintenance of the circuit breaker. 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 of the depot. The cost of the training shall be quoted for separately.

9.0 TEST CERTIFICATES.

9.1 The manufacture shall make available type test certificates for the equipment (as specified in SANS 62271-100 when required. Routine test certificates shall be supplied with each circuit breaker.

10.0 GUARANTEE AND DEFECTS.

10.1 The contractor shall guarantee the satisfactory operation of the circuit breaker supplied and accept liability for maker's defects, which may appear in design, materials and workmanship.

10.2 The guarantee period shall expire after: -

A period of 12 months commencing on the date of energising of the circuit breaker.

10.3 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, shall automatically be deemed an inherent defect. Such inherent defect shall be fully rectified to the satisfaction of the maintenance manager of the depot and at the cost of the Supplier.If urgent repairs have to be carried out by Transnet freight rail staff to maintain supply during the guarantee period the supplier 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.

11.0 INSPECTION.

11.1 Transnet freight rail reserves the right to carry out inspection and any tests on the equipment at the works of the supplier/ manufacture.

11.2 Arrangements must be made timeously for such inspections to be carried out before delivery of the equipment to the client.

12.0 PACKAGING AND TRANSPORT.

12.1 The tenderer shall ensure that the equipment be packed in such a manner that it will be protected during handling and transport.

12.2 The tenderer shall provide transport for the delivery of the equipment to the site where required.

13.0 BIBLIOGRAPHY

[1] SANS 1019: 2008. Edition 2.5

END

SCHEDULE OF REQUIREMENTS
(To be completed by client)

1.0 SYSTEM DETAIL

1.1 AC Circuit Breakers: _____ substation/location.

1.2 Pollution level: Heavy_____ Very Heavy _____

1.2 Quantity of AC Circuit Breakers. _____

1.1 Nominal phase to phase voltage for 3 phase system: _____ kV.

1.2 Nominal phase to neutral voltage for single phase systems: _____ kV.

1.3 Frequency: _____ Hz

1.4 Circuit breaker control DC voltage: _____ V

1.5 Circuit breakers to be used for the following:

- 3 kV DC Traction substations. Yes/No
- Distribution substations. Yes/No
- 25 kV AC Traction substations. Yes/No
- 50 kV AC Traction substation. Yes/No

DETAIL OF AC CIRCUIT BREAKERS.

2.0 Type of circuit breakers required:

Vacuum: Yes / No

Gas (SF6): Yes / No _____

2.2 Number of circuit breakers required: _____

2.3 Number of poles: _____

2.4 Rated Voltage: _____ kV

2.5 Rated short-circuit breaking current: _____kA

2.6 Rated normal current: _____ Ampere.

END

TECHNICAL DATA SHEET
(To be completed by tenderer)

DETAIL OF CIRCUIT BREAKER

1.1 Make and manufacturer _____

1.2 Rated Voltage _____ kV.
(Highest rated voltage for equipment)

1.3 Rated Insulation level _____ kV.
(Rated lightning withstand Voltage)

1.4 Number of Poles: _____

1.6 Rated short circuit breaking current _____ kA.

1.7 Rated normal current: _____ Ampere.

1.6 Breaker operating time:

1.6.1 Closing: _____ ms.

1.6.2 Opening: _____ ms.

1.7 Number of operations after which breaker contact maintenance / measurement is required:

1.7.1 Under full load conditions_____

1.7.2 Under fault conditions _____

1.8 First Pole to Clear Factor_____

1.9 DC control voltage:_____ V

TRANSNET
freight rail

TECHNOLOGY MANAGEMENT

SPECIFICATION

AC PRIMARY CIRCUIT BREAKER CONTROL PANEL AND AC/DC DISTRIBUTION PANEL FOR 3kV TRACTION SUBSTATION

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- Technology Management

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1.0 SCOPE

This specification covers Transnet Freight Rail's requirements for the design, manufacture, delivery, installation and commissioning of the high voltage AC primary circuit breaker control panel and AC/DC distribution panel for 3 kV DC traction substations. The purpose of the AC primary circuit breaker control panel and AC/DC distribution panel is to house the protective and control equipment for the suitable operation of the substation.

2.0 BACKGROUND.

3 kV DC traction substation comprises of a high voltage outdoor yard and a building housing the indoor equipment. The outdoor yard equipment consists of HV disconnects, primary circuit breakers, current and voltage transformers, and main traction - and auxiliary supply transformers. The indoor equipment comprises of a 3 kV DC rectifier with its associated control equipment,
3 kV DC high speed circuit breakers, 110 V battery charger unit and batteries.

3.0 STANDARDS AND PUBLICATIONS.

The following publications are referred to:

3.1 IEC - INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC 60255-5:	Electrical relays - 5. Insulation coordination for measuring relays and protective equipment- requirements and tests.
IEC 60529:	Degree of protection provided by Enclosures. (IP code.)
IEC 60051-1:	Direct Acting Indicating Analogue Electrical Measuring Instruments and their accessories. Part 1 - Definitions and general requirements common to all parts.

3.2 SOUTH AFRICAN NATIONAL STANDARDS

SANS 156:	Moulded Case Circuit Breakers.
SANS 1091:	National colours standard for paint.
SANS 1274:	Coatings applied by the powder-coating process.
SANS 10142:	Installation and wiring of premises.

3.3 TRANSNET FREIGHT RAIL'S SPECIFICATIONS

CEE.0224:	Drawings, catalogues, instruction manuals and spares list for electrical equipment supplied under contract.
BBB0041:	Preparation of drawings for Transnet Freight Rail Infrastructure.
BBB2502:	Requirements for battery chargers for 3 kV DC traction substations.

3.4 TRANSNET FREIGHT RAIL'S DRAWINGS

CEE-TBD-7:	Earthing arrangement for 3 kV DC traction substation.
CEE-TBK-0027:	Control circuit diagram. No-volt coil protection.

4.0 APPENDICES

The following appendices form part of this specification:

Appendix 1: Shows the recommended layout of the AC/DC Distribution Panel.

Appendix 2: Shows the recommended layout of the AC Primary Circuit Breaker Control Panel.

Appendix 3: Schedule of requirements.

5.0 TENDERING PROCEDURE

5.1 Tenderers shall indicate clause by clause compliance with this 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 The tenderer shall motivate a statement of non-compliance.

5.3 Tenderers shall submit schematics and wiring diagrams, general constructional details and principal dimensions of the panels.

5.4 Failure to comply with clauses 5.1, 5.2, and 5.3 could preclude a tender from consideration.

6.0 SERVICE CONDITIONS

The primary circuit breaker control panel and AC/DC distribution panel shall be designed and rated for continuous operation under the following conditions:

6.1 ATMOSPHERIC 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.

6.2 MECHANICAL

The substation in which the panels will be installed is situated next to a railway line and the equipment will therefore be subjected to vibration. The design must take appropriate counter measures to ensure reliability of equipment that are sensitive.

6.3 ELECTRICAL

Nominal DC control voltage:	110 V (Minimum being 88 V and maximum128 V
Nominal AC auxiliary supply:	400 V / 230 V, 50Hz

The existing main protection current transformers are of the bushing or free standing post type.
The class of the current transformers are 10P10
The burden rating is of the order of 15VA or greater
The ratios are of the order as listed below:

Supply Voltage	Ratio
132kV	30/1 or 30/5
88kV	50/1 or 50/5
66kV	75/1 or 75/5

Equipment within the substation-building environment is subjected to electromechanical interference as well as voltage surges.

7.0 GENERAL REQUIREMENTS OF CONTROL /DISTRIBUTION PANELS.

7.1. The successful supplier shall be responsible for the design, the ratings of all, cabling, wiring, protection circuitry, sizing of contactors, relays, moulded circuit breakers, (mcb's) Isolators, fused isolators, fuse ratings, terminations and any other equipment and circuitry used.
In the event of a dispute, Transnet Freight Rail staff's shall make the final decision on technical matters.

7.2 The construction of the control/distribution panels shall be either two separate panels or a combination of both into one panel with the AC and DC circuitry separated. Refer to Appendix 1 Clauses 1.0, 2.0 and 3.0.

7.3 The control/distribution panels shall be so designed that the control switches are accessible and indicating lights, flag indicators, volt and ammeters are visible without opening the doors.

7.4 Appendix 1 and Appendix 2 show the recommended layout of the control equipment on the front door of the substation control panels.

7.5 All circuitry shall be wired in the fail to safe mode i.e. relays and contactors must be de-energised under fault conditions.

7.6 All relays, control switches, indicating lights, and control push buttons, etc. which are mounted on panel door shall be suitably labelled to clearly indicate their function. The labels shall be engraved with white lettering on a black background and permanently fixed with miniature screws, rivets or high quality adhesive.

7.7 Laminated plastised labels shall be used for labelling inside the panel and panel door. The lettering shall be either engraved or etched.

8.0 AC PRIMARY CIRCUIT BREAKER CONTROL PANEL

The panel shall be fitted with the following:

- Flag relays and associated LED Annunciator panel. (Clause 8.1)
- AC Primary circuit breaker control circuitry and equipment (Clause 8.2)
- Rectifier control circuitry and equipment. (Clause 8.3)
- Main AC thermal overload and instantaneous over current protection relays. (Clause 8.4)
- Auxiliary transformer overload protection relay. (Clause 8.7)
- AC earth leakage protection relay. (Clause 8.5)
- DC Earth leakage protection relay. (Clause 8.6)
- Main and auxiliary transformer protection circuitry. (Clause 8.7)
- Local and remote control circuitry and equipment. (Clause 8.8)
- Emergency stop button. (Clause 8.11)
- Lock out reset button and indication. (Clause 8.12)

8.1 FLAG ANNUCIATOR UNIT

8.1.1 The purpose of the flag annunciator unit is to give an alarm/indication of the status of the substation equipment and shall not be used as a tripping mechanism for any of the protection circuits or form part of the tripping circuits.

8.1.2 The design of the flag annunciator unit shall allow any input condition to trigger the flag annunciator alarm and the corresponding indicator shall illuminate.

8.1.3 All inputs shall be latchable and shall continue to indicate even after a power failure.

8.1.4 The flag annunciator alarm shall be equipped with a "Test button" which will apply power supply voltage to all inputs for test purposes.

8.1.5 The alarm annunciator system shall be supplied with a "Reset button" to clear any alarm.

8.1.6 When buzzers or flashing indicators are fitted an alarm "Accept button" shall be provided.

8.1.7 The flag relay and annunciator unit shall make provision for a minimum of 20 annunciator circuits.

8.1.8 The annunciator shall have the following minimum indications.

- Main overload.
- Main overload protection relay fault. (Watchdog facility)
- Auxiliary Overload (If applicable).
- Oil temperature.
- Winding temperature.
- DC Earth Leakage.
- AC Earth leakage.
- Main transformer Bucholz operation.
- Aux transformer Bucholz operation (If applicable).
- Rectifier Attenuation and over temperature.
- Rectifier diode failure
- Rectifier fan failure.
- Battery undervoltage.
- 400 V 3 phase auxiliary supply phase failure.
- Low SF6 gas pressure (If applicable).

8.2 AC PRIMARY CIRCUIT BREAKER CONTROL AND INDICATION

8.2.1 Provision shall be made for the following:

- Local / Remote two position switch. The switch shall have no "off" or "neutral" position
- Local indication. Open/Trip (green) and closed (Red).
- Lockout indication. (Amber)

8.3 RECTIFIER FAN CONTROL AND PROTECTION CIRCUITRY

8.3.1 Provision shall be made for the following:

- Fan motor protection circuitry.
- Fan failure circuitry (vane switch).
  The circuitry shall be fail-safe and shall provide a signal to the flag annunciator panel when the fan fails.
- Rectifier current sensing circuitry.
  The operation of the rectifier fan/fans shall be dependent on the full load current rating of the rectifier as well as the temperature of the rectifier.
  The rectifier current sensing control circuitry shall operate at 50% (adjustable) of the full load current rating of the rectifier. The current sensing circuitry shall be adjustable between 10% and 90% of full load of the rectifier.
  In order to avoid oscillatory pumping action of the fans a timing circuit shall ensure that fans remain energised for a period of at least 3 minutes after each and every start irrespective of the load condition in that time span.
- Diode supervisory circuitry.
- Fan test switch (switch on front of panel).
  A spring-loaded self-resetting switch shall be provided for the manual testing of the fan/fans.

8.4 MAIN AC THERMAL OVERLOAD AND INSTANTANEOUS OVERLOAD PROTECTION RELAYS.

8.4.1 The protection relays shall be of the type readily available on the open market.

8.4.2 The protection relays shall be in accordance to IEC 60255-5 and shall be flush mounted. Electronic protection relays shall be provided with a password system to prevent any unauthorised changing of the relay settings.

8.4.3 The protection relays shall incorporate a watchdog facility, which shall energise in the event of failure of the relay or relay functions.

8.4.4 The high voltage AC primary circuit breaker shall be provided with AC thermal overload and instantaneous overload protection on each of two phases

8.4.5 The protective elements of the relay shall be suitable for operation in conjunction with the main current transformers. The secondary current ratings are 5 ampere and 1ampere.

8.4.6 In the event of protection relay failure, the relay shall fail-safe and shall trip the AC primary circuit breaker.

8.4.7 The thermal overload protection shall be provided to permit loads not less than the specified load-rating curve of the 3 kV rectifier, which is tabled below and shall not exceed the manufacturers, declared rectifier rating.
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
Short circuit proof for 200 milli seconds

8.4.8 The operating level of the overload elements and time delay settings shall be independently adjustable.

8.4.9 For AC overload the protection relay shall have a minimum calibrating range from 3 to 6 times the full load line current of the rectifier equipment.

8.4.10 The AC overload protection shall be provided with an adjustable time delay to prevent operation as a result of inrush currents during switching of the transformer, and to provided sufficient time delay of operation to ensure that only the 3 kV DC high speed track circuit breakers operate under fault conditions.

8.5 AC EARTH LEAKAGE PROTECTION RELAY

8.5.1 An instantaneous relay for the AC earth leakage protection shall be supplied. The relay may be separate or incorporated as a function of the main overload relay.

8.5.2 The AC earth fault protection shall trip and lockout the AC primary circuit breaker in the event of any flashover or earth leakage which may occur on the outdoor AC high voltage equipment

8.5.3 The relay shall be suitable for operation in conjunction with its associated earth fault current transformer. The relay shall have a calibration range of between from 50 to 100 amperes adjustable.

8.5.4 The relay shall be fitted in the primary circuit breaker control panel.

8.6 DC EARTH LEAKAGE PROTECTION RELAY.

8.6.1 The DC earth leakage relay shall not be fitted in the control panel but on the outside of the control panel. In the case of space constraints (single unit substations) the relay may be mounted on a wall or other location, which shall be decided after consultation with Transnet Freight Rail's staff.

8.6.2 The steelwork of all 3 kV DC equipment installed in a traction substation is connected to a DC earth leakage busbar which is mounted on insulators. This busbar is connected to the substation negative (which is near earth potential) through the DC earth leakage relay by means of two 95mm² PVC insulated copper cables. In the event of a failure of the 3 kV DC insulation, the fault current flows to rail (substation negative) by way of the relay causing its operation at the calibrated current setting.

8.6.3 The DC earth leakage busbar may also be installed so that its passes through the aperture of the DC earth leakage relay. The one side of the busbar is connected to the substation negative and the steelwork of the electrical equipment is connected on the other side.

8.6.4 A suitable DC earth leakage relay shall be provided that will trip at a predetermined value in the event of failure of the 3 kV DC insulation.

8.6.5 The DC earth leakage copper busbar dimensions minimum 50x10 mm² shall be provided for. Provision shall be made for a minimum of ten 95 square mm conductor lugs.

8.6.6 The connection between the DC earth leakage primary busbar and the steelwork of the equipment inside the substation shall be made by means of 95 mm² PVC insulated conductors. (Drawing CEE-TBD-7 which shows a typical layout of the interconnections between the steelwork of the equipment and the DC earth leakage busbar.

8.6.7 The DC earth leakage relay shall be robustly constructed and protected against the ingress of dust, dirt and moisture.

8.6.8 The DC earth leakage relay shall have provision for lead-and-wire sealing to prevent unauthorised tampering with the calibration.

8.6.9 Once the DC earth leakage relay has operated it shall remain latched in the tripped position until it is manually reset.

8.6.10 The operation of the DC earth leakage relay shall be instantaneous.

8.6.11 The DC earth leakage relay shall be provided with a flag indicator and facilities for electrical remote flag indication.

8.6.12 The DC earth leakage relay shall incorporate sufficient auxiliary contacts to enable the correct operation of the circuit. The contacts shall be continuously rated to carry and make or break a 5 A, 110V inductive circuit.

8.6.13 The aperture of the magnetic core of the DC earth leakage relay shall be large enough to accommodate two 95mm² PVC insulated copper conductors, which connect the DC earth leakage busbar to substation negative. (See Engineering Instruction S.013 Issue 2).

8.6.14 The DC earth leakage relay shall be capable of operating under short-circuit conditions where the fault current could be in the order of 50 kA DC and the possible rate of rise between 3 and 6 kA per second.

8.6.15 The trip setting of the DC earth leakage relay shall be easily adjustable in the range 10 – 200 A. The trip setting shall be indicated on a dial and pointer to facilitate calibration.

8.6.16 The calibration must be stable and accurate to plus minus 10 percent of the trip setting of the DC earth leakage relay.

8.6.17 The DC earth leakage relay shall be protected from accidental damage or contact by a sturdy enclosure manufactured from a suitable transparent non-conductive material.

8.6.18 The copper busbar shall be insulated from the mounting surface by means of suitable insulators etc and provision shall be for the termination of the earthing conductors.

8.7 MAIN AND AUXILIARY TRANSFORMER GAS ACTUATED AND TEMPERATURE PROTECTION RELAYS CIRCUITRY

8.7.1 Provision shall be made for the main transformer Bucholz relay and oil and winding temperature relay alarm and trip circuits.

8.7.2 Provision shall be made for the auxiliary transformer Bucholz relay and oil / winding temperature alarm and trip circuits as required.

8.8 OVERLOAD PROTECTION FOR AUXILIARY TRANSFORMERS

8.8.1 An overload relay shall be supplied for the protection of the primary winding of the auxiliary transformer.

8.8.2 The overload protection relay shall be the Strike FP2004 or other type approved by Technology Management.

8.9 LOCAL AND REMOTE CONTROL CIRCUITRY AND INDICATION EQUIPMENT

Provision shall be made for the local and remote tripping and closing of the AC primary circuit breaker.

8.10 TRIP CONDITIONS

A trip refers to a condition where a substation may be switched back on load from local or remote in the case where the relevant fault has cleared itself.

- Main Overload.
- Auxiliary transformer overload.
- Oil Temperature.
- Rectifier over temperature.
- 400 V auxiliary supply phase failure with time delay module adjustable from 0 to 60 seconds.
- Wave filter room interlock (where fitted)

8.11 LOCKOUT CONDITIONS

A lockout refers to the condition where the AC primary circuit breaker is tripped and inhibited from being closed by either local or remote control signal. In order to bring the substation back on load the relevant failure has to be addressed and rectified from inside the substation.

- DC Earth Leakage. Complete substation lockout.
- AC Earth Leakage.
- Protection relay failure. (Watchdog)
- Rectifier first diode failure.
- Rectifier attenuation failure.
- Battery undervoltage.
- Bucholz main transformer.
- Bucholz auxiliary transformer (If applicable).
- Low SF6 gas (If applicable).
- Winding temperature.
- Rectifier fan failure.
- No volt coil protection. Refer to Transnet Freight Rail's drawing No CEE-TBK–27 for control circuitry.

8.12 EMERGENCY STOP

A mushroom head (red) latched push button shall be provided. The operation of the pushbutton shall completely shutdown and isolate the substation from all supplies by the tripping of the high voltage AC primary circuit breaker(s) and all the 3 kV DC track breakers. It shall not be possible to carry out local and remote control of the equipment until the emergency push button has been reset.

8.13 LOCK OUT RESET BUTTON AND INDICATION.

Provision shall be made for the manual reset of a lock out condition, which occurs in the substation. The reset of the lockout condition shall only be possible with the operation of the annunciator flag reset and lockout reset button.

9.0 AC/DC DISTRIBUTION PANEL

The panel shall make provision for:

- AC Distribution (400 V, 3 Phase) (Clause 9.1.)
- DC Distribution (110 V DC) (Clause 9.2)
- DC Control and supervisory circuitry and track breaker control. (Clause 9.3)

9.1 AC DISTRIBUTION. (400V, 3 PHASE)

Provision shall be for the following:

- 3 phase 15 kA short circuit rated, 415 V moulded case circuit breaker / fused isolator for the protection of the three-phase auxiliary transformer supply. The fused isolator shall be the AEG or equivalent type that has been approved by Technology Management.
- busbars protected by clear Perspex barriers shall be marked with a danger sign and "400 V."
- current transformers in the control panel for the measurement of the low voltage currents for each phase of the 400 V supply.
- ammeter and voltmeter for the measurement of the 3 phase currents and voltages.
- suitable four-way rotary selector switches for the measurement of the 3 phase currents and voltages.

9.1.1 400V 3PHASE DISTRIBUTION SUPPLY

The following 3 phase supplies are normally required but could vary for each substation. These supplies shall be individually protected by moulded case circuit breakers.

- 60 A calibrating set supply.
- Substation distribution board.
- Substation building fan.
- Battery room fan including overload protection.
- Spare supply points as required.
- 40 A supply for regenerative breaking absorption equipment where specified.

9.1.2 3 PHASE DETECTION FAILURE RELAY.

One three phase detection failure relay shall be installed in the panel. The relay shall monitor the 400 V panel supply for the following:

- Phase failure.
- Sequence reversal.
- Excessive phase unbalance.
- The relay shall have of hysteresis of not more than 5% and a reaction time of 3 seconds or better.
- An adjustable time delay setting shall be incorporated on the front of the detection relay to prevent the operation of the relay due to Eskom supply dips. The time delay adjustment shall be between 0 to 60 seconds.

9.1.3 230 V SINGLE PHASE DISTRIBUTION SUPPLY

The following single phase supplies are normally required but could vary for each substation. These supplies shall be individually protected by moulded case circuit breakers.

- Telecontrol supply.
- Eskom metering supply.
- 3 pin 230 V, 15 A socket outlet protected by earth leakage unit in accordance with SANS 10142.
- Battery charger supply.
- Substation distribution board and lights.
- Supplies to the primary circuit breaker control panel.

9.1.4 400V AUXILIARY SUPPLY CHANGE OVER SYSTEM

9.1.4.1 Unless otherwise specified a 400 V auxiliary supply change over system shall be installed in the panel to provide a continuous 400 V supply in the substation for the following situations.

- Where in a double unit substation two auxiliary transformers are installed and one unit is switched off or
- Where it is required to supply the traction substation from a standby auxiliary supply in the event of the traction substation been switched off.

9.1.4.2 The contactors for the change over system shall be mechanically and electrically interlocked.

9.1.5 INDICATING INSTRUMENTS FOR THE 400 V AC DISTRIBUTION

The panel shall be fitted with the following indicating instrument for the AC distribution auxiliary supply.

- One 0 to 400 V voltmeter with its own selector switch. The instrument shall be labelled "AC VOLTS"
- One 0 to 100 A ampere meter with its own selector switch. The instrument shall be labelled "AC AMPERES"

9.2 110 DC VOLT DISTRIBUTION

9.2.1 The 110 V DC supply shall be obtained from the substation battery bank, which is charged by a freestanding battery charger unit. Refer to Transnet Freight Rail's Specification BBB 2502 latest version. The installation of a battery charger in the AC/DC distribution panel is not acceptable.

Provision shall be made on AC/DC distribution panel for the following:

9.2.2 INDICATING INSTRUMENTS

9.2.2.1 One 0 to 150 V DC voltmeter labelled "DC VOLTS" to indicate the battery output voltage. The voltmeter shall be provided with a selector switch to be able select any of the following positions:

- DC Volts.
- Battery earth fault between battery positive and negative DC earth leakage busbar. (Frame)
- Battery earth fault between battery negative and negative DC earth leakage busbar. (Frame)

9.2.2.2 One 0 to 150 V DC voltmeter labelled "HOLDING COIL VOLTS" to indicate the holding coil supply voltage.

9.2.2.3 One 0 to 30 A DC ampere meter labelled "HOLDING COIL AMPERES" to indicate the holding coil current.

9.2.2.4 One 0 to 30 A DC ampere meter labelled "DC AMPERES" to indicate the battery output current.

9.2.2.5 One DC ampere meter labelled "BATTERY FLOAT CHARGE" to indicate the float charge to the battery. A short circuiting spring loaded switch shall be provided to protect the instrument against fault conditions i.e.

- Charging batteries at the maximum rate.
- Reverse current through the ammeter when the battery charger is disconnected.

9.3 110V DC DISTRIBUTION SUPPLY

9.3.1 The following 110 V DC supplies are normally required but could vary for each substation. These supplies shall be individually protected by moulded case circuit breakers.

- Panel lamps and switches.
- Primary circuit breaker control panel.
- 3 pin 110 V, 15 A DC socket outlet.
- Substation distribution board.
- Eskom metering.
- Telecontrol.
- 3 kV DC undervoltage relay.
- For the 110 V battery supply a double pole, 100 to 150 A DC Isolator or MCB, dependant on the ampere-hour rating of the batteries shall be provided.
- Protection and control circuit supplies for regenerative braking equipment. (If specified).

9.3.2 For the track breaker control circuitry the following size mcb's shall be required:

- The 110 V positive (busbar) supply for the closing coil requires 80 amperes or less depending on type of track breaker.
- The 110 V negative (busbar) supply for the closing coil requires 80 amperes or less depending on type of track breaker.
- The 110 V constant voltage positive supply for the holding coil requires 5 amperes.
- The 110 V positive (busbar) supply for the holding coil requires 5 amperes.
- The 110 V negative (busbar) supply for the holding coil requires 5 amperes.

9.4 DC CONTROL AND SUPERVISORY CIRCUITRY AND TRACK BREAKER CONTROL.

The DC control and supervisory system shall have the following circuitry fitted:

- Battery undervoltage relay adjustable from 80 to 110 V DC.
- Lockout relay.
- Earth leakage slave relays.
- 3 kV DC High Speed Circuit Breaker control circuitry (dependant on number High Speed Circuit Breakers.)
- Selector and control switches.
- Measuring instruments for DC amperes, DC voltages, Holding coils voltage and holding coil current.

10.0 PROTECTION RELAYS

10.1 The protection relays (see clause 8.4 and 8.5) shall be flush mounted on the panel door.

11.0 CIRCUIT BREAKERS, CONTACTORS, RELAYS AND INDICATING LAMPS.

11.1 All contactors and relays shall be protected from the ingress of dirt or dust by means of suitable non-flammable dust tight covers. The relays shall have a protection rating of IP 34 as defined in IEC 60529.

11.2 All circuit breakers, contactors, relays and indicating lamps shall be readily available on the open market.

11.3 Contactors and relays shall be of the sturdiest construction and shall not be affected by vibration.

11.4 DC operated relays shall be capable of satisfactory operation between 85 Volts and 140 Volts without any damage to the relays.

11.5 AC operated relays and contactors shall be suitably rated for the auxiliary supply voltage, which could vary due to the tapping range of the main and auxiliary transformers.

11.6 The contractor shall supply and install surge protection for the 400 volt 3 phase AC and 110 volt DC supplies to the control panels.

11.6.1 Dehn type surge protection units or equivalent shall be provided for the 110 volt DC supply and shall be connected as follows:

- One unit connected between the 110 Volt DC Positive and Negative.
- One unit connected between the 110 volt DC Positive and the panel earth.
- One unit connected between the 110 volt DC Negative and the panel earth.

11.6.2 A DehnGuard MTT pole surge protection unit or equivalent shall be provided for the 400 volt three phase AC supply to the control panels.

11.7 All low voltage circuits in the panel, which require protection, shall be suitably protected by moulded case circuit breakers, which comply with the requirements of SANS 156.

11.8 The low voltage moulded case circuit breakers shall be of suitable rating and rupturing capacity.

11.9 Selector switches used for the DC voltmeter shall be of the make before break type.

12.0 ELECTRICAL MEASURING INSTRUMENTS

12.1 The type of measuring instruments shall be readily available on the open market.

12.2 All analogue electrical indication meters shall be in accordance with IEC 60051-1. The meters shall be flush mounted.

12.3 Analogue meters shall be used for the measurement of AC values and shall have a class index of 1.5. The analogue face of the meters shall not be less than 96mm x 96mm with a 90 degree display.

12.4 Analogue or digital meters may be used for the measurement of DC voltage and current.

12.5 Digital instruments shall have a display of 3.5 digits, 12 milli meters high and have an accuracy of 0.5%.

13.0 TELECONTROL

Provision is made for the closing, monitoring and tripping of the substation equipment from a Control office.
Telecontrol signals are incorporated in both the AC Primary Circuit Breaker and the AC/DC Distribution panels. Provision shall be made for the termination of the telecontrol signals to a common terminal strip. This is connected to the telecontrol panel by means of a multicore cable. Provision shall be made for the following signals:

13.1 AC PRIMARY CIRCUIT BREAKER

- Open, Close and Lockout conditions.

13.2 3 kV DC HIGH SPEED CIRCUIT BREAKERS.

- Open, Close and Lockout conditions.

13.3 TRANSFORMERS (Main and Auxiliary where applicable)

- Transformer Overload.
- Over temperature (Oil / winding).
- Bucholz operation.

13.4 EARTH FAULT CONDITIONS

- DC Earth Leakage.
- AC Earth Leakage.

13.5 RECTIFIER FAILURE

- Over temperature.
- Diode failure.
- Fan failure.

13.6 SUPPLY VOLTAGE FAILURES

- 400 V AC auxiliary supply phase failure.
- 110 V DC Failure.
- 3 kV DC undervoltage relay failure.

13.7 BATTERY

- Battery undervoltage.

13.8 MAIN OVERLOAD/AC EARTH LEAKAGE RELAY FAILURE

- Protection relay failure. (Watchdog)

14.0 WIRING AND TERMINALS.

14.1 Sufficient terminal strips shall be provided for the number of circuit breakers to be controlled.

14.2 All terminals on equipment such as switches and relays shall be suitably numbered and reflected on the substation schematics and wiring diagrams.

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

14.4 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.

14.5 Terminals shall be provided near the bottom of the panels for the connection of cables from ducts, pipes etc. The terminal strips shall be grouped together and arranged so as to facilitate the removal of connections.

14.6 Suitable terminal strips shall be provided to facilitate wiring between the various items of equipment and to the remote control station or telecontrol.

14.7 All wiring shall be carried out on the loop-in system and the looping-in shall be done at the terminal strips. "X" type wiring will not be acceptable.

14.8 The method of loop wiring from one relay to another without protection for the individual circuits is not acceptable.

14.9 The cross-sectional area of all small conductors for low voltage circuits shall be not less than that required to ensure sufficient mechanical strength. The conductors shall be stranded to ensure flexibility.

14.10 All wires and conductors for low voltage circuits shall be a minimum of 2.5 square mm with the exception of the main battery supply cables between the main battery switch and busbars, which shall be at least 16 square mm.

14.11 The conductors for the multicore telecontrol cable shall be at least 1,5 square mm per conductor. Provision shall be made for 10% spare conductors in the multicore telecontrol cable supplied.

14.12 All wires and conductors shall be routed via PVC channel trunking with a removable cover. Use should be made of trunking of sufficient capacity to easily hold the conductors and wires.

14.13 Where low voltage busbars are mounted inside panels, they must be mounted in such a manner as not to cause a hazard to maintenance staff working in the panels. These busbars shall be provided with translucent Perspex barriers to prevent accidental contact with the live busbars. The barriers shall be provided with warning signs.

14.14 Where equipment is mounted on the doors of the panels, adequate flexibility of the wiring shall be provided to eliminate any damage to the conductors.

14.15 The panels shall be provided with earthing studs for 95mm earthing cables. (CEE-TBD-7 Earthing arrangement for 3 kV DC traction substations.)

PROTECTION TEST BLOCK

14.16 A test block shall be provided for the main overload protection relays and shall be fitted in the control panel at a height of one metre from the bottom of the control

14.17 The test block shall be the PK2 or Chamberlain & Hookam type.

14.18 The test block shall form part of the circuitry from the secondary wiring of the current transformers that terminate in the control panel and the overload protection relays.

15.0 PANEL CONSTRUCTION.

15.1 The panels shall be constructed from steel sheeting of at least 2mm thickness. The panels shall be of a rigid construction with facilities for lifting purposes.

15.1.1 Only on special request will the panels be constructed from stainless steel or other rust resistant steel.

15.2 The minimum dimensions shall be:

Height 2100mm (Including metal plinth)
Width 1000mm
Depth 900 mm

Any deviation from the above dimensions shall be discussed with Transnet Freight Rail's electrical staff.

15.3 The panels shall be supplied with rigidly constructed removable gland plates fitted at least 100 mm above the metal plinth to allow for easy access to cables. All required holes shall be punched into the gland plates by the successful tenderer. Any deviation from this shall be discussed with Transnet Freight Rail.

15.4 The panels shall be provided with hinged front doors to allow easy access to the control equipment. The doors shall be fitted with a handle or panel key locks. A minimum of two keys shall be supplied with each panel.

15.5 The panels shall be fitted with dummy interior covers so as to ensure that when components are mounted, no bolts, nuts or screws are visible on the exterior of the panels.

15.6 The control panel(s) shall be powder coated in accordance with SANS 1274. The finishing colours shall be Eau-de-Nil to SANS 1091 colour No H 43 on the outside and white gloss on the inside of the panels.

15.7 The control panel shall be mounted and secure onto a 75mm high metal plinth.

15.8 The panels shall be insulated from the concrete floor to reduce stray currents flowing into the panels.

15.9 The control and protective equipment shall be mounted on or within suitable panels constructed of sheet metal and fitted with front opening hinged doors to all allow for easy access to the equipment.

15.10 The panels shall be so constructed that control switches, indicating lamps, voltmeters and ammeters as well as LED type flag indication devices are visible without opening the hinged front doors.

15.11 The layout of the control equipment fitted on or in the panels, which includes relays, contactors, busbars, terminal strips etc shall provide for easy access.

15.12 The panels shall be provided with a 230V AC light with its own standby battery supply. The light shall be switched on by means of a micro switch when the panel door is opened.

15.13 Three pin 15-ampere industrial plugs shall be supplied for both the 230V AC and 110V DC supplies.

16.0 QUALITY ASSURANCE

16.1 Transnet Freight Rail reserves the right to carry out inspection and any tests on the equipment at the works of the supplier/ manufacture.

16.2 Arrangements must be made timeously for such inspections to be carried out before delivery of the equipment to the client.

17.0 SITE TESTS AND COMMISSIONING.

17.1 The contractor shall be responsible for carrying out on-site functional tests before the commissioning of the equipment.

17.2 Acceptance by the Maintenance Engineer or the delegated staff 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.

17.3 Commissioning will only take place after all defects have been rectified to the satisfaction of the Maintenance Engineer or the delegated staff.

17.4 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.

17.5 On completion of commissioning the contractor will hand the equipment over to the Maintenance Engineer or the delegated staff in terms of the relevant engineering instructions.

18.0 DRAWINGS, INSTRUCTION MANUALS AND SPARES LISTS

18.1 Drawings, instruction manuals and spare parts catalogues shall be supplied in accordance with Transnet Freight Rail's specification CEE.0224 and BBB0041.

18.2 The tenderer shall supply three copies of an instruction/maintenance manuals, schematic and wiring diagrams.

18.3 Approved schematic and wiring diagrams, which are supplied for maintenance and faultfinding, shall be A3. (29,7cm x 42cm).

18.4 The contractor shall submit details of spares required in accordance with specification No. CEE.0224.

18.5 All spares recommended for normal maintenance purposes that are not available locally (requires importation) must be highlighted.

19.0 SPECIAL TOOLS AND/OR SERVICING AIDS

19.1 Special tools or servicing aids necessary for the efficient maintenance, repair or calibration of the equipment shall be quoted for separately.

19.2 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.

20.0 TRAINING

20.1 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.

21.0 GUARANTEE AND DEFECTS

21.1 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.

21.2 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.

21.3 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.

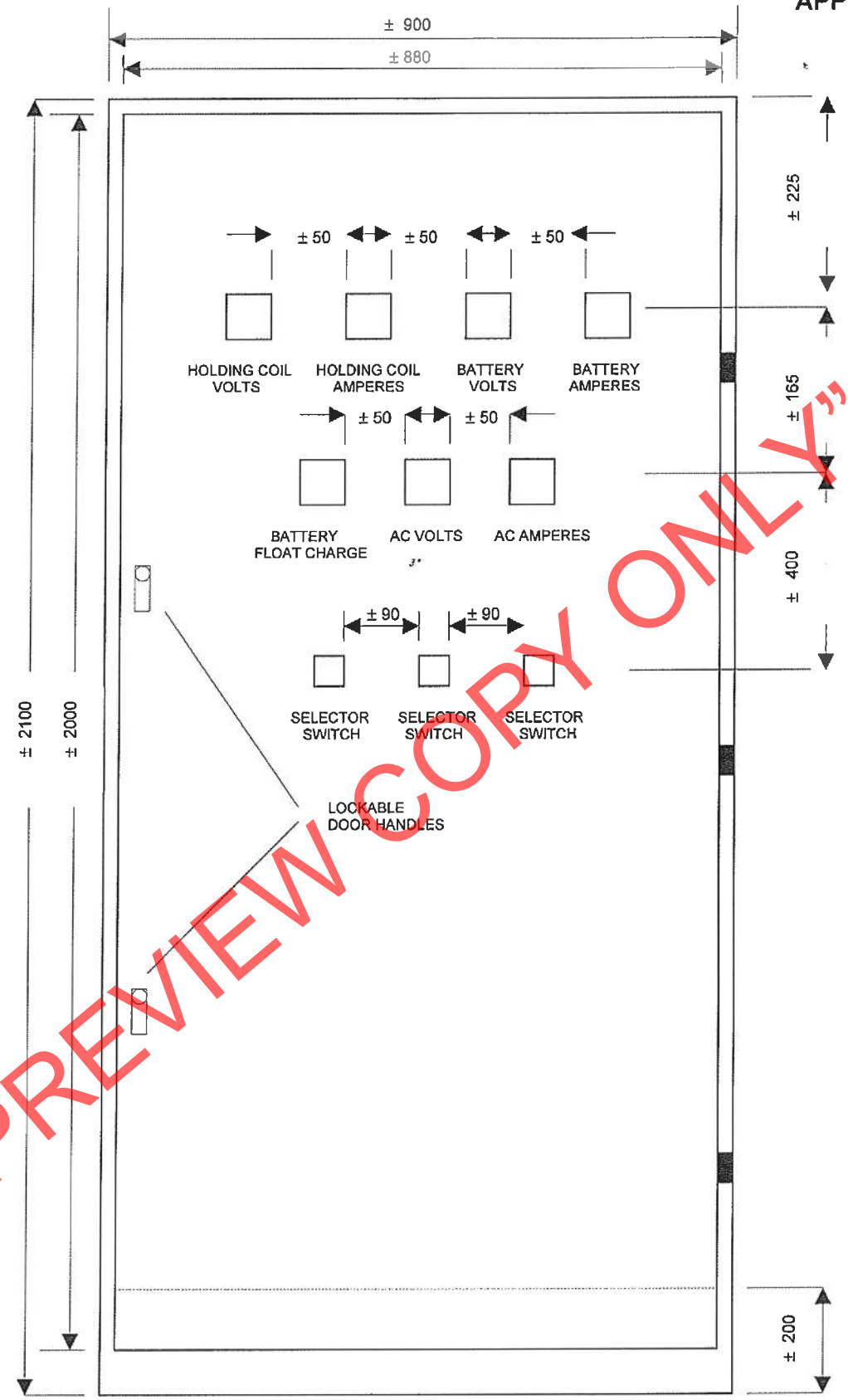
21.4 If urgent repairs have to be carried out by Transnet Freight Rail's staff to maintain supply during the guarantee period the contractor shall inspect such repairs to ensure that the guarantee period is not affected and should they be covered by the guarantee, reimburse Transnet Freight Rail the cost of material and labour.

22.0 PACKAGING AND TRANSPORT.

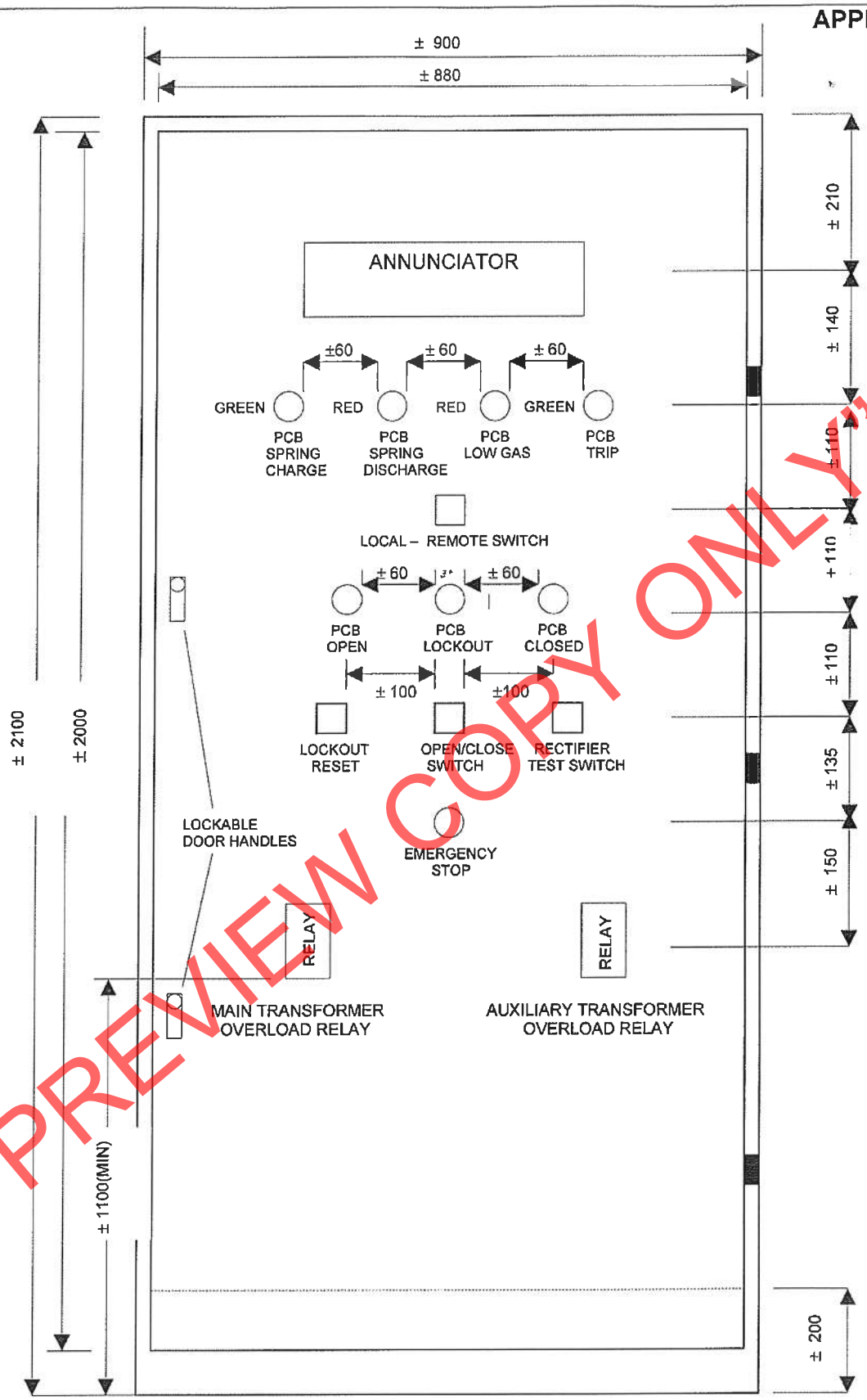
22.1 The tenderer shall ensure that the equipment be packed in such a manner that it will be protected during handling and transport.

22.2 The tenderer shall provide transport for the delivery of the equipment to the site where required.

END



AC/DC DISTRIBUTION PANEL



AC PRIMARY CIRCUIT BREAKER CONTROL PANEL

NOTE: WHERE THE ANNUNCIATOR PANEL MAKES PROVISION FOR THE SF6 LOW GAS INDICATION THE PCB LOW GAS AND PCB TRIP INDICATION LIGHTS MAY BE OMITTED

SCHEDULE OF REQUIREMENTS
(To filled in by the client)

OPTIONS OF CONTROL PANELS CONSTRUCTION.

1.0	Single AC primary circuit breaker control panel.	YES / NO
2.0	Single AC/DC distribution panel.	YES / NO
3.0	Combination of 1.0 and 2.0 into one panel.	YES / NO
4.0	Name Plate of substation to be fitted on the control panels	YES / NO

SPOORNET

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

Technical: Railway Engineering

Specialised Business: COALlink

INDEX

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/km²/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 fire 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 from 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 mm² 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 95mm² 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 Spoornet Engineering staff who will approve or reject them.

8.6.2 No additions, alterations or modifications shall be acceptable unless Spoornet 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

TRANSNET
freight rail

TECHNOLOGY MANAGEMENT.

SPECIFICATION.

REQUIREMENTS FOR POSITIVE ISOLATOR FOR 3 kV DC TRACTION SUBSTATIONS

Author:	Chief Engineering Technician Technology Management	D.O.Schulz	.....
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Date: 21st 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 provided 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 500mm² 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.

TRANSNET FREIGHT RAIL'S REQUIREMENTS FOR THE INSTALLATION OF ELECTRICAL EQUIPMENT FOR 3kV DC TRACTION SUBSTATIONS

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Date: 06th October 2011

Circulation Restricted To:

Transnet Freight Rail – Chief Engineer Infrastructure
- Technology Management

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SECTION 1: SUBSTATION DESIGN INFORMATION

1.0 SCOPE

1.1 This specification covers Transnet Freight Rail's requirements for the installation of electrical equipment in 3kV DC traction substations.

1.2 This specification should be read with the Scope of Work specification for each site/project and the applicable equipment specifications.

1.3 This specification also covers the requirements for the supply of security fencing, preparation of the High Voltage (HV) outdoor yard and the erection of all structural steelwork.

2.0 STANDARDS, PUBLICATIONS AND DRAWINGS

Unless otherwise specified this specification must be read in conjunction with the current edition of the relevant SANS, BS and Transnet Freight Rail's specifications.

2.1 SOUTH AFRICAN NATIONAL STANDARDS (SANS)

SANS 121:	Hot dip galvanized coatings for fabricated iron or steel articles. Specifications and test methods.
SANS 156:	Moulded-case Circuit Breakers.
SANS 780:	Distribution Transformers.
SANS 1019:	Standard voltages, currents and insulation levels for electricity supply.
SANS 1091:	National Colour Standard.
SANS 1222:	Enclosures for Electrical Equipment.
SANS 1339:	Cross-Linked Polyethylene (XLPE) - Insulated Electric cables for rated voltages (3,8/6,6kV to 19/33kV)
SANS 1431:	Weldable structural steels.
SANS 1507:	Electric cables with extruded solid dielectric insulation for fixed installations. (300/500V to 1900/3,300V) Part 1
SANS 10142-1:	The wiring of premises. Part 1
SANS 60044-1:	Instrument Transformers Part 1. Current Transformers.

2.2 TRANSNET FREIGHT RAIL SPECIFICATIONS/ ENGINEERING INSTRUCTIONS

CEE.0023:	Laying of cables.
CEE.0045:	Painting of steel components of electrical equipment.
CEE.0099:	Specification for 3kV DC high speed circuit breakers for traction substations.
CEE.0224:	Drawings, catalogues, instruction manuals and spares lists for electrical equipment supplied under contract.
CEE.0227:	The manufacture of 3kV DC breaker cells and trucks.
BBB 0496:	3kV rectifier for traction substations.
BBB 0845:	Requirements for metal oxide surge arresters in accordance with SANS 60099-4.
BBB 1267:	Specification for Outdoor High Voltage Alternating Current Circuit Breaker in Accordance with SANS 62271-100.
BBB 1616:	450 Volt gas arrester spark gap for traction power supplies.

BBB 2502:	Requirements for battery charger for 3kV DC traction substations.
BBB 2721:	AC primary circuit breaker control panel and AC/DC distribution panel for 3kV traction substation.
BBB 3005:	3kV DC under voltage relay manufacturing specification.
BBB 3139:	Wave filter capacitors for 3kV DC traction substations.
BBB 3162:	Wave filter inductors for 3 kV DC traction substations.
BBB 3890:	Requirements for 1.8 milli Henry DC reactor for 3kV DC traction substations.
BBB 5019:	Requirements for traction transformers for 3kV DC traction substations in accordance with BS 171 and IEC 60076-1.
BBB 7842	Outdoor, High Voltage, Alternating Current Disconnectors combined with earthing switch.
BBC 0198:	Requirements for the supply of cables.
BBC 0330:	Isolation transformer.

2.3 STATUTORY REQUIREMENTS

Occupational Health and Safety Act and Regulations, Act 85,1993

3.0 TENDERING PROCEDURE

3.1 Tenderers shall indicate clause-by-clause compliance with the specification as well as the relevant equipment 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.

3.2 The tenderer shall motivate a statement of non-compliance.

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, and 3.3 could preclude a tender from consideration.

4.0 SERVICE 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:	-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.

5.0 ELECTRICAL SERVICE CONDITIONS

5.1 The incoming AC voltage can vary ±5% of the nominal system r.m.s voltage. Under crippled conditions the supply voltage can drop to as low as minus 15% of the nominal r.m.s voltage.

5.2 Frequency of the supply voltage is 50 ± 2.5 Hz.

5.3 The AC high voltage system shall be treated as effectively earthed unless otherwise specified.

5.4 The traction DC supply voltage is 3,15 kV DC nominal but can vary between 2,4kV and 3,9kV for sustained periods.

5.5 The 3kV DC equipment may be subjected to fault currents up to 30kA for 200 milli seconds.

6. 0 GENERAL REQUIREMENTS

6.1 Equipment/Installations supplied shall be in terms of this specification. Deviations from the specification will not be allowed without the written consent of the Project Manager/Engineer.

6.2 Transnet Freight Rail reserves the right to subject material and equipment offered to test or inspection to verify compliance with the clauses of this specification, prior to adjudication or at any stage during manufacture.

6.3 The tenderer shall submit the layout drawings of equipment, electrical wiring schematics, and constructional designs to Transnet Freight Rail for design review.

6.4 The successful tenderer will be responsible for all costs caused by modifying or replacing equipment accepted by Transnet Freight Rail on the grounds of his statement of compliance and found by Transnet Freight Rail not to comply.

6.5 All equipment shall be adequately earthed, insulated, enclosed and interlocked to ensure the safety of staff as well as equipment.

6.6 The general design and layout of all equipment shall provide for easy access to all parts.

6.7 The equipment shall be installed in such a manner so as to limit fire damage, which may be caused by equipment failure, overheating or flashovers.

6.8 The substation control and protection circuits shall be designed and wired according to the fail-safe principle. Control equipment, contactors and relays shall de-energise under fault, power failure or alarm (flag) conditions.

6.9 No high voltage cables shall be laid in the same trench or duct as low voltage cables.

7.0 GENERAL DESIGN OF EQUIPMENT

7.1 This section covers substation equipment with electrical capacities between 3,0 MW and 6,0 MW.

7.2 The overload ratings of the rectifier units shall be:

2 times full load for thirty minutes.

3 times full load for one minute.

3 ½ times full load for ten seconds.

7.3 The substation can either be a single unit or double unit substation. Each unit comprises of one set of high voltage AC switchgear, one rectifier transformer, and one rectifier assembly, connected for 6 or 12 pulse operation and protected by a AC primary circuit breaker.

7.4 For a double unit substation each unit shall have the overload rating as specified in clause 7.2.

7.5 Each substation unit shall be capable of operating independently to allow for maintenance, fault finding and servicing of the equipment.

8.0 INSULATION AND CLEARANCES FOR 3kV DC EQUIPMENT

8.1 All indoor equipment, which may be energised at a potential of more than 1,0kV shall be protected by, metal barriers, mesh type screens or panels.

8.2 The minimum clearance in air between the rectifier unit and any metal barriers, mesh type screens or panels shall not be less than 450mm.

8.3 All exposed electrical equipment and busbars connected between the rectifier transformer secondary and the rectifier cubicle(s), or between the rectifier cubicle(s), positive isolators, DC smoothing equipment or track breakers, which is at a potential above 1,0kV, shall be arranged so that there is a minimum clearance of 2,7 m from the lowest "live" high voltage connections and ground or the floor of the access way, unless suitably screened, or otherwise protected.

8.4 All nominal 1,5kV and 3kV insulation to earth shall be designed such that the complete rectifier assembly, when installed on site ready for commissioning, will successfully withstand a test voltage of 10,5kV, 50 Hz AC for one minute.

8.5 Where the equipment or subassemblies of the rectifier assembly is enclosed and insulated from the outer framework, the insulation between the equipment and outer framework shall withstand the test voltage of 10,5kV 50 Hz for one minute.

8.6 The clearance between the reactor and any metal frame shall not be less 100mm. The reactor must successfully withstand a test voltage of 10,5kV AC 50 Hz for one minute

8.7 The successful tenderer shall advise what precautions must be taken before undertaking the withstand insulation level voltage tests to avoid damage to the equipment.

8.8 Creepage distance of insulation and the required air clearances shall be as large as possible. The latter shall not be less than:

- Outdoors: 150mm between the transformer secondary busbars and any steelwork such as wall plates, screening etc.
- Indoors: 100mm between the equipment at nominal 1,5kV or 3kV DC and negative busbars and panel steelwork, between the high voltage AC supply to the rectifier cubicles and panel steelwork, the equipment at nominal 3kV DC and negative busbars.

9.0 OUTDOOR CLEARANCES AND INSULATION LEVELS

9.1 The minimum safety outdoor earth clearances which shall be maintained between any live conductor or metal and earthed metal and the minimum clearances of power lines above ground are in accordance with the statutory requirements of clause 15.1 of the "Electrical Machinery Regulations" of the "Occupational Health and Safety Act and Regulations, Act 85,1993", and are tabled below: -

TABLE 1:

Highest phase-to-phase r.m.s voltage for equipment. (U_m)	24kV	36kV	48kV	72kV	100kV	145kV
Nominal system r.m.s. voltage. (U_n)	22kV	33kV	44kV	66kV	88kV	132kV
Minimum safety outdoor clearance	320mm	430mm	540mm	770mm	1000mm	1450mm
Minimum clearance of power lines above ground						
Outside security fence but within Transnet Freight Rail's reserve	5200mm	5300mm	5400mm	5700mm	5900mm	6300mm
Outside Transnet Freight Rail's reserve	5500mm	5500mm	5500mm	5700mm	5900mm	6300mm

9.2 In terms of Transnet Freight Rail's Electrical Safety Instructions the clearances between the nearest exposed electrical equipment and a restricted access way are tabled below: -

TABLE 2:

Highest phase-to-phase r.m.s voltage for equipment. (U_m)	24kV	36kV	48kV	72.5kV	100kV	145kV
Nominal system r.m.s. voltage. (U_n)	22kV	33kV	44kV	66kV	88kV	132kV
Restricted access way (Vertical height) *	2820mm	2930mm	3040mm	3270mm	3500mm	3950mm

*See clause 903.1.3 of "Transnet Freight Rail's Electrical Safety Instructions"
(The vertical heights in restricted access ways for the various system voltages are calculated by adding 2,5metres to the normal outdoor earth clearance for the different system voltages. Refer to Annexure 9.4 of Transnet Freight Rail's Electrical safety Instructions).

INSULATION LEVELS

9.2 For the medium and high voltage nominal r.m.s voltage systems on Transnet Freight Rail the recommended Insulation levels in accordance with SANS 1019 is tabled in table 3.

TABLE 3

Highest phase-to-phase r.m.s voltage for equipment. (Um)	Nominal system r.m.s. voltage. (U_n)	Rated lightning impulse withstand voltage peak.	Rated short duration power- frequency withstand r.m.s voltage.
7,2 kV	6,6 kV	75 kV	22 kV
12 kV	11 kV	95 kV	28 kV
24 kV	22 kV	150kV	50 kV
36 kV	33 kV	200 kV	70 kV
52 kV	44 kV	250 kV	95 kV
72,5 kV	66 kV	350 kV	140 kV
100 kV	88kV	380 kV 450 kV	150 kV 185 kV
145 kV	132 kV	550 kV 650 kV	230 kV 275 kV
245 kV	220 kV	850 kV 950 kV	360 kV 395 kV
Insulation levels for highest voltage for equipment U_m < 100 kV are based on an earth fault factor equal to $\sqrt{3}$ and for U_m > 100 kV an earth fault factor equal to $0,8\sqrt{3}$. Where more than one insulation level is given per voltage system, the higher level is appropriate for equipment where the earth fault factor is greater than 1,4.			

TABLE 3: Standard Voltages and insulation levels in accordance with SANS 1019:2008 [1]

SECTION 2: TRACTION SUBSTATION EQUIPMENT

OUTDOOR YARD EQUIPMENT

10.0 METAL OXIDE SURGE ARRESTERS

10.1 The contractor shall supply and install metal oxide gapless surge arresters in accordance with Transnet Freight Rail's specification BBB 0845.

10.2 The surge arresters shall be connected between each phase of the high voltage supply and substation main earth electrode/earth mat

10.3 The maximum protected distance from the main transformer bushing terminal to the surge arrester terminal shall be as indicated in table 4.

TABLE 4:

NOMINAL SYSTEM R.M.S VOLTAGE (kV)	MAXIMUM DISTANCE (Metres)
44kV	5
66kV	6
88kV	6
132kV	7

10.4 The neutrals of high voltage supplies are to be treated as effectively earthed unless otherwise specified.

10.5 For the installation of high voltage surge arresters on the main transformer, refer to Transnet Freight Rail' s drawing BBB 0938

11.0 HIGH VOLTAGE AC DISCONNECTOR

The contractor shall supply and install the high voltage AC disconnecting switch in accordance with Transnet Freight Rail's specification BBB 7842.

12.0 HIGH VOLTAGE PRIMARY CIRCUIT BREAKER

The contractor shall supply and install the high voltage AC primary circuit breaker in accordance with Transnet Freight Rail's specification BBB 1267.

13.0 MAIN CURRENT TRANSFORMERS

13.1 The main current transformers shall comply with the requirements of Transnet Freight Rail specification BBB 0937.

13.2 The main current transformers shall either be fitted in the high voltage bushings of the main traction transformer or shall be the freestanding post type current transformers install on the line side of the main traction transformer.

13.3 In the event of Eskom or Local Utility requiring three current transformers for metering purposes the successful contractor shall supply and install the additional current transformer.

13.4 The ratios, accuracy and burdens of the current transformers shall be in accordance with Transnet Freight Rail's Specification BBB 0937.as specified:

14.0 MAIN TRACTION TRANSFORMER

14.1 The contractor shall be responsible for the delivery, assembling, filling of transformer oil and installation on site of the main traction transformer in accordance with Transnet Freight Rail's Specification BBB 5019.

15.0 AUXILIARY TRANSFORMER

15.1 The contractor shall make provision for the supply of an auxiliary transformer which shall comply with the requirements of SANS.780

15.1.1 The auxiliary transformer shall be three phase with a minimum rating of 50kVA or higher depending on the substation requirements.

15.1.2 The 3 phase auxiliary transformer shall be supplied from the tertiary winding of the main traction transformer

15.1.3 The auxiliary transformer shall be the sealed unit type suitable for outdoor installation. Full details of the transformer shall be submitted.

15.2 In the case of a double unit substation one auxiliary transformer may be provided unless otherwise specified.

15.3 The secondary winding of the auxiliary transformer shall be star-connected.

15.4 The auxiliary transformer shall supply the required kVA rating without exceeding the permissible temperature rise laid down in SANS 780.

15.5 The nominal no-load secondary voltage of the auxiliary transformer shall be 400V three phase.

15.6 Off-load, externally operated tap changing gear shall be provided on the transformer, with tappings to compensate for any change in the main transformer tapping.

15.7 All primary and secondary terminals, including the secondary neutral, shall be brought out through the transformer tank by means of bushing type terminals and shall be arranged for busbar/cable connections.

16.0 AUXILIARY TRANSFORMER PROTECTION

PRIMARY WINDING

16.1 The contractor shall make provision for overload protection of the primary winding. Refer to clause 8.8 of specification No BBB 2721.

16.2 The protection system shall consist of an approved type of overload relay with its associated current transformers.

16.3 SECONDARY WINDING

16.4 The contractor shall supply and install a three phase isolating and earthing switch for the secondary supply of the auxiliary transformer to the substation.

16.5 The isolating and earthing switch shall be fitted with mechanical interlocking of the key exchange type, which shall form part of the interlocking procedure for the substation. Refer to clauses 31.0 and 32.0 of this specification.

17.0 AC EARTH LEAKAGE CURRENT TRANSFORMER.

17.1 The contractor shall supply and install a bar primary current transformer for the AC earth leakage protection. The current transformer shall be installed on the support steel structure of the primary circuit breaker.

17.2 One terminal of the primary winding shall be connected to the primary circuit breaker frame and the other terminal shall be connected to the substation main earth electrode/mat. (Refer to drawing CEE-TBD-7 and BBB 3620).

17.3 The current transformer shall be class 10P10, ratio 50/5 or 100/5.

17.4 The current transformer shall be designed to withstand a test voltage of 2kV for 1 minute.

INDOOR EQUIPMENT

18.0 3kV DC RECTIFIER

18.1 The contractor shall supply and install 3kV DC rectifiers in accordance with Transnet Freight Rail's Specification BBB 0496.

18.2 Each rectifier unit and its associated control equipment shall be designed to form an independent unit.

18.3 The rectifier equipment shall be installed in screened bays fitted with gates.

18.4 The gates shall be fitted with mechanical interlocks of the key exchange type in accordance with clauses 31 and 32 of the specification.

18.5 The bay screens shall be constructed of approximately 25mm woven wire mesh or expanded metal fixed to tubular or angle iron frames complete with doors, pillars, gates etc.

18.6 The height of the screens and gates shall be similar to the height of the control panels but shall be not be less than 1,8 m.

18.7 In a double unit substation the rectifier units are referred to as the "A" and "B" units and shall be labelled as such.

18.8 It is required that each rectifier unit in a double unit substation can be isolated independently and earthed without shutting down the whole substation.

18.9 Individual rectifier units shall be screened from each other and from any other live common equipment. A mechanical key exchange interlocking system type in accordance with clauses 31 and 32 shall be fitted to ensure the safety of personnel working on the isolated rectifier equipment.

18.10 The rectifier units and bay screens shall be insulated from the floor.

19.0 3kV DC REACTOR

19.1 The contractor shall supply and install a 1.8 milli Henry 3kV DC air core reactor for each rectifier unit. The installation shall include the supply of all the required insulators, foundations, foundation bolts and fasteners.

19.2 The 3kV DC reactor shall be in accordance with Transnet Freight Rail's Specification BBB 3890.

19.3 The reactor shall be insulated from the substation floor by means of insulators.

19.4 Sufficient space shall be allowed for access to the reactor for maintenance and inspection purposes.

20.0 WAVE FILTER

20.1 The contractor shall supply and install the wave filter equipment in accordance with Transnet Freight Rail's specification BBB 3139 for wave filter capacitors and BBB 3162 for inductor coils.

20.2 A wave filter is connected in parallel with the rectifier output. The filter unit is a capacitive inductive circuit, which is tuned to resonate at specific harmonic frequencies.

20.3 The filter equipment shall be so designed that no individual harmonic voltage is greater than 2% of the output voltage.

20.4 The inductor coils shall have sufficient adjustment to compensate for change in the capacitance values due to ageing. Refer to Transnet Freight Rail's drawing BBB 3483 for assembly.

20.5 A 100 Ampere High Rupturing Capacity (H.R.C) fuse shall be fitted to protect the wave filter equipment.

20.6 The fuse holder shall be mounted on insulators.

20.7 The insulators shall be so designed that the flashover path is not less than 100mm and shall support the fuse at a distance of not less than 100mm from the bolts securing the base plate. The insulators shall have a minimum dry flashover value of 20kV.

20.8 Access to the wave filter equipment shall only be possible once the wave filter capacitors have been connected to rail, discharged and the primary circuit breaker tripped.
A 75 kilo Ohm resistor consisting of two 150 Kilo Ohm, 150 watt vitreous enamel resistors connected in parallel shall be provided for the discharging of the wave filter capacitors when the equipment is isolated and earthed.

20.9 The discharge resistors shall be mounted on a suitable insulation panel or bar, which shall be insulated for 3kV DC. A minimum clearance of 75mm must be provided between the terminals, and 100mm between any 3kV live portion of the equipment and earth.

20.10 The wave filter capacitors shall be earthed with 95mm² PVC insulated copper cables to the DC earth leakage system.

20.11 The wave filter equipment shall be housed in a separate explosion proof room or cubicle.

21.0 3kV DC POSITIVE ISOLATOR

21.1 The contractor shall supply and install the 3kV DC positive isolator in accordance with Transnet Freight Rail's specification BBB 4724.

21.2 The DC positive isolator metal cubicle/housing shall be insulated from the substation floor.

22.0 CONTROL PANELS

22.1 The contractor shall supply and install the AC primary circuit breaker control panel and the AC/DC distribution panel in accordance with Transnet Freight Rail's specification BBB 2721.

22.2 The control panels shall be insulated from the substation floor.

ELECTRONIC EQUIPMENT

22.3 The tenderer must be aware that high voltage surges and transient voltages can be induced in low voltage and control wiring due to switching and lightning. Special care shall be taken in the design and layout of the equipment to limit these voltages.

22.4 Electronic equipment shall suitably be protected against over voltages, surges and transients. Dehn type surge protection units or equivalent shall be used. Liberal use of metal oxide varistors is also encouraged.

23.0 BATTERIES

23.1 The contractor shall supply, install and commission a 53 cell 110 Volt Planté lead acid battery bank. The capacity of the battery can either be 100 Ampere hour rating, 200 Ampere hour rating or capacity dependant on the substation requirements.
The standard for the batteries shall be the 10-hour rate at 20°C. The battery shall be capable of delivering a minimum of 10 Amperes for 10 hours.

23.2 Batteries are installed in traction substations for control and protection purposes. The battery is used for the following functions:

- Tripping and closing of primary circuit breakers.
- Supply to protection relays.
- Closing and holding coil supply to DC high speed circuit breakers.
- 110 Volt supply to control panel.

24.0 BATTERY CHARGER.

24.1 The contractor shall supply and install the battery charger in accordance with Transnet Freight Rail's specification BBB 2502.

24.2 The battery charger shall be insulated from the substation floor by means of "Marley" or "Lino" floor covering not less than 2mm thickness.

25.0 TRACK FEEDER HIGH SPEED CIRCUIT BREAKERS

25.1 The successful tenderer shall supply and install the required 3kV DC high speed circuit breakers in accordance with Transnet Freight Rail's specification CEE.0099 as well as with the following additional requirements:

25.2 The high-speed circuit breakers shall be of the conventional truck mounted type as commonly used by Transnet Freight Rail in the 3kV DC traction substations.

25.3 High-speed circuit breakers shall be fitted with an automatic reclosing feature, which provides for 1 (one) reclosure at 20 to 35 seconds interval. Refer to drawings CEE-TBP-35. "Connection diagram for the high speed circuit breaker and electronic control relay".
CEE-TBP-39."Circuit diagram for auto reclosure for the high speed circuit breaker.

25.4 Transnet Freight Rail shall provide the auto reclosure relays. The relays shall be wired by the contractor in accordance with the requirements of clause 25.3.

25.5 The high speed circuit breakers shall be complete in all respects. This shall include housings, rack out trucks, base rails, main and auxiliary contacts and flapper gear and any other fittings or equipment required for the correct operation of the high-speed circuit breakers.

25.6 The high-speed circuit breakers shall be racked into breaker cells, each having two fixed contacts mounted at the rear of the breaker cell. One contact is connected to the substation positive busbar and the other to a wall bushing mounted in the building outer wall.

25.7 All other items of material such as cell slabs, main busbars, earthing connections, wall bushing plates or blanking-off plates, control cables etc, shall be included in the tenderer's offer.

25.8 Transnet Freight Rail shall provide details of the wall plate frame and standard cell slabs where applicable.

25.9 Where access is possible to the rear of the high-speed circuit breakers (busbar chamber) access barriers shall be installed.

25.9.1 The barriers shall be fixed to angle iron frames with fasteners which only be removed with tools. Warning signs shall be fitted to the barriers.

26.0 MODULAR TYPE STEEL HOUSED HIGH SPEED CIRCUIT BREAKERS

26.1 Where tenderers offer modular type high-speed circuit breakers they shall submit full information, construction and dimensional drawings with their offer.

26.2 Transnet Freight Rail specification CEE.0227 shall be used as a guideline.

26.3 The tenderers must be fully aware that the requirements of Transnet Freight Rail's specification CEE.0099 are relevant.

26.4 Transnet Freight Rail reserves the right to accept or reject offers for equipment after consultation with tenderers. Transnet Freight Rail's Senior Engineer, Technology Management, shall approve all designs.

26.5 The modular type steel housings shall be insulated from the substation floor.

27.0 REGENERATIVE HIGH SPEED CIRCUIT BREAKER

27.1 At certain substations Transnet Freight Rail will require 3kV DC regenerative braking energy absorption equipment. If required the successful contractor shall supply the high speed circuit breaker for the protection of the regenerative breaking equipment in accordance with Transnet Freight Rail's specification CEE.0099.

28.0 3kV DC UNDERVOLTAGE RELAY

28.1 The contractor shall supply and install a 3kV DC undervoltage relay with a high voltage potential divider in accordance with Transnet Freight Rail Specification BBB 3005 and shall provide the following:

28.2 Fibre optic technology must be used to provide galvanic isolation between the potential divider and the undervoltage relay.

28.3 The potential divider shall be mounted in the 3kV busbar chamber or in the high voltage compartment of the positive isolator cubicle in accordance with Transnet Freight Rail's Specification BBB 4724.

28.4 The potential divider shall be protected by an H.R.C fuse connected between the positive side of the 3kV DC supply and the input of the potential divider.

28.5 Insulation clearance shall be not less than 100mm. All normally live equipment on the potential divider shall withstand a test voltage of 10,5kV AC RMS 50 Hz for one minute to earth without breakdown.

28.6 If the undervoltage relay is wall mounted, an engraved warning label shall be fixed to the front of the undervoltage relay panel with the following warning:

WARNING

THE POSITIVE BUSBAR MUST BE ISOLATED AND EARTHED BEFORE WORK IS UNDERTAKEN ON THE UNDERVOLTAGE RELAY

28.7 The following connections shall consist of 95mm² cross-sectional area copper or copper equivalent conductors.

- Potential divider to negative busbar.
- Resistor base plate to DC earth leakage busbar.
- Relay metal case to DC earth leakage busbar.

SECTION 3: INSTALLATION

SUBSTATION EARTHING

29.0 INDOOR EARTHING (REFER TO DRAWING CEE-TBD-0007)

The successful contractor shall supply, install and comply with the following:

29.1. The supply and installation in the substation building of all earthing conductors for the earthing of all metal work which includes supporting frames, control panels, battery charger, positive isolator panel, track breaker cells, rectifier bay screens, chequer plates and metal bases of insulators mounted directly on the walls or floor etc.

29.2. The frames and bases of all items associated with the 3kV DC including the track feeder wall plates, shall be connected through the DC earth leakage relay to the negative busbar in accordance with Transnet Freight Rail' s drawing CEE-TBD-0007.

29.3. The DC earth leakage relay and the installation thereof shall comply with the requirements specified in clause 8.6 of Transnet Freight Rail' s specification BBB2721.

29.4. Earthing conductors which could be subjected to 3 kV DC faults caused by insulation breakdown, etc., shall be not less than 70mm² copper strap cross-sectional area or 95mm cross-sectional area PVC insulated stranded copper cable. Other earth conductors must have a minimum of 16mm² copper cross-sectional area.

29.5. The earthing system for the 3kV DC positive busbar chamber shall be supplied by the successful tenderer. The design of the system shall be in conjunction with Transnet Freight Rail staff.

29.6. The successful tenderer shall supply the portable earthing device and cables according to Transnet Freight Rail's requirements.

29.7. All connections to the DC earth leakage relay shall form part of a ring circuit for safety when part of the circuit is disconnected. Refer to drawing CEE-TBD-0007.

29.8. The earth conductors shall not be installed in such a manner as to bridge out the earth leakage relay.

29.9. The resistance between the DC earth leakage busbar and the substation main earth electrode/mat shall be not less than 25 ohms.

29.10. Holding-down bolts grouted in the floor shall not be in direct contact with reinforcing or in with the earth under the concrete floor in the substation.

29.11. Where mounting bolts are used for securing electrical equipment to the floor, these bolts must be insulated to prevent electrical contact with any reinforcing or floor.

29.11.1 The indoor substation equipment shall be earthed in groups as shown in Transnet Freight Rail's drawing CEE-TBD-0007.

30.0 OUTDOOR EARTHING (DRAWING NO CEE-TBD-7 AND BBB 3620)

The successful tenderer shall supply, install and comply with the following:

30.1 Outdoor yard earthing which includes earth spikes, trench earths, earth connections to the support steel structures and fence posts. The material used shall comply with Transnet Freight Rail's specification BBB 3059 and drawing BBB3620.

30.2 A rail-earth switch mounted on the gate that provides access to the outdoor yard and where applicable to the 3kV DC overhead feeder security area and provide all connections thereto.

30.3 In Transnet Freight Rail switchyards where the supply from the Electrical Utility is terminated on portal structures or where a flying busbar is provided the contractor shall earth these structures.

30.3.1 Install two 50mm² galvanised steel earth conductors, one each between the outside portal structure or flying busbar support and the gable of the substation building.

30.3.2 The earth conductor shall be suitably terminated and connected to the portal or flying busbar structures. A suitable bracket shall be supplied and mounted on the gable of the substation building. The earth conductors shall directly be terminated on the bracket and connected to the main earth electrode/mat.

Insulating of structures and electrical equipment.

30.3.3 The tenderer shall make provision for the insulating of the support steel structures for i.e. the primary circuit breaker, main current transformers and any other structure that is connected to the AC earth leakage system from the concrete foundation.

30.3.3.1 The insulating material shall be either the same material used for the insulating of the mast bases for the overhead track equipment or other insulating material that has been approved by Technology Management.

30.4. The tenderer shall make provision for the insulating of the base of the main traction transformer from the concrete plinth. Malthoid or any other approved insulation shall be used.

31.0 INTERLOCKING (mechanical)

GENERAL

31.1 The equipment for each substation shall include a mechanical interlocking system; preferably the "Castell" or other approved key type. Full details of the type offered instead of the "Castell type shall be submitted with the tender.

31.2 The mechanical interlocking system must be designed to prevent access to the high voltage equipment whilst "live" and ensure that switching and isolating operations are carried out in the correct sequence.

31.3 All equipment shall be delivered with the necessary interlocks fitted.

31.4 It shall not be possible to operate the locks and release the keys in any but the correct sequence or in any position of the switches or gates, other than the fully "closed" or fully "open" position, as the case may be.

31.5 When a unit is switched to local condition and isolated, no remote switching from the control office shall be possible. Tenderers shall furnish full explanatory details of the arrangement whereby the foregoing provisions are met.

31.6 The track feeder breakers shall remain closed throughout the isolation procedure.

32.0 ISOLATING PROCEDURE

Sequence to isolate a single unit substation rectifier unit.

32.1 Trip high voltage AC circuit breaker.

32.2 Open high voltage AC disconnecting switch-key "1" released.

32.3 Remove key "1"- AC disconnecting switch locked in open and earthed position.

32.4 Use key "1" to operate auxiliary supply's three phase isolating and earthing switch - key "1" trapped - key "2" released.

32.5 Use key "2" to unlock DC positive isolating and earthing switch.

32.6 Open DC positive isolating and earthing - key "2" trapped - key "3" released. Remove key "3". DC positive isolating and earthing switch locked in open position.

32.7 Use key "3" to open rectifier unit bay gate (and DC smoothing reactor screen if required).

32.8 If a number of keys are required to open the rectifier cubicles, a key exchange system may be used.

32.9 Procedure is reversed to switch the rectifier unit back on load.

32.10 The number indicated for the keys are for single unit substations only. Where there are two units in one substation the numbers of keys for the two units shall be A1 and B1, A2, and B2, etc. It shall not be possible to exchange keys between any equipment on different units.

32.11 The foregoing sequence is given as a guide and may be altered to suit tenderer's equipment. The design shall be approved by Transnet Freight Rail.

32.12 Where the wave filter equipment is not located in the rectifier bay, the access to the equipment shall be mechanically interlocked and form part of the interlocking procedure.

32.13 Access to the wave filter shall only be possible once the positive isolator is earthed and the primary circuit breaker is tripped. Refer to clause 20.8

32.14 Any deviation from the above guideline must be approved by Transnet Freight Rail.

33.0 INDOOR CABLING, BUSBARS AND ASSOCIATED EQUIPMENT

The contractor shall supply and install the following:

33.1 All low voltage PVC insulated supply and control cables.

33.2 3kV DC copper cables and copper busbars from the Anode wall plate to the rectifier and from the rectifier equipment to the DC positive isolating switches, DC smoothing reactors, and main DC negative busbar. In the event of aluminium (grade 6063) being used the minimum size shall by 50mm X 25mm busbar.

33.3 Where required, the supply and fitting of hot dip galvanised anode wall plates in the wall of the substation building, at the rectifier bays. The wall plate galvanising shall comply with SANS 121.

33.3.1 Wall plates shall be fitted with wall bushings, one for each phase and the neutral.

33.3.2 Designs and drawings of the wall plate arrangement must be submitted for approval after adjudication of the tender.

33.4 The interconnecting busbars from the anode wall plate to the rectifier.

33.5 The main 3kV DC positive and negative copper busbars. Minimum dimension of busbars shall be 100mm X 10mm copper or 127mm X 12,5mm aluminium (grade 6063) busbar.

33.6 The 3kV DC output positive busbar system, which includes high-speed circuit breaker busbars, and where required the outgoing feeder cables between the high speed circuit breaker busbars and wall bushings.

33.7 Barriers in accordance with clause 8.0 where exposed busbars exist between the positive isolator and the DC track breaker positive, busbar.

33.8 Cables from the DC smoothing reactor or main positive busbar to the wave-filter equipment.

33.9 Control cables from the rectifier cubicles to their respective control panels.

33.10 Cables from the auxiliary equipment to the substation control panels.

33.11 Connections and cabling between control panels.

33.12 Cables between the 110V substation battery and the auxiliary DC panel (2 core, minimum 16mm²).

33.13 Cables (95mm² stranded copper) to the wave-filter room(s) for rail (negative) and DC earth leakage connections to wave-filter equipment.

33.14 Earthing cables (95mm² stranded copper) between the DC earth leakage busbar and substation negative busbar.

33.15 Two core 16mm² and multicore 2,5mm² cables between panel and high-speed 3kV DC circuit breakers.

33.16 Two core 6mm² cables between the 25A circuit breakers on the DC panel and the Electrical Supply Utility meter room. Make-off and connect at the DC panel only.

33.17 All other busbars and cables required for the interconnection of the substation indoor equipment.

33.18 Cable glands for the termination of the cables at the control panels and other equipment. Neoprene shrouds shall be fitted over the cable glands.

33.19 The maximum current density per square mm for open conductors shall not exceed 1,55 Ampere for copper and 1.0 Ampere for aluminium.

33.20 Low voltage cables for indoor use may be unarmoured.

33.21 All high voltage cables shall be armoured XLPE insulated and shall comply with SANS 1339 and Transnet Freight Rail specification BBC 0198. All wiring used on the 3kV DC equipment shall have nominal 3kV insulation unless the clearances comply with those laid down in clause 8.9.

33.22 All negative connections and terminals associated with high voltage circuits and which are accessible without first having to isolate and earth such high voltage circuits e.g. the main negative busbar, DC earth leakage relay, etc., shall be of 95mm², copper or copper equivalent cross-section. The terminals shall be painted red.

33.23 Not withstanding the above clauses the contractor shall supply and install any other cables, conductors or busbars required for the successful operation of the substation.

33.24.0 BLOCK JOINTS

33.24.1 The contractor shall make block joints in the armouring of all the low voltage supply and control cables, which are connected between the indoor control equipment and the outdoor yard equipment.

33.24.2 The block joints shall be clearly visible and shall be not less than 200mm from the cable glands terminating at the outdoor equipment.

33.24.3 The block joints shall be sealed with a heat shrink covering to prevent the ingress of moisture.

33.25.0 CHEQUER PLATES

33.25.1 The contractor shall be responsible for the supply of all metal chequer plates required for covering of cable trenches inside the substation.

33.25.2 Earthing studs suitable for the fitting of 95mm² copper cable shall be welded to each chequer plate.

34.0 CABLES, BUSBARS AND CONNECTIONS. (OUTDOOR)

The Contractor shall supply and install the following:

34.1 The Inter-connections cables or conductors in the High Voltage yard.

34.2 The high voltage AC connections which shall be solderless, concentric grip, or other approved solderless type. The connections must have adequate cross-sectional area to suit both electrical and mechanical requirements.

34.3 Copper busbars between separately mounted outdoor equipment. The busbars shall incorporate a degree of flexibility to avoid any overstressing of connections due to foundation movement and expansion or contraction.

34.4 All negative connections and terminals associated with high voltage circuits and which are accessible without first having to isolate and earth such high voltage circuits e.g. the main negative busbar shall be of 95mm², copper or copper equivalent cross-section. The terminals shall be painted red.

34.5 Copper busbars with removable flexible connections or "all aluminium" stranded conductor may be used interconnection conductors between the main traction transformer secondary bushings and the anode wall bushings which are fixed to the anode wall plate of the substation building.

34.5.1 Where "all aluminium conductors are to be installed the following sizes and number of conductors shall be installed:

- 2 X 800 mm² "all aluminium" stranded conductor per each phase for 4,5 MW substations, or 50mm X 25mm aluminium (grade 6063) busbar in accordance to Transnet freight rail drawing BBF1615.
- 2 X 500 mm² "all aluminium" stranded conductor per each phase for 3 MW substations, or 50mm X 25mm aluminium (grade 6063) busbar in accordance to Transnet freight rail drawing BBF1615.

34.5.2 Where two different conductor material joints are used, the Bi-Metallic plates shall be applied.

34.6 Conductors from the high voltage AC line aerial conductors and between the surge arresters, AC disconnecting switch, high voltage AC circuit breaker, current transformers, rectifier transformer and rectifier.

34.7 Cables or busbars from the rectifier transformer to the auxiliary transformer.

34.7.1 The auxiliary transformer shall be connected directly to the tertiary winding of the traction transformer for new installations or existing installations where tertiary windings are employed on the main traction transformer.

34.8 Cable from the auxiliary transformer secondary to the short-circuiting switch.

34.9 Control cables from the high voltage AC disconnector, AC circuit breaker and main and auxiliary transformers to the substation control panels.

34.10 A multi-core 4mm² cable between the current transformers and the Electrical Supply Utility meter room. Make-off and connect at the current transformer only.

34.11 In the case of the Electrical Supply Utility Tee-supplies a multi-core 4mm² cable between the voltage transformers and the Electrical Supply Utility. The Electrical Supply Utility will do the cable connection.

34.12 In the case of the Electrical Supply Utility Duplicate Supplies one multi-core 4mm² cable between Transnet Freight Rail's high voltage AC circuit breaker and the Electrical Supply Utility meter room. (For interlocking Electrical Supply Utility M.O.D's). The cable shall have 10% spare cores.

34.13 A multi-core 2,5mm² cable between the tele-control remote terminals on the control panel and the electrical supply utility meter room. (For tele-control of the Electrical Supply Utility equipment). The cable shall have 10% spare cores.

34.14 All other cables as specified. e.g. security lighting and alarms.

34.15 All control cables, security and alarm cables shall be armoured cables.

34.16 Not withstanding the clauses above the contractor shall be responsible for all cables, busbars and connections required for the successful operation of the 3kV DC traction substation.

35.0 LABELS AND TERMINALS

35.1 All labels shall be in English. All lettering shall be white on a black background. Lettering shall be a minimum of 6mm in height.

35.2 All labels shall be neatly secured by rivets or screws.

35.3 All conductors and cables shall be provided with identification tags at terminals.

35.4 All terminals and equipment such as switches and relays shall be suitably numbered according to the substation schematic and wiring diagrams. All terminal blocks and groups of terminal blocks shall be suitably numbered.

36.0 SUBSTATION NEGATIVE RETURN

The substation negative return system which can be in the form of the following:

- Buried XLPE insulated copper cable.
- Rail on sleepers.
- Aerial conductors.

36.1 BURIED XLPE INSULATED COPPER CABLE

36.1.1 The contractor shall install 2 x 500mm² single core XLPE copper cables from the substation negative busbar to the negative manhole situated near the railway line.

36.1.2 Transnet Freight Rail's staff will undertake the provision of the bare conductors from the negative manhole to track, as well as the rail connections.

36.1.3 The negative manhole to drawing CEE-TU-41 is to be supplied and installed by the contractor.

36.1.4 The negative return cables shall be laid, in 150mm of soft soil in a trench, at a depth of not less than 1000mm below ground level and spaced not less than 300mm between centres.

36.1.5 Where cables are likely to be damaged they shall be protected by concrete slabs. Refer to Transnet Freight Rail specification CEE.0023.

36.1.6 The cable route shall be provided with cable warning tape. Refer to Transnet Freight Rail specification CEE.0023.

36.1.7 The cable runs shall be marked by cable markers painted signal red. (Stores Item No 9/1503)

36.2 RAIL NEGATIVE RETURN.

36.2.1 Where rail is used for the negative return system Transnet Freight Rail shall supply and install the rail from the inside of the substation building to the railway track.

36.2.2 The rail shall be insulated from ground by means of concrete sleepers supplied by Transnet Freight Rail.

36.2.3 Where the rail enters the substation building it must be insulated from all concrete and brickwork to prevent stray current damage to building reinforcing or other metal. After installation the hole in the wall shall be sealed and made good by Transnet Freight Rail.

36.2.4 The rail shall be connected to negative output of the rectifier by means of a suitably rated busbar/cable supplied by the contractor. Transnet Freight Rail will make provision for terminations on the rail.

36.2.5 Transnet Freight Rail shall connect the negative return rail to the track by means of PVC insulated steel conductors.

36.3 NEGATIVE FEEDER MONITORING SYSTEM.

36.3.1 The contractor shall design supply and install a negative feeder monitoring system in accordance with Transnet Freight Rail specification BBB1843.

36.3.2 The negative feeder monitoring system shall be designed to trip the 3 kV DC track breakers in the event of the traction substation negative return circuit becoming open circuited due to cable theft of the negative return cables or other cause of failure of the negative return circuit.

36.4 AERIAL CONDUCTORS

36.3.1 Where aerial conductors are used for the negative return, the contractor shall provide the wall plates and wall bushings where required.

36.3.2 In the case of aerial conductors used for the negative return, Transnet Freight Rail shall provide the conductors and the installation.

37.0 3kV DC POSITIVE FEEDER CABLES

The positive feeder cables shall be either:

- Buried armoured medium voltage XLPE insulated cable.
- Aerial aluminium conductor

37.1 BURIED XLPE INSULATED CABLE

37.1.1 The contractor shall install two single core 6,6kV, 500mm² armoured medium voltage XLPE insulated cables with stranded copper conductors. The cables shall be manufactured with copper tape screen, armour and sheath in accordance with SANS 1339 and Transnet Freight Rail specification BBC 0198. The cables shall run from the high-speed circuit breaker busbar chamber to the associated track switch structure.

37.1.2 Tenderers are to allow for making off the cables with suitable terminations. Sufficient length of cable must be left buried at the base of the track switch structure for erection and connection to the track switch. Transnet Freight Rail will do connection to the track switch.

37.1.3 The medium voltage cables shall be laid in 150mm of soft soil, in a trench at a depth of not less than 1000mm below ground level and spaced not less than 300mm between centres.

37.1.4 Where cables are likely to be damaged they shall be protected by concrete slabs. Refer to Transnet Freight Rail specification CEE.0023.

37.1.5 The cable route shall be provided with cable warning tape. Refer to Transnet Freight Rail specification CEE.0023.

37.1.6 The cable runs shall be marked by cable markers painted white (Stores Item No 9/1539).

37.1.7 Should it be necessary for the cables to pass under the tracks suitable pipes will be installed by Transnet Freight Rail.

37.1.8 Where required, the contractor shall supply the necessary wall bushings for positive feeder cables.

37.2 AERIAL CONDUCTOR

37.2.1 In the case of aerial conductors used for the positive feeders, Transnet Freight Rail shall make provision for conductors and installation.

37.2.2 Where aerial conductors are used for the 3kV DC positive, the contractor shall provide the wall plates and wall bushings.

38.0 TRENCHING FOR OUTDOOR YARD EARTHING CONDUCTORS AND CONTROL CABLES.

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

38.2 In existing substation outdoor yards the contractor shall remove the necessary crusher stone in the outdoor yard before any excavation commences. The contractor shall restore the crusher stone after the completion of the work.

38.3 Trenching includes all trenches required for the installation of the earthing system and control cables.

38.4 The depth of trenches shall not be less than 700 millimetres.

38.5 With the installation of new earthing conductors and control cables at existing substations, care must be taken not to damage existing cables in the high voltage outdoor yard during trenching operations.

38.6 The Contractor and Transnet Freight Rail staff shall inspect the trenches before and during the installation of the earthing system and control cables.

38.7 Before the trenches are closed a representative from Transnet Freight Rail shall inspect the earthing system and other cabling for damage.

39.0 FOUNDATIONS.

39.1 The successful tenderer shall be responsible for the design and casting of foundations for the portal and support structures in the traction substation high voltage outdoor yard.

39.2 Notwithstanding the supply arrangements (single or double) at any particular substation, tenderers shall clearly understand that all foundations and steelwork to accommodate the supply and to cater for the traction yard are to be provided and erected by the successful tenderer.

39.3 Wherever there is a combined traction and 11kV/6,6kV distribution yard, a flying busbar is to be provided in Transnet Freight Rail's yard. All foundations and steelworks required to suit this arrangement, including the erection and earthing thereof shall be included in tenderer's offers.

39.4 The foundations in the high voltage outdoor yard shall include the following:

- Voltage Transformers if applicable.
- Surge arresters.
- AC disconnectors.
- Current transformers. (If applicable)
- Primary circuit breakers.
- Main traction transformer.
- Auxiliary transformers.
- Portal lattice structures as required.
- Any other foundations as specified.

39.5 The successful tenderer shall carry out his own survey in regard to soil types and their load bearing capabilities.

39.6 Equipment support foundations shall be finished off 200mm above the finished earth level of the yard. The design must be such as to prevent standing water.

39.7 All foundation edges shall be bevelled, and the surfaces must be float finished.

39.8 All support foundations shall be at the same level.

39.9 The design of the concrete plinth for the main traction transformer shall include a concrete gutter around the perimeter of the plinth to contain any spillage of transformer oil.

39.10 Provision shall be made on the plinth for skid rails. The spacing of the rails between centres shall be a minimum of 1meter. Details of the design and load bearing parameters of the skid rail system, plinth and rail shall be submitted to Transnet Freight Rail for approval.

39.11 The auxiliary transformer if separate shall be provided with its own concrete plinth with a concrete gutter, or may be installed on the same plinth as the main traction transformer.

39.12 The 28-day strength of all concrete used shall be a minimum of 20Mpa.

39.13 Hand mixed concrete is not acceptable, it must be mechanically mixed.

40.0 SUPPORT STRUCTURES

40.1 The design, supply and installation of all steel structures for the support of equipment and tensioning of conductors shall be the responsibility of the successful tenderer.

40.2 Special attention shall be taken for the prevention of corrosion of all metallic parts.

40.3 The bases of insulators, studs, bolts, support structures and other parts made of ferrous material associated with the electrical connections outdoors, shall be hot-dip galvanised, in accordance with SANS 121.

40.4 Steelwork for outdoor installation in coastal areas, i.e., within 50km of the coast, shall first be hot-dip galvanised in accordance with SANS 121, followed immediately at the galvanising plant by the application of the Sterling paint system in accordance with specification CEE.0045.

40.5 Steelwork for outdoor installation in inland areas, i.e., at a distance greater than 50km from the coast, shall be hot-dip galvanised to SANS 121.

40.6 All high voltage equipment shall be provided with hot-dipped galvanised support structures or pedestals to provide a minimum clearance of 3,6 m (up to 88kV) or 4,1 m (above 88kV) from the lowest "live" high voltage connection to finished ground level.

40.7 Structural steel shall comply with SANS 1431.

40.8 All welded joints shall be seal welded with no gaps or blowholes.

40.9 All fasteners, nuts and bolts used for the installation of substation steelwork and equipment shall be hot dipped galvanized to prevent corrosion.

41.0 FENCING

41.1 The successful tenderer shall supply and install new perimeter fencing as specified.

41.2 The successful tenderer shall make provision for the levelling of outdoor yard if required.

41.3 The fencing shall be either of the following:

- Concrete palisade fencing in accordance to drawing CEE-TDF- 0016.
- Hot dipped galvanised steel palisade fencing with the minimum requirements of:
  Height 2,4 metres
  Size and thickness of pales 40mm x 40mm x 3mm thick.
  Corner and intermediate posts 100mm x100mm x 3mm.
  Horizontal cross bars 40mmx5mm.

41.3.1 The successful tenderer shall make provision for the installation of safety barriers in the high voltage yard in accordance with Transnet Freight Rail's requirements. (Refer to Transnet Freight Rail's Engineering instruction S.016)

41.3.2 The successful tenderer shall make provision for a metal barrier screen of 25mm-wire mesh or expanded metal to be constructed around the auxiliary transformer to prevent accidental contact.

41.3.3 The successful tenderer shall cast a concrete apron of 150mm wide x 300mm under the perimeter fences of the substation. The top of the apron shall be a minimum of 100 mm above the ground level.

42.0 GATES

42.1 The contractor shall supply and install two 4.6 metre wide X 2,4 metres minimum height lockable gates in the perimeter fence to allow for:

- Entrance to substation building and yard.
- Entrance to the high voltage outdoor yard adjacent to the main transformer (s).

42.2 Where access to the HV outdoor yard is gained between the substation building and perimeter fence, a fence the same height as the perimeter fence shall be installed. A 1000mm wide lockable gate shall form part of the fence.

42.3 Provision must be made for the fitting of a spark gaps and rail earth switch on the HV yard small gate. Refer to drawings CEE-TBD-7 and BBB3620. The spark gaps shall be provided by Transnet Freight Rail on request.

42.4 Where steel palisade fencing is used the gates shall be connected to the fence support post by means of a flexible connection to prevent electrolytic corrosion of gate hinges.

42.5 Warning notices and danger signs in accordance with Transnet Freight Rail's Electrical Safety Instructions shall be fitted to the perimeter fencing and gates. This shall be provided by Transnet Freight Rail.

43.0 CRUSHER STONE AND WEED KILLER

43.1 After completion of construction, installation of equipment, the laying of all cables and earthing conductors, a suitable weed killer approved by the Technical Officer shall be applied in HV outdoor yard.

43.2 Great care shall be exercised to avoid contaminating private property and water supplies.

43.3 After treatment with the weed killer, a 100mm layer of 25mm crusher stone shall be laid over the whole area of the Transnet Freight Rail high voltage outdoor yard (within the apron).

44.0 PAINTING

44.1 All indoor and outdoor steelwork, metal screens and barriers shall be painted in accordance with Transnet Freight Rail's Specification CEE.0045.

44.2 The finishing coats for indoor equipment shall be in accordance with SANS 1091.

Metal Bay Screens - Eau-de-Nil (H43).
Support frameworks (indoor) - Eau-de-Nil (H43).

45.0 DISTRIBUTION, LIGHTING OF SUBSTATION BUILDING AND STANDBY 400V AUXILIARY SUPPLIES

45.1 The successful tenderer shall supply and install all light fittings, plugs, conduits, distribution boards, switches, cables and other material in accordance with SANS 10142-1. Galvanised, alternatively PVC conduit and galvanised fittings shall be provided at all substations within 50km of the coast.

45.2 The contractor shall furnish a certificate of compliance for the 400V/220V AC distribution and lighting of the traction substation signed by the accredited person in terms of SANS 10142-1 and who is registered with "Electrical Contracting Board".

45.3 Complete Layout drawing showing the position/type of light fittings, position of plugs, distribution board and switches to be submitted to Transnet Freight Rail for approval.

45.4 220V AC fluorescent light fittings shall provided. The minimum lighting requirement shall be 100 lux in terms of the "Occupational Health and Safety Act".

11KV/6,6KV TO 400V AUXILIARY SUPPLY AND CHANGE OVER SYSTEM.

45.5 Where specified a 11kV/6,6kV to 400V distribution transformer will be installed to supply the traction substation in the event of substation failure or when the substation is taken off load.

45.5.1 The 3 phase 400V supply from the above transformer shall be connected to the control circuitry via a automatic change over switching system.

45.5.2 The change over switching system shall be mechanically and electrically interlocked.

45.5.3 Transnet Freight Rail shall supply and install a suitably rated 4core armoured cable from the 11kV/6,6kV to 400V distribution transformer to the change over switching unit.

45.5.4 A 1:1 ratio isolation transformer shall be installed between the 11kV/6.6kV to 400V distribution transformer and change over switching system.

45.5.5 The isolation transformer shall comply with specification BBC 0330.

45.5.6 The successful tenderer shall supply the isolation transformer unless otherwise specified.

EMERGENCY LIGHTING.

45.6 Fluorescent light fittings with its own battery back up supply shall be supplied for emergency lighting.

45.6.1 A minimum of three fittings shall be installed in a single unit substation and four in a double unit substation.

45.6.2 The light fittings shall be installed at the following locations:

- In single unit substations two in the main walkway between the control panels and rectifier unit. One flameproof fitting in the battery room
- In a double unit substation three in the main walkway and one flameproof fitting in the battery room.
- In additional locations where requested by the Project Manager/Engineer.

45.6.3 The light switch shall be clearly labelled " EMERGENCY LIGHTNING".

MOULDED CASE CIRCUIT BREAKERS

45.7 All low voltage circuits and equipment shall be protected by moulded case circuit breakers, which comply with specification SANS 156.

SECURITY LIGHTS

45.8 Where outdoor security lights are specified 400W high-pressure sodium fittings shall be installed at locations specified by the "Scope of Work".

46.0 COOLING AND VENTILATION

46.1 Where specified, 3 phase cooling fans shall be supplied and installed in the substation building.

46.2 The required filters, louvres and guards shall be provided and installed.

47.0 BATTERY ROOM

47.1 A three/single phase non-sparking extraction fan shall be installed for the battery room.

47.2 Only Ex non-sparking light fittings shall be installed in the battery room.

47.3 Light switches and plug sockets shall not be installed in the battery room.

47.4 No-smoking, naked flames and hand protection warning signs shall be fitted to the battery room doors.

47.5 A wooden stand treated with acid proof paint shall be provided for the batteries.

47.6 A hydrometer and logbook shall be supplied by the contractor for each installation.

47.7 The floor of the battery room shall be painted with acid proof paint.

48.0 CLEARING OF SITE

48.1 All rubble which is left over as a direct result of work performed by the Contractor shall be removed from the substation building and yard and disposed of by the Contractor. The substation floors and walls shall be left in a clean condition. All cable, wire and conductor cut-offs and surplus material shall be removed from site.

SECTION 4: SITE TESTING AND COMMISSIONING

49.0 SITE TESTS AND COMMISSIONING

The successful tenderer shall be responsible for carrying out on-site tests and commissioning of all equipment supplied and installed in terms of this specification and the contractual agreement.

49.1 ON-SITE TESTS

49.1.1 Functional on-site tests shall be conducted on all items of equipment, circuitry and interlocking to prove the proper functioning and installation thereof.

49.1.2 The successful tenderer shall submit a detailed list of on-site tests for the approval of the Project Manager/Engineer at least six weeks before tests are due to commence at the first substation.

49.1.3 The successful tenderer shall arrange for the Project Manager/Engineer or his representative to be present to witness the on-site tests at each substation.

49.1.4 On-site tests and subsequent commissioning shall 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 substation equipment will not be allowed to take place in a construction site environment.

49.1.5 On-site tests shall include the following;

- Polarity tests on all CT's.
- Ratio tests on all CT's.
- Magnetising current of all CT's.
- Secondary injection of all relays.
- Trip testing, all relays must be checked for correct operation.
- The functionality of all electrical circuitry must be tested.
- The operation of both mechanical and electrical interlocking.
- Tests on primary circuit breakers and other primary equipment in accordance with manufacturer's instructions.

49.1.6 At the completion of the on-site tests the Project Manager/Engineer or his representative, shall either sign the test sheets (supplied by the successful tenderer) as having witnessed the satisfactory completion thereof, or hand to the successful tenderer a list of defects requiring rectification.

49.1.7 Upon rectification of defects the successful tenderer shall arrange for the Project manager/Engineer or his representative to certify satisfactory completion of on-site tests for that particular substation.

49.1.8 Acceptance by the Project Manager/Engineer 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.

49.2 COMMISSIONING OF EQUIPMENT

49.2.1 Commissioning will include the energising of equipment from the AC disconnects to the OHTE track feeder switches. The successful tenderer must prove the satisfactory operation of all equipment under live conditions.

49.2.2 On completion of commissioning the successful tenderer will hand the substation over to the Project Manager/Engineer in terms of the relevant instructions.

49.2.3 Tenderers shall allow a period of at least three days per substation between satisfactory completion of on-site tests and commissioning of equipment.

49.2.4 During this period the Transnet Freight Rail's Test staff will test the operation of all protective relays and circuits and set the protection relays at each substation.

49.2.5 The contractor shall rectify any faults found during the testing and setting of the protection relays.

49.2.6 The final testing of the substation must commence at least three days ahead of the contract completion date.

49.2.7 The commissioning of the protection equipment by Transnet Freight Rail will in no way absolve the successful tenderer from any of his responsibilities during the guarantee period. It is the successful tenderers responsibility to satisfy himself 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.

49.2.8 The commissioning dates for the substations will be dependent on the availability of power supplies from the supply utility as well as Transnet Freight Rail's electrification program and will be defined by the Project Manager/Engineer.

SECTION 5: GENERAL

50.0 QUALITY ASSURANCE

50.1 Transnet Freight Rail reserves the right to carry out inspection and tests on the equipment at the works of the supplier/manufacturer.

50.2 Arrangements must be made timeously for such inspections and type/routine tests in accordance with the equipment specifications are carried out before delivery of the equipment to the site.

50.3 Type/routine test sheets of the equipment shall be forwarded to the Project Manager.

51.0 GUARANTEE AND DEFECTS

51.1 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.

51.2 The guarantee period shall commence from the date of successful commissioning of the substation.

51.3 The guarantee period for all substations shall expire after a period of 12 months commencing from the date of successful completion of the contract or the date the equipment is handed over to Transnet Freight Rail whichever is the later.

51.4 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.

51.5 The cost of training shall be included in the tenderers quotation.

52.0 DRAWINGS, INSTRUCTION MANUALS AND SPARES LISTS

52.1 Drawings, instruction manuals and catalogues shall be supplied in accordance with Transnet Freight Rail specification CEE.0224.

52.2 The tenderer shall supply three copies of an instruction/maintenance manuals, schematic and wiring diagrams.

52.3 The contractor shall submit details of spares required in accordance with Transnet Freight Rail's specification no. CEE.0224.

52.4 All spares recommended for normal maintenance purposes that are not available locally (requires importation) must be highlighted.

53.0 SPECIAL TOOLS AND/OR SERVICING AIDS

Special tools or servicing aids necessary for the efficient maintenance, repair or calibration of the equipment shall be quoted for separately.

54.0 TRAINING

54.1 The contractor shall submit details with the tender of the training courses which will be conducted by the contractor for the training of Transnet Freight Rail 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.

55.0 PACKAGING AND TRANSPORT.

55.1 The contractor shall ensure that the equipment be packed in such a manner that it will be protected during handling and transport.

55.2 The contractor shall provide transport for the delivery of the equipment to the site where required.

56.0 BIBLIOGRAPHY

[1] SANS 1019: 2008 Edition 2.5 Standard voltages, currents and insulation levels for electricity supply

APPENDIX 1

DRAWINGS ISSUED WITH THIS SPECIFICATION

DRAWING NUMBER	AMENDMENT	DESCRIPTION.
CEE-TDF-0016		Concrete fencing
CEE-TBD-7		Earthing Arrangements Traction Substations.
CEE-TU-41		Negative Return Cable Terminating Box.
CEE-TCK-1		Reactor 1,84mH, 1 500 A. (For reference purposes only)
CEE-TBP-1		Wiring diagram for auto reclosure for HSCB.
CEE-TBP-39		Circuit diagram for auto reclosure for HSCB
CEE-TBP-35		Connection diagram for HSCB and electronic control relay
CEE-TBP-38		Schematic Diagram of 3kV HV Protection.
CEE-TCL-63		3kV Busbar Chamber Arrangement: Cable Feeders.
CEE-TCQ-208		DC High Speed Circuit Breaker Cell Panel (Cell slabs) (sheets 1 to 10)
CEE-TBP-33		DC Track Breaker and Truck Wiring Diagram.
BBB 0938		Surge arresters mounted on traction transformer.
BBB 3620		3kV Earthing arrangement for traction substation
BBF 1615		Busbar connection assembly

SPOORNET

A division of Transnet limited

ENGINEERING AND TECHNOLOGY

TECHNOLOGY MANAGEMENT

SPECIFICATION

REQUIREMENTS FOR THE SUPPLY OF ELECTRIC CABLES

(Appendix to be filled in by client)

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INDEX

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.

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^2): .....

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^2): .....

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^2): .....

END

SPOORNET
(INFRASTRUCTURE)(POWER SUPPLIES)

SPECIFICATION No. CEE.0023.90

THIS ISSUE CANCELS
SPECIFICATION NO.:
CEE.0023.86

SPECIFICATION FOR THE INSTALLATION OF CABLES

This specification covers Spoornet's requirements for the installation, laying, terminating, jointing, testing and commissioning of the high and low voltage cables.

INDEX

1.0 SCOPE

1.1 This specification covers Spoornet's requirements for the installation, laying, terminating, jointing, testing and commissioning of high and low voltage cables.

2.0 REFERENCE LIST

The following publications, drawings and documents (latest edition) are referred to herein.

2.1 South African Bureau of Standards

SABS 97 - Impregnated paper insulated electric cables.

SABS 0142 - Code of practice for the wiring of premises.

SABS 150 - Polyvinylchloride (PVC) insulated electric cables and flexible cords.

SABS 763 - Hot-dip (galvanised) zinc coating.

SABS 1339 - Cross-linked polyethylene insulation of electric cables.

SABS 1299 - Direct-acting indicating electrical measuring instruments and their accessories.

2.2 British Standard Institution

BS 5467 - Armoured cables with thermosetting insulation for electricity supply.

BS 6480 - Impregnated paper-insulated cables.

2.3 Machinery and Occupational Safety Act, Act No. 6, 1983

2.4 Spoornet

CEE.0012 - Method of Tendering

CEE.0045 - Painting of steel components of electrical equipment.

CEE.0089 - Drawings of electrical equipment supplied under electric light and power contracts.

Safety Instructions - High Voltage Electrical Equipment

3.0 APPENDICES

The following appendices form an integral part of this specification.

3.1 Appendix 1 - "Scope of Work"

3.1.1 This appendix specifies the extent of the work required and the order of priorities.

3.2 Appendix 2 - "Drawings".

3.2.1 This appendix lists Spoornets drawings applicable to the installation,

3.2.2 Cable routes indicated on these drawings shall only be a general guide to the contractor.

3.3 Appendix 3 - "Schedule of Items, Estimated Quantities, Unit Rates and Prices".

3.3.1 To ensure a uniform basis for tendering purposes, tenders shall be based on the estimated quantities given in this schedule which shall be completed in full and returned as part of the tender.

Complies/Does not comply

3.3.2 The importance of full completion of this schedule cannot be overstressed as this will constitute the tenderer's quotation.

Complies/Does not comply

3.3.3 Rates specified in this schedule will be applicable if any adjustments to requirements become necessary.

Complies/Does not comply

3.3.4 Any additional items considered to be necessary by the tenderer for the satisfactory completion of the installation and fulfilment of his guarantee shall be added by the tenderer on a similar unit price basis to this schedule and included in his total tendered price.

Complies/Does not comply

3.3.5 Actual quantities required will be based on the final survey by the successful contractor, and payment will be based on the actual measurements.

Complies/Does not comply

4.0 DRAWINGS AND INSTRUCTIONS

4.1 All drawings submitted by the tenderer shall be in accordance with Spoornets Specification No. CEE.0089

Complies/Does not comply

4.2 Where joints and terminations are to be done by others, the contractor shall submit detailed instructions regarding the procedure recommended by the cable manufacturer.

Complies/Does not comply

5.0 STANDARD OF WORK

5.1 The electrical installation shall conform to the requirements of SABS Code of Practice 0142 and shall be to the satisfaction of Spoornet.

Complies/Does not comply

5.2 Galvanising, where specified, shall be in accordance with SABS 763.

Complies/Does not comply

6.0 SAFETY INSTRUCTIONS

6.1 Work on the high voltage equipment shall be carried out in accordance with the Safety Instructions High Voltage Electrical Equipment of Spoornet.

Complies/Does not comply

6.2 All work done must comply with the requirements of the MACHINERY AND OCCUPATIONAL SAFETY ACT, Act No. 6, 1983.

Complies/Does not comply

7.0 SURVEYS

7.1 Pre-installation Route Surveys.

7.1.1 The Contractor shall within 30 days after being awarded the contract, carry out a pre-installation route survey which shall include digging test holes and, guided by the drawings contained in appendix 2, determine a suitable route.

Complies/Does not comply

7.1.2 The contractor shall determine where cables are liable to be subjected to chemical, electrolytic, mechanical or other damage and shall submit his recommendation to the Engineer for approval.

Complies/Does not comply

7.1.3 The Contractor shall submit in triplicate plans of the cable routes selected to the Engineer for approval. Plans may be submitted in sections as the survey progresses.

Complies/Does not comply

7.1.4 No excavation of any section of the cable route shall commence before the Contractor is in possession of the relevant approved plans and the Engineer has authorised the commencement of work on the section concerned.

Complies/Does not comply

7.2 Post Installation Surveys

7.2.1 After completion of all cable laying and jointing and before commissioning of any cable the Contractor shall carry out a final "as laid" survey of the cable routes and submit plans on transparencies suitable for reproduction.

Complies/Does not comply

7.2.2 The cable route plans shall include the following information :

7.2.2.1 Overall length, type, size and voltage of each cable.

7.2.2.2 Accurate indication of the position of each cable joint by indicating two distances to each joint from permanent structures.

Complies/Does not comply

7.2.2.3 Pipes and chambers provided.

8.0 EXCAVATIONS

8.1 Excavations shall be carried out in strict compliance with the specification No. E.7 for works on, over, under or adjacent to a railway line.

Complies/Does not comply

8.2 Trenching procedure shall be programmed in advance, approved by the Engineer and shall not be departed from except with the consent of the Engineer.

Complies/Does not comply

8.3 The Contractor will be advised of any known buried services such as cables, pipes, etc. in the vicinity of the cable route.

8.3.1 When trenching the contractor shall take all necessary precautions to prevent damage to underground services.

Complies/Does not comply

8.3.2 On encountering any uncharted service, the Contractor shall promptly advise the Engineer who will give the necessary instructions. Additional excavations shall be paid for at scheduled rates.

Complies/Does not comply

8.4 Should any underground service, water mains, road pavement, drainage system, building or any other structure be damaged by the Contractor's staff, it shall be reported immediately to the Engineer, who shall arrange for the necessary repairs. The Contractor shall be responsible for the cost of repairs.

Complies/Does not comply

8.5 The removal of obstructions along the cable routes shall be subject to the approval of the Engineer and shall be paid for at the agreed rates.

Complies/Does not comply

8.6 The Contractor shall not trench beneath any railway line without departmental supervision. Should the contractor wish to carry out such work, a minimum of 14 working days notice is required by the Engineer to arrange for the necessary supervision. The cost of such supervision shall not be charged to the Contractor.

Complies/Does not comply

8.7 Excavations crossing oil pipe lines shall not commence until an authorised representative is present on site. The Engineer shall be advised 14 days in advance when such excavations will take place.

Complies/Does not comply

8.7.1 Cable crossings of oil pipe lines shall only be at right angles.

Complies/Does not comply

8.8 Trenches across roads, access ways or foot-paths shall not be left open. If trenching, cable laying and backfilling cannot be done during the same shift, the portion of trench across the full width of the road, etc., must be temporarily backfilled and consolidated sufficiently to carry the traffic concerned without subsidence. Alternatively, adequately strong cover plates shall be laid across the trench.

Complies/Does not comply

8.9 Power driven mechanical excavators may be used for trenching operations. Spoornet shall not be responsible for any damage to other Services in close proximity when using mechanical excavators.

Complies/Does not comply

8.10 The Contractor shall provide shuttering in places where the danger exists of the trench collapsing, and causing damage to formations or other nearby structures.

8.10.1 Shuttering shall be paid for at scheduled rates.

Complies/Does not comply

8.11 Trenches shall be as straight as possible and the bottom of each cable trench shall be firm and of smooth contour without sharp dips or rises which may cause tensile forces in the cable during backfilling.

Complies/Does not comply

8.11.1 Trenches shall have no sharp objects which may cause damage to the cable during laying or backfilling.

Complies/Does not comply

8.12 The unfinished depth of trenches unless otherwise stated shall be as follows :

8.12.1 HV cables and associated pilot cables = 1 000 mm

8.12.2 LV cables and separate pilot cables = 750 mm

8.13 The width of the trench unless otherwise stated shall be 500 mm for one or two HV cables and associated pilot cables, and shall increase by 300 mm for each additional HV cable and its associated pilot cable.

8.13.1 The width of the trench at any bend or places where cable slack is required, shall be such that the bending radius of the cables shall not be less than that specified for the particular cable as per specifications SABS 150, SABS 97 and SABS 1339.

Complies/Does not comply

8.13.2 Trenching in railway formations shall be in accordance with Spoornet's Chief Civil Engineer's drawing FG 263.

8.14 The material excavated from each trench shall be placed in such a manner as to prevent nuisance or damage to adjacent ditches, railway lines, drains, gateways and other properties and shall not interfere with traffic.

Complies/Does not comply

8.14.1 Where, owing to certain considerations, this is not possible the excavated materials shall be removed from site and be returned for refilling the trench on completion of laying.

Complies/Does not comply

8.15 When excavating close to railway tracks, the ballast must be covered by tarpaulins or other sheeting to prevent soiling.

Complies/Does not comply

8.16 Removal of accumulated water or other liquid from trenches shall be done by the Contractor at his expense. The Contractor shall provide all pumps and appliances required to carry out this operation. Water or any other liquid removed shall be disposed of without creating any nuisance or hazard.

Complies/Does not comply

8.17 Spoornet reserves the right to alter any cable route or portion thereof prior to cable laying. Payment in respect of any additional work involved shall be at scheduled rates.

Complies/Does not comply

9.0 CABLE LAYING

9.1 General

9.1.1 All possible care shall be exercised in handling cables on site.

Complies/Does not comply

9.1.2 Any drum of cable showing signs of damage shall not be used.

Complies/Does not comply

9.1.3 The outer covering of cables shall not be damaged in any way and cables shall not be bent at radii less than allowed by the manufacturer.

Complies/Does not comply

9.1.4 When cable is supplied by the contractor, the drums thereof remain the property of the Contractor and shall be removed from the site and disposed of by him.

Complies/Does not comply

9.1.5 Cable pulling and laying shall be done manually unless otherwise approved by the Engineer. No cable shall be subjected to a tension exceeding that stipulated by the cable manufacturer.

9.2 IN TRENCHES

9.2.1 High Voltage cables shall be spaced at a minimum of 300 mm apart (centre to centre).

9.2.2 Low Voltage cables shall be spaced at a minimum of 150 mm apart (centre to centre).

9.2.3 Pilot cables shall be laid beside the associated power cables.

9.2.4 High Voltage and Low Voltage cables (and pilot cables not associated with High Voltage cable) shall be spaced at a minimum of 300 mm apart.

9.2.5 Pilot cables, when they are routed separately from their associated power cables, may be run next to one another.

9.2.6 Cables shall not be buried on top of each other except where cable runs cross.

9.2.7 Where the cable cannot be laid down at the specified depth, prior authority shall be obtained from the Engineer by the Contractor to protect the cable by means of 150 mm diameter half round concrete pipes with 50 mm concrete slab coverings, or other approved methods.

9.2.8 Where cables have to be drawn around corners well lubricated skid plates shall be used. The skid plates shall be securely fixed and constantly examined during cable laying operations.

9.2.9 Suitable rollers may be used during the laying of cables.

9.2.10 Cables shall be visually inspected for damage during and after laying. Any damage shall be reported immediately to the Engineer who will issue the necessary instructions.

Complies/Does not comply

9.3 IN SLEEVE PIPES

9.3.1 All cables crossing beneath roads and pavements shall be enclosed in asbestos cement pipes with a minimum internal diameter of 150mm. The Engineer shall be advised timeously of the locations and quantity of pipes to be laid and chambers to be provided by others. Separate lengths of pipe shall be properly jointed.

Complies/Does not comply

9.3.2 Pipes shall maintain or exceed the specified cable spacing.

Complies/Does not comply

9.3.3 Only one High Voltage cable shall be laid per pipe.

Complies/Does not comply

9.3.4 Pipes shall extend at least 1 m on either side of the road- or pavement formations and shall maintain the specified cable depth. All pipes shall be graded for water drainage : the required grade is 1:400.

Complies/Does not comply

9.3.5 All cables crossings underneath railway tracks shall be in pipes in accordance with Chief Civil Engineer's drawing FG 263.

9.4 IN DUCTS AND BUILDINGS

9.4.1 Concrete ducts and pipes within buildings will be provided by others.

9.4.2 Before installing cables, the ducts are to be inspected to ensure that they are suitable and clean as not to damage the cables.

Complies/Does not comply

9.4.3 The cables are to be neatly positioned and cross overs are to be avoided.

Complies/Does not comply

9.4.4 Steel checker plates over ducts will be supplied by others. The tenderer will however be required to cut all the slots for emerging cables. These slots are to be neatly cut and smoothed to avoid damage to the cable.

Complies/Does not comply

9.4.5 The Contractor shall supply all cable trays, racks, wooden cleats or other supports required to adequately support cables not laid in ducts.

Complies/Does not comply

9.4.6 Cable trays or racks shall be of reinforced glass fibre or steel suitably treated to prevent corrosion, Steel trays, racks and other supports shall be galvanised in accordance with SABS 763 when used within 50 km of the sea or inland exposed conditions.

Complies/Does not comply

9.5 UNDER BRIDGES AND IN TUNNELS

9.5.1 Where a cable route can only be against the concrete wall of a bridge or tunnel the cable shall be supported on :

9.5.1.1 suitable brackets at 750 mm intervals.

or

9.5.1.2 straining wire secured at maximum 1 200 mm intervals.

Complies/Does not comply

9.5.2 Brackets shall be of robust design and shall be galvanised and painted in accordance with specification CEE.0045

Complies/Does not comply

9.5.3 The height of the cable route on the brackets or strain wire shall be determined and agreed upon on site.

Complies/Does not comply

9.5.4 The brackets or strain wire shall be supplied and installed by the contractor.

Complies/Does not comply

9.6 CROSSING OF PIPELINES AND OTHER CABLES

9.6.1 Cables shall pass beneath pipelines with a 300 mm minimum clearance between the top of any cable and the bottom of any oil pipe.

Complies/Does not comply

9.6.1.1 The level of any cable at an oil pipeline crossing shall be maintained for not less than 3 m on either side of the centre line of the pipeline or on either side of the centre line of the outermost pipelines where there is more than one pipeline on the same route.

Complies/Does not comply

9.6.2 Where cables cross communication or signal cables, at least 300 mm of fill shall be provided between the two cables. In addition a concrete slab in accordance with Spoornets drawing No. CEE 55/027367 shall be placed between the two cables parallel to the lower cable.

Complies/Does not comply

9.7 IN RAILWAY FORMATIONS

9.7.1 Cables to be accommodated in railway formations shall be laid in accordance with Chief Civil Engineer's drawing No. FG 263.

Complies/Does not comply

9.8 SECURED TO POLES

9.8.1 Cables to be terminated at disconnectors (isolators) mounted on wood, concrete or steel poles, shall be clamped onto such structures by means of stainless steel straps applied at such a tension that the cable or cable sheath is not damaged. Straps shall be located at intervals of not more than 1,2 m.

Complies/Does not comply

9.8.2 Cables shall be protected by a pipe or boxed section of galvanised steel or other approved material for a distance of 250 mm below and 600 mm above ground level, strapped or screwed to the pole at a minimum of two points and connected to the earth connection, if of steel construction.

Complies/Does not comply

9.8.3 Straps and pipes shall be supplied and installed by the Contractor.

Complies/Does not comply

9.9 EXPOSED CONDITIONS

9.9.1 Whenever cables enter buildings or tunnels, or where excavations are not permitted down banks or cuts, the exposed portion shall be suitably protected by means of concrete slabs, or suitable steel pipes or boxed sections which shall be galvanised in accordance with SABS 763.

Complies/Does not comply

9.9.2 These pipes or boxed sections shall be firmly secured to the bank or cut, at regular intervals.

Complies/Does not comply

9.9.3 All such material shall be supplied and installed by the Contractor.

Complies/Does not comply

9.9.4 Stake routes shall only be supplied when specifically called for in Appendix 1.

10.0 CABLE TERMINATIONS

10.1 General

10.1.1 All cables shall be terminated and connected to the respective equipment, whether provided by the Contractor or by others.

Complies/Does not comply

10.1.2 Jumpers between cable end boxes and disconnectors shall either be short enough to be rigidly self supporting, or shall be supported on suitably placed pin insulators.

Complies/Does not comply

10.1.3 Termination of cables on outdoor equipment shall not be done during inclement weather conditions.

Complies/Does not comply

10.1.4 Both ends of each cable shall be identified by means of embossed stainless steel strips clamped around the cables. The characters shall have a minimum height of 6 mm.

Complies/Does not comply

10.1.5 All materials necessary for cable termination shall be provided by the Contractor.

Complies/Does not comply

10.1.6 The contractor shall ensure that correct phase rotation is maintained throughout.

10.1.7 Glands of cables terminating on equipment provided with frame leakage protection shall be insulated from the frame by high grade non-deteriorating, non-hygroscopic insulation, at least 2 mm thick, capable of withstanding a test voltage of 4 kV DC for one minute.

Complies/Does not comply

10.2 HV Cables

10.2.1 The cable armouring shall be bonded with an approved copper bond to the cable end box at one end of the cable only as directed by the Engineer. This bond shall be easily removable for testing purposes.

Complies/Does not comply

10.2.2 Where for any reason a cable cannot be terminated, sufficient length of cable shall be left to reach the cable end box position. The cable shall be coiled and buried or otherwise protected, The cable end of paper insulated cables shall be capped immediately with a plumbed lead seal. Other cables shall be sealed with suitable tape.

Complies/Does not comply

10.3 LV Cables (and Pilot Cables)

10.3.1 All cut ends of cables are to be sealed with suitable tape, or other approved means until they are ready to be terminated.

Complies/Does not comply

10.3.2 The cables shall terminate in compression type glands, brass or bronze, suitable for PVC SWA ECC cables.

Complies/Does not comply

10.3.2.1 The glands shall be fitted with neoprene shrouds.

Complies/Does not comply

11.0 CABLE JOINTS

11.1 General

11.1.1 Jointing shall be carried out strictly in accordance with the manufacturer's jointing instructions and by artisans thoroughly experienced and competent in jointing the classes of cables used. They shall be adequately supervised to ensure the highest quality of workmanship.

Complies/Does not comply

11.1.2 Jointing shall not be carried out during inclement weather.

Complies/Does not comply

11.1.3 The cores of cables shall be jointed number to number or colour to colour.

Complies/Does not comply

11.1.4 The joints shall not impair the anti-electrolysis characteristics of the cables.

Complies/Does not comply

11.1.5 The conductor bridging the armouring shall be adequate to carry the prospective earth fault current.

Complies/Does not comply

11.1.6 A through joint shall only be permitted after every full drum length of cable.

Complies/Does not comply

11.1.7 Each cable joint shall be identified by a non-corrodible label fixed securely to the top of the joint. Each label shall have stamped on it, in characters having a minimum height of 10 mm, the identification of equipment at each end of the cable concerned.

Complies/Does not comply

11.1.8 Spoornet reserves the right to be present during jointing operations to familiarise themselves with any special techniques.

Complies/Does not comply

11.1.9 No joint shall be situated inside a cable pipe.

Complies/Does not comply

12.0 COVERING, BACKFILLING AND REINSTATEMENT

12.1 Filling of trenches shall not commence before the Engineer or his authorised representative has inspected and approved the cables and cable joints in situ in the section of trench concerned.

Complies/Does not comply

12.2 Trenches in railway formations shall be backfilled and reinstated in accordance with Spoornet's Chief Civil Engineer's drawing No. FG 263.

Complies/Does not comply

12.3 All other trenches shall be backfilled and reinstated as follows:

12.3.1 Two 75 mm thick layers of soil sifted through a 6 mm mesh shall be laid directly under and over the cables respectively and consolidated by hand ramming only.

Complies/Does not comply

12.3.1.1 Only soil with a thermal resistivity of 1,5 degrees C.m/watt, or lower may be used for this purpose.

Complies/Does not comply

12.3.1.2 When necessary imported fill shall be arranged by the Contractor and paid for at scheduled rates.

Complies/Does not comply

12.3.2 HV cables shall, where likely to be mechanically damaged as decided by the engineer, be protected by concrete slabs (to Drawing No. CEE 55/027367) to be supplied and laid by the Contractor on top of the sifted soil. These slabs shall be laid close-butted, convex end to concave end, directly above each HV cable throughout the underground portion except where otherwise protected as by pipes, etc. Only unbroken cable protection slabs may be used, and only slabs actually laid will be paid for.

Complies/Does not comply

12.3.3 The minimum dry densities of backfilling after compaction shall be not less than 1 600 kg/cubic metre.

Complies/Does not comply

12.3.4 All excavations made (whether for the purpose of cable laying, joint bays or trial holes) shall be back-filled in 150 mm layers, the earth in each layer being well rammed and consolidated and sufficient allowance being made for settlement. The back-filling shall be completed to the satisfaction of the Engineer. If necessary, water shall be used to obtain the specified compacted density. Any cable damaged during backfilling shall be replaced by the Contractor at his own expense.

Complies/Does not comply

12.3.4.1 Backfilling at pipe entries shall be such as not to stress or damage the cable during compaction from the top.

12.3.5 A continuous plastic cable warning tape, to drawing No. CEE-MA-307 shall be laid directly above each HV cable, 150 mm below the normal surface level and run for the full length of the cable before completing the back-filling.

Complies/Does not comply

12.4 The back filled trench shall be maintained in a thoroughly safe condition by the contractor for the duration of the contract.

Complies/Does not comply

12.5 All back filling of road crossings shall be mechanically rammed.

Complies/Does not comply

12.6 Final surfacing of roads shall be restored by others unless called for under "Scope of Work", Appendix 1.

Complies/Does not comply

12.7 Concrete cable route markers shall be provided and installed by the contractor in accordance with drawing CEE-PK-14.

Complies/Does not comply

12.8 Pipes shall be filled with a sand/water mixture to also have a thermal resistivity of 1,5 degrees C.m/watt or lower when dry. The sand used in the mixture shall be chemically tested not to be harmful to the cable outer sheath.

Complies/Does not comply

13.0 MEASUREMENTS

13.1 All measurements for payment purposes shall be made jointly by representatives of the Contractor and Spoornet and shall be agreed upon by both parties. The Contractor shall be responsible for obtaining the Engineer's signed approval of such measurements.

Complies/Does not comply

13.2 Measurements of cable length shall be made from centre to centre of cable joints and to the cable ends and will exclude any wastage due to jointing and terminating.

Complies/Does not comply

13.3 When cable is drawn through pipes, only the portion remaining in the pipe will be paid for at the rates quoted for "as installed in pipes".

Complies/Does not comply

13.4 Determination of trench volume for measurement purposes shall be based on measured length and specified width and depth. No allowance shall be made where trenches have to be widened at the bottom to accommodate cables, cable joints and protection slabs.

Complies/Does not comply

13.5 The classification of different types of ground for measurement purposes shall be as follows:

13.5.1 Soft rock will be taken as broken or friable rock which can be removed by pick or mechanical excavator or paving breaker. This includes hard clay.

13.5.2 Hard rock will be taken as rock which cannot be removed by a mechanical excavator and requires drilling and blasting or splitting. This includes reinforced or plain concrete.

14.0 TESTS

14.1 The costs of all post-installation tests shall be borne by the Contractor.

Complies/Does not comply

14.2 The Contractor shall be responsible for remedial work necessary due to damages caused during tests.

Complies/Does not comply

14.3 Spoornet reserves the right to carry out any further tests deemed necessary, using either the Contractor's instruments and equipment or its own, or both. The costs of such tests will not be charged to the Contractor.

Complies/Does not comply

14.4 Test instruments shall be of the accuracy class 1.0 or better in accordance with SABS 1229. Calibration certificates from a recognised testing authority shall be available for inspection and shall not be older than one year.

Complies/Does not comply

14.5 Time measurements shall be carried out using an approved digital timer.

Complies/Does not comply

14.6 The final commissioning site tests will be carried out by Spoornet.

Complies/Does not comply

14.6.1 A suitably qualified staff member of the Contractor shall assist Spoornet during the tests and shall carry out any remedial work where necessary.

Complies/Does not comply

14.7 The contractor shall notify the Engineer in writing 4 weeks before the commissioning date and shall have carried out the following site tests before such date :

Complies/Does not comply

14.7.1 Prove the continuity and insulation resistance of the multicore pilot cables.

Complies/Does not comply

14.7.2 Verify that the insulation level between frame and earth of switchboards fitted with frame leakage protection is not reduced by the installation of the cables.

Complies/Does not comply

14.7.3 The following voltage withstand tests on each completed cable run:

14.7.3.1 Paper insulated cables:

(i) rating up to 12,7/22 kV : test specified in paragraph D-3 of SABS 97.

Complies/Does not comply

(ii) rating 19/33 kV : test specified in paragraph B-3 of BS 6480, Part 1.

Complies/Does not comply

The extruded PVC impermeable serving shall withstand a test voltage of 10 kV DC between armouring and earth for 1 minute.

Complies/Does not comply

The insulation between armouring and lead sheath shall withstand a test v for 1 minute.

Complies/Does not comply

14.7.3.2 XLPE Insulated Cables:

All cables rated up to 19/33 kV shall be tested as specified in appendix E, clause 1.4, of SABS 1339, and cables rated up to 1,9/3,3 kV shall be tested as specified in appendix B, clause B.6, of BS 5467.

Complies/Does not comply

Note :

Where a new XLPE cable is to be joined to an existing XLPE Cable, the test shall differ, in that a 4 kV DC test voltage shall be applied for one minute between the brass screens of the cores and the armouring. The outer sheath shall withstand a test voltage of 10 kV DC for 1 minute between the armouring and earth.

Complies/Does not comply

14.7.4 PVC insulated cables shall be tested as specified in paragraph D-3 of SABS 150.

Complies/Does not comply

14.7.5 The Contractor shall submit three copies of certified test reports to the Engineer within three weeks after completion of the tests.

15.0 GUARANTEE

15.1 All work undertaken by the Contractor shall be subject to a guarantee for a period of one year against faulty and/or inferior workmanship and material.

Complies/Does not comply

15.2 The guarantee period shall commence the day the installation is formally handed over to and accepted by Spoornet.

Complies/Does not comply

15.3 The Contractor shall undertake to repair all faults or defects due to bad workmanship and/or faulty materials, and to replace all defective equipment or materials during the guarantee period.

Complies/Does not comply

15.4 Any defects that may become apparent during the guarantee period shall be rectified to the satisfaction of, and free of cost to Spoornet.

Complies/Does not comply

15.5 The Contractor shall undertake work on the rectification of any defects that may arise during the guarantee period within 7 days of his being notified by Spoornet of such defects.

Complies/Does not comply

15.6 Should the Contractor fail to comply with the requirements stipulated above, Spoornet shall be entitled to undertake the necessary repair work or effect replacement of defective apparatus or materials, and the Contract shall reimburse Spoornet the total cost of such repair or replacement, including the labour costs incurred in replacing defective material.

Complies/Does not comply

TENDERER'S SIGNATURE .....

DATE .....

CHIEF ENGINEER (POWER SUPPLIES)
(INFRASTRUCTURE)

SCOPE OF WORK

1.0 Site inspection required/not required.

Date : .....

Time : .....

CHIEF ENGINEER (POWER SUPPLIES)
(INFRASTRUCTURE)

REFERENCE :

DRAWINGS

DRAWING NO.	TITLE
CEE 55/027367	Concrete slab, cable protection
CEE-PK-14	Route marker, cable, electrical.
CEE-MA-307	Tape, cable warning, underground
FG 263	Accommodation of cables in Railway formations.

CHIEF ENGINEER (POWER SUPPLIES)
(INFRASTRUCTURE)

REFERENCE :

SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
1.0	Route surveys (clause 7.0)		complete		
2.0	Excavations in				
a)	Hard rock		/cubic metre		
b)	Soft rock		/cubic metre		
c)	Soil		/cubic metre		
3.0	Transportation of soil		/cubic metre		
4.0	Shuttering (clause 8.10)		/m		
5.0	Concrete slabs supplied and installed (clause 12.3.2)		each		
6.0	Plastic cable warning tape supplied and installed (clause 12.3.5)		/m		
7.0	150 mm dia. half round concrete pipes supplied and installed (clause 9.2.7.)		/m		
8.0	150 mm dia. asbestos cement pipes supplied and installed		/m		
9.0	Cutting of checker plates (clause 9.4.4)		/m cut		
10.0	Backfilling of trenches with soil (clause 12.3)		/cubic metre		
11.0	Backfilling of trenches with 10:1 soil/cement mix (clause 12.2)		/cubic metre		

SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
12.0	Importation of soil		/cubic metre		
13.0	Concrete cable route markers		each		
14.0	Reinstate tarred surface		/cubic metre		
15.0	Reinstate concrete surface		/cubic metre		
16.0	Installation of cables				
16.1	Installed in trenches (Clause 9.2)				
16.1.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
16.1.2	Low Voltage Cables		/m		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
16.2	Installed in sleeve pipes (clause 9.3)				
16.2.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				

SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
16.2.2	Low Voltage Cables		/m		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
16.3	Installed in ducts (clause 9.4)				
16.3.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
16.3.2	Low Voltage Cables		/m		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
17.0	Installation of cables (Special conditions)				
17.1	Cable supports (clause 9.4.5 and 9.4.6)				
17.1.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				

SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
17.1.2	Low Voltage Cables		/m		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
17.2	Securing cables to poles (clause 9.8)				
17.2.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
17.2.2	Low Voltage Cables		/m		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
17.3	Securing cables to concrete/tunnel walls				
17.3.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				

SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
17.3.2	Low Voltage Cables		/m		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
17.4	Installation of cables in track formations				
17.4.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
17.4.2	Low Voltage Cables		/m		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
18.0	Cable terminations complete (Supply material, terminate and connect up).				
18.1	XLPE cable				
18.1.1	High Voltage terminations		each		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				

SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
18.1.2	Low Voltage terminations		each		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
18.2	PILC SWA cable				
18.2.1	High Voltage terminations		each		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
18.2.2	Low Voltage terminations		each		
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
	..... core ..... mm sq				
19.0	Cable joints complete (Supply material, terminate and connect up)				
19.1	PVC to PVC		each		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				

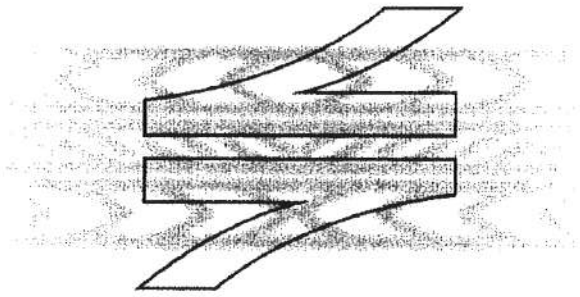
SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
19.2	XLPE to XLPE		each		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
19.3	PILC to PILC		each		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
19.4	XLPE to PILC		each		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				

TENDERER'S SIGNATURE .....

DATE .....

CHIEF ENGINEER (ELECTRICAL)
(INFRASTRUCTURE)



SPOORNET

A division of Transnet limited

TECHNICAL
RAILWAY ENGINEERING
SPECIFICATION

PAINTING OF STEEL COMPONENTS OF ELECTRICAL EQUIPMENT

Circulation restricted to:
Technical: Maintenance (Infrastructure)
Technical: Maintenance

INDEX

1.0 SCOPE

This specification covers the surface preparation, paint systems and painting of steel components of electrical equipment.

2.0 REFERENCES AND GLOSSARY

The following standards and specifications are referred to herein:

2.1 South African Bureau of Standards: -

SABS 064 : Code of Practice for the Preparation of Steel Surfaces for Coating.
SABS 1091 : National Colour Standards for Paint.

2.2 Trade names :

OptiDegreaser
OptiPrime^{Aqua}
Noxyde

2.3 Classification of level of surface degradation:

RE1 – 0.05% of surface rusted
RE2 – 0.5% of surface rusted
RE3 – 1.0% of surface rusted
RE4 – 3.0% of surface rusted
RE5 – 8.0% of surface rusted

3.0 METHOD OF TENDERING

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

4.0 SURFACE PREPARATION

4.1 NON-GALVANISED STEELWORK

4.1.1 New Steelwork

SURFACE PREPARATION (Read: NOTES and SPECIAL INSTRUCTIONS)	PRODUCT REQUIREMENTS & APPLICATION (See Variations for Specific Environmental Conditions)
➢ Sandblast to a standard of Sa2 to remove mill scale and/or flash rust ➢ Remove dust with clean compressed air (Check air for oil contamination)	➢ Apply a stripe coat to edges, bolts, crevices, nuts and rivets. ➢ Apply one thick coat of Noxyde to the entire structure with contrasting color. ➢ Apply a final thick coat of Noxyde at a consumption rate of minimum 400g/m^2

4.1.2 Previously Coated Steelwork

4.1.2.1 COATING START FAILING TO A LEVEL OF RE 2

➢ Test for adhesion (refer to supplier) ➢ Degrease thoroughly with OptiDegreaser ➢ Hydro Blast complete substrate using a rotating nozzle and minimum 250 bar at the nozzle	➢ Apply a stripe coat to edges, bolts, nuts and rivets and fill crevices. ➢ Apply one coat of Noxyde to entire substrate in a contrasting color

4.1.2.2 COATING FAILURE AND RUSTING TO A LEVEL OF RE 4

➢ Remove all visible traces of rust by mechanical means ST2 (chip/grind/sand) OR shotblasting /spotblasting) ➢ Degrease thoroughly with OptiDegreaser ➢ Hydro Blast complete substrate using a rotating nozzle and minimum 250 bar at the nozzle.	➢ Apply a thick coat of Noxyde to the de-rusted areas, edges, bolts, nuts and rivets and fill crevices ➢ Apply one coat of Noxyde at a consumption rate of minimum 400g/m^2 to the entire substrate using a contrasting color.

4.1.2.3 BITUMEN COATED

➢ Remove all visible rust and loosely adhering bitumen coating by means of chipping and scraping (ST2) ➢ Degrease thoroughly with OptiDegreaser ➢ Hydro Blast complete substrate using a rotating nozzle and minimum 250 bar at the nozzle.	➢ .Apply a thick coat of Noxyde to the de-rusted areas, edges, bolts, nuts and rivets and fill crevices ➢ Apply two coats of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using contrasting colors

4.1.2.4 BADLY RUSTED STEEL WITH PITTING & CRUST FORMATION TO RE 5

➢ 1.Degrease thoroughly with OptiDegreaser ➢ 2.Hydro Blast complete substrate using a spinner tip and minimum 250 bar at the nozzle ➢ Shotblast/sandblast complete substrate giving particular attention to bolts nuts rivets and crevices. Sa2 ➢ 4.Dedust	➢ Apply a first thick coat of Noxyde to the entire substrate ➢ Apply a stripe coat to edges, bolts, nuts and rivets and fill crevices using a contrasting color ➢ Apply a final coat of Noxyde at a consumption rate of minimum 400g/m^2

4.2 GALVANISED STEELWORK

4.2.1 NEW AND WEATHERED GALVANISING WITH A SMOOTH GLOSSY FINISH

➢ Degrease thoroughly with OptiDegreaser ➢ Rinse down with copious quantities of potable water	➢ Apply one thin coat of OptiPrime^{Aqua} (100 micron wet/35 micron dry) ➢ Apply a stripe coat of Noxyde to edges, bolts, nuts and rivets and fill crevices ➢ Apply two coats of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using contrasting colors

4.2.2 WEATHERED GALVANISING

4.2.2.1 White rust (zinc oxide)

➢ Degrease thoroughly using OptiDegreaser – ensure that all traces of "white rust" are removed ➢ Rinse down with copious quantities of potable water	➢ Apply one thin coat Noxyde ➢ Apply a stripe coat of Noxyde to edges, bolts, nuts and rivets and fill crevices ➢ Apply a final coat of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using a contrasting color

4.2.2.2 Combination of red rust (iron oxide) and white rust (zinc oxide)

➢ Remove all traces of red rust ➢ Degrease thoroughly using OptiDegreaser – ensure that all traces of "white rust" are removed ➢ Rinse down with copious quantities of potable water	➢ Apply a thick coat of Noxyde to the de-rusted areas, edges, bolts, nuts and rivets and fill crevices ➢ Apply a final coat of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using a contrasting color

NOTES and SPECIAL INSTRUCTIONS:		
1 Sand or Grit-blasting a) Always use clean, non-recycled grit b) Always use fine or extra fine grit c) Always use oil free air d) Always use a moisture trap e) Dedust	2 Degreasing: a) Use only OptiDegreaser b) Dilute according to instructions – see data sheet c) Always follow up with hydro-blasting to remove all chemical residues	3 Hydro-blasting: a) Always use clean potable water b) Use a rotating nozzle and ensure a pressure of minimum 250 bar at the nozzle c) Remove ALL traces of dirt and any form of salt contamination and residues of the degreasing agent d) Concentrate in crevices and other similar "collection" areas

5. PRODUCT APPLICATION

5.1 METHOD OF APPLICATION

OptiPrime^{Aqua}	Noxyde
Temperature-Min 5 °C Relative humidity-Max 80% R.H. ➢ Apply by brush, lacquer roller or airless spray using a no. 11 nozzle ➢ Apply one thin coat only - 100 micron wet = 35 micron dry (DFT) ➢ Small parts can be dipped - dilute with 10% water for dipping	Temperature-Min. 8 °C, Max. 55 °C Relative Humidity-Max 80% R.H. ➢ Apply by brush, roller or airless spray ➢ For airless spray applications refer to "Tips for airless spraying of Noxyde"

5.2DRYING TIME AND OVERCOAT PERIODS

➢ Do not overcoat within 12 hours ➢ Wash down with clean potable water (100 bar) before over coating to remove dust or any other form of intermediate contamination	➢ Drying time is dependant on ambient conditions and can vary from a few minutes (in dry windy conditions) to a few hours (in humid shaded conditions) ➢ Overcoat as soon as possible to avoid contamination of previous coat ➢ Wash down with clean potable water (100 - 150 bar) before over coating if danger of contamination exists or if left more than 4 hours before over coating

5.3 CURING TIME

n/a	➢ 7 - 14 days to "full cure". During this period the product is prone to mechanical damage - the longer time it is allowed to cure, the tougher it becomes

5.4 DRY FILM THICKNESS (DFT) READINGS

35 micron	➢ Severe coastal & marine environments (in the spray zone) – TWO stripe coats & overall minimum DFT of 400 micron ➢ Normal coastal environment (1 5 km from the coast line) - a single stripe coat & overall minimum DFT of 400 micron ➢ Non coastal high rainfall areas, in the immediate vaccinate of rivers, dams, lakes, etc., and in industrial areas with high levels of chemical pollution - a single stripe coat & overall minimum DFT of 400 micron ➢ Dry non aggressive environments - a single stripe coat & overall minimum DFT of 250 micron NOTE: DFT readings can only be taken after 72 hours

5.5 Notwithstanding the above requirements, all surfaces shall be cleaned according to the appropriate method described in SABS 064 for the particular surface to be cleaned, the contamination to be removed and the primer to be applied.

5.6 Blast cleaning of components shall be in accordance with clause 4.3 of SABS 064 to a degree of cleanliness of at least Sa 2 for inland exposure components and Sa 2 ½ for coastal exposure components. See Table 1 of SABS 064 for the appropriate profile.

5.7 Sheet metal that cannot be blast cleaned shall be cleaned by pickling according to clause 4.6 of SABS 064.

5.8 Components that will be powder coated shall be cleaned and prepared by the surface conversion process according to clause 5 of SABS 064 to a medium weight classification of table 2 of that specification.

5.9 Oil and accumulated dirt on steel components where no rusting is present shall be removed according to clause 3 of SABS 064.

6.0 PAINT SYSTEM

A choice of two systems is available to suit the contractors equipment.

6.1 Noxyde paint system

1st coat: OptiPrime^{Aqua}

Wet film thickness: 100 micrometers. Dry film thickness: 35 micrometers.

2nd coat: Noxyde Topcoat

Dry film thickness: 165 micrometers @ 400g/m^2.

6.1.1 Paint application:

6.1.1.1 The primer and paint is normally applied by brush at supply viscosity (no reducer required).

6.1.1.2 The practical spreading rate of the primer and paint is a function of the ambient temperature, wind velocity and the application technique, but will generally fall in the range of 400g/m^2 in low to mild corrosive areas, and 500g/m^2 in severely corrosive areas.

6.1.1.3 Once the applied coat of primer/paint is touch dry, the next coat of paint may be applied.

6.1.1.4 If painted steelwork is to be bolted onto structures, it is imperative that the paint has been allowed to hard dry before the steelwork is bolted onto structures. This is to prevent the soft paint being damaged when tightening the bolts securing the steelwork to the structures.

6.2 Powder Coating System.
The powder-coating process shall be in accordance with SABS 1274 type 4: Corrosion-resistant coatings for interior use and using the thermosetting type high gloss coatings.

7.0 COATINGS AND WORKMANSHIP

7.1 All specified coatings shall be applied according to the relevant specification and the manufacturer's instructions shall be followed.

7.2 Coatings shall not be applied under conditions that may be detrimental to the effectiveness of the coating or the appearance of the painted surface.

7.3 When examined visually, the finished products shall have a uniform appearance and shall show no sign of damage. Damaged areas shall be repaired coat for coat to obtain the desired finish.

TENDERER'S SIGNATURE.....

DATE.....

TRANSNET
freight rail
A division of Transnet limited

TECHNOLOGY MANAGEMENT

SPECIFICATION

3 KILOVOLT DC HIGH SPEED CIRCUIT BREAKERS FOR TRACTION SUBSTATIONS

Author:	Electrical Engineer Technology Management	Shonell Harripershad
Approved:	Senior Engineer Technology Management	Ludwig Borchard
Authorised:	Principal Engineer Technology Management	Willie Coetzee

Date: 27 August 2010

Circulation restricted to: Transnet Freight Rail

INDEX

1.0 SCOPE

This specification covers Transnet Freight Rail's requirements for the supply of 3kV DC, 2000A (nominal) high speed circuit breakers for use on a DC electrified railway system.

2.0 REFERENCES

2.1 The following standard specifications (latest edition) are referred to in this document:

2.1.1 INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC 60947-2	:	Switchgear and Controlgear

2.1.2 TRANSNET FREIGHT RAIL

CEE 0224	:	Drawings, Catalogues, Instruction manuals and spares lists for electrical equipment supplied under contract.
CEE 0227	:	The design and manufacture of a modular 3kV DC, 2000A circuit breaker cell and truck for use on a 3kV DC traction system
BBB 0041	:	Preparation of drawings for Transnet Freight Rail Infrastructure.

2.2 A list of Transnet Freight Rail's drawings applicable to this specification is reflected in Appendix 1.

3.0 DEFINITIONS

All technical terms used in this specification shall have the definitions as per IEC 60947-2 section 2.

4.0 METHOD OF TENDERING

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. This document can be used by tenderers to elaborate on their response to a clause.

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 The Schedule of Requirements, Quantities and Prices, Appendix 1 to this specification shall be fully completed by Tenderers.

4.5 Failure to comply with clauses 4.1, 4.2, 4.3 and 4.4 could preclude a tender from consideration.

5.0 APPENDICES

The following appendices form an integral part of this specification:-

5.1 Appendix 1: List of drawings.

5.2 Appendix 2: Schedule of Specific Requirements.

5.3 Appendix 3: Technical Data Sheet (specific technical information to be furnished with tenders).

5.3.1 Equipment offered in this appendix shall be supplied in terms of this specification and no changes or substitutes will be allowed without the written consent of Transnet Freight Rail.

5.3.2 Acceptance by Transnet Freight Rail's Technology Management staff of the equipment offered in this appendix, in no way relieves the tenderer of his obligation to fulfil his statement of compliance with this specification.

5.3.3 Transnet Freight Rail reserves the right to subject the material offered to tests and inspection to check compliance with the relevant clauses of this specification and/or the quality/performance claimed by the tenderer, prior to adjudication or at any stage during manufacture.

6.0 SERVICE CONDITIONS.

The circuit breakers shall be designed and rated for operation under the following service conditions:

6.1 Atmospheric service conditions.

Altitude:	O to 1 800 m above sea level
Ambient temperature:	-5°C to +50°C.
Relative humidity:	10% to 90%
Lightning conditions:	12 Ground flashes per square kilometre per annum.
Pollution:	Industrial and heavily salt laden coastal pollution.

6.2 Mechanical service conditions.

The substations in which the breakers are to be installed are situated next to the railway lines and the breakers will therefore be subjected to vibration.

6.3 Electrical service conditions.

6.3.1 The circuit breakers are required for the switching and protection of overhead track circuits, the rail being the negative return.

6.3.2 The system voltage is nominally 3.15kV DC, but varies during normal operation between 2,4kV and 3,9kV.

6.3.3 For the purpose of surge and lightning protection to the substation equipment, a 4 micro Farad capacitor is connected between the positive cable termination and negative rail. A Zinc Oxide surge arrester, having a residual voltage of 13kV, is also connected between the positive cable termination and earth mat.

6.3.4 The breakers are fed from sub- or tie-station busbars and calibrated to protect sections of overhead equipment to which they are connected. Sub- and tie-stations are unattended but remote controlled.

6.3.5 Circuit conditions under which track breakers operate vary over a wide range. The following information is considered typical.

6.3.5.1 Sub-station spacing: On open lines it varies from 10 to 25 km, whilst in heavily loaded, multi track areas it varies from 3 to 10 km.

6.3.5.2 Sub-station capacity: The installed capacities vary from 3MW to 12MW, with individual rectifier capacities varying from 3MW to 6MW.

6.3.6 The substation has the following overload ratings:

200 percent for 30 minutes

Short circuit proof for 200 milliseconds.

6.3.7 Typical fault conditions.

	Fault near sub	Fault remote from sub.
Prospective current	50kA	10kA
Time constant	10ms	45ms

6.3.8 All substations on a section normally work in parallel.

6.3.9 The breakers will be fitted with single shot 20 second interval auto reclosing relays. The breakers will be remote controlled, permitting reclosures to be attempted from remote at approximately 2 minute intervals.

7.0 LIFE CYCLE COST

7.1 The cost of the high speed circuit breaker is not the only deciding factor when purchasing high speed circuit breakers. Life cycle cost will be taken into account when evaluating the offers made.

7.2 The life cycle cost will be based on maintenance history in Transnet Freight Rail. The following information shall be submitted by the tenderer.

7.2.1 A separate quotation for the recommended spares Transnet Freight Rail should acquire for normal maintenance purposes to cover expected requirements for a five year operating period, per 20 breakers purchased, indicating the price per item.

7.2.2 A separate quotation for any special tools required, for the maintenance of breakers.

7.2.3 A separate quotation for any other items required, to adapt the breakers to fit into Transnet Freight Rail's system.

7.2.4 A prescribed average maintenance requirement in man-hours per year per high speed circuit breaker, over a 25 year period.

7.3 The recommended quantity of spares and prescribed man-hours per year shall be based on 30 overload and fault trips per month per breaker. It is estimated that an average of 10 percent of all trips are due to faults.

8.0 DRAWINGS, INSTRUCTIONS AND CATALOGUES

8.1 Tenderers shall include in their tenders for the supply of operating and maintenance instruction manuals and drawings to enable the erection, maintenance, repair and adjustment of the breakers to be carried out.

8.1.1 All catalogues, instruction manuals and spares lists shall comply with the requirements of Transnet Freight Rail's specification CEE.0224 (Latest edition).

8.1.2 The preparation of the drawings shall be in accordance with Transnet Freight Rail's specification BBB 0041.

8.1 One copy of the instruction manual must be supplied for every 4 breakers supplied, plus a further 10 copies.

8.2 Tenderers shall also include in their tenders for the supply of spare parts catalogues. These catalogues must contain detailed illustrations and descriptions, and suitably indexed pages reflecting:

8.2.1.1 Illustration item numbers, complete description of items including coil winding data and material, manufacturer's item numbers and Transnet Freight Rail stores item number (left blank).

8.2.2 One copy of the catalogue must be supplied for every 10 breakers supplied, plus a further 10 copies.

8.3 Proof copies of the drawings, instruction manuals and spare parts catalogues shall be submitted by the successful tenderer for approval as soon as possible after the business has been placed to enable the final copies to be supplied at the commencement of delivery of the breakers.

8.4 The successful tenderer shall supply Transnet Freight Rail with one complete set of detailed manufacturing drawings and specifications of all consumable items, i.e. of all coils, main and arcing contacts, arc chutes and components, etc.

9.0 TECHNICAL REQUIREMENTS

9.1 GENERAL

9.1.1 The breakers shall have a minimum continuous rating of 2 000A and shall be suitable for operation under the service conditions described in clause 6.

9.1.2 The breakers shall be capable of clearing a prospective short circuit current of 50kA with a time constant of 10ms, 4 times in succession with time intervals of 20s, 60s and 120s between applications. It shall then still be capable of normal service without attention.

9.1.3 Consideration will only be given to those types of breakers which have been proved to operate satisfactorily on a 3kV DC traction system, under conditions comparable with those encountered on Transnet Freight Rail. Tenderers shall furnish full details (Appendix 3) in regard to experience, viz. approximate number of breakers of tendered design manufactured to date, dates of supply and where installed.

9.1.4 The breakers shall be mounted horizontally on the standard rackout type truck provided by Transnet Freight Rail to drawings referred to in Appendix 1 of this specification or in a modular circuit breaker cell as per specification CEE 0227.

9.1.5 The overall dimensions of a breaker, complete with arc chute, when mounted on this truck shall be such as to afford clear passage of the truck into the standard breaker cell, leading dimensions of which are indicated on the drawings.

9.1.6 The breakers shall operate satisfactorily in buildings where the roof details are as follows:

9.1.6.1 Concrete roof: minimum height 2,6m.

9.1.6.2 Roof consisting of steel members supporting asbestos or metal sheeting: minimum height 3,25m.

9.1.7 All parts shall be interchangeable between breakers.

9.1.8 The breaker and arc chute shall be designed to require the minimum maintenance. The minimum maintenance interval shall be 250 trips at a trip setting of 4 000A at 3,2kV. Of these trips 10 percent may be fault trips.

9.2 INSULATION

9.2.1 The minimum clearance distance in air that shall apply from the 3kV DC circuit to the auxiliary circuits and to the steel base shall be 100mm. Alternatively, double insulation or barriers shall be provided.

9.2.2 The insulation between the 3kV DC circuit and (a) the auxiliary circuits and (b) the steel base shall be capable of withstanding a test voltage of 10,5kV(rms) 50Hz for one minute.

9.2.3 All low voltage auxiliary equipment shall be capable of withstanding a test voltage of 2kV(rms) 50Hz for one minute.

9.2.4 The circuit breaker shall be able to withstand the following 50Hz test voltages for 60 seconds between the open main contacts:

9.2.4.1 With the arc chute removed: 10,5kV(rms).

9.2.4.2 With the arc chute in its working position: 5,4kV(rms).

9.2.5 Full particulars of the insulation, including the class, shall be supplied.

9.3 CIRCUIT BREAKER

9.3.1 The circuit breaker shall be of the trip free type.

9.3.2 The method of closing, latching and the trip free feature shall be described in detail, with the use of drawings and sketches.

9.3.3 In the event of circuit breakers being offered that use mechanical latching (to be delatched), the tenderer shall ensure that the circuit breakers will not malfunction to open due to the mechanical latching mechanism not operating correctly. Such mechanisms shall be suitably protected from dust or fragments from the arc chutes or contacts which can affect their satisfactory operation.

9.3.4 Main contacts, which are not self-cleaning, shall be of material which will not oxidise when the breakers are open or closed for lengthy periods.

9.3.5 Main contacts (or arcing contacts, if fitted) shall be tipped with material with a high resistance to arc erosion, welding and sticking.

9.3.6 Arcing contacts (if fitted) and main contacts shall be accessible for inspection and maintenance and shall be designed to facilitate any necessary adjustments and renewal.

9.3.7 The temperature rise limit of main contacts (if made of copper) shall not exceed 45 degrees Celsius while passing the continuous rated current.

9.3.8 It shall **not** be possible to close the breaker manually.

9.3.9 The breakers shall be designed to prevent dust or fragments from the arc chutes or contacts from affecting their satisfactory operation.

9.3.10 All adjustments shall be such that they can be easily effected. The need for special tools should be avoided.

9.3.11 Tenderers shall furnish full details of all adjustments which can be made, particularly of the main contact alignment and pressure, and where applicable of pole face and toggle mechanism.

9.4 CALIBRATION

9.4.1 The breakers may be either uni- or bi-directional tripping. Tenderers shall state what type is offered; giving details of the calibration ranges for both the forward and reverse current tripping.

9.4.2 A scale plate, indicating the maximum and minimum trip settings and at least five intermediate graduations shall be provided on each breaker at the calibration adjustment position.

9.4.3 The calibration range for the forward direction shall be from 2 000A to 5 000A.

9.4.4 The calibration range for the reverse direction (if reverse tripping is possible) shall be at least the same as that of the forward direction.

9.4.5 Tenderers shall indicate clearly the means whereby the above calibration ranges are provided.

9.4.6 The stability at any particular setting shall be such that the current required to trip the breaker shall not vary by more than 2 percent below or above the set calibrated value when calibration is checked under similar conditions.

9.4.7 The breaker design shall incorporate features to ensure that the breakers can be closed satisfactorily on to a steady (residual) load of not less than 60 percent of any particular calibration setting.

9.5 ARC CHUTES

9.5.1 Arc chutes manufactured from asbestos cement shall not be accepted. Arc chutes made of low maintenance materials are preferred. Tenderers shall specify what materials are used.

9.5.2 Transnet Freight Rail would prefer an offer of an arc chute incorporating a removable metal splitter plate design.

9.5.3 Materials used in arc chutes must be of a type that is easily cleaned.

9.5.4 The arc chutes shall be constructed as to render the contacts easily accessible by removal of separate parts of the arc chutes as a unit.

9.5.5 Tenderers shall submit full details of the principles of operation of the arc chute, as well as sketches and drawings of the various components and assemblies. Details of the maintenance and repairs that can/should be done, and at what intervals, shall also be furnished.

9.6 AUXILIARY CONTACTS

9.6.1 Auxiliary contacts for operating in conjunction with the indication and control circuits shall be located well clear of the arc chutes and main contacts.

9.6.2 The auxiliary contacts shall be of robust construction and tipped with silver or other suitable material.

9.6.3 At least six auxiliary contacts which close ('a' contacts) and six auxiliary contacts which open ('b' contacts) when the breaker closes shall be provided and mounted on each breaker.

9.6.4 A robust, dust tight, non-metallic non-flammable cover for the auxiliary contacts shall be provided on each breaker to prevent ionised air from the 3kV DC circuit or dust causing flashovers or tracking. Hard plastic covers are not acceptable.

9.7 CONTROL CIRCUITRY

9.7.1 Drawings CEE-TBP-35, 39. 40, 41, 42 and 44 reflect the control schematic diagram of circuit breakers in use at present.

9.7.2 The closing and control circuits are supplied from a 110V DC battery under constant trickle charge. The equipment shall be capable of satisfactory continuous operation at any voltage between the limits of 90V and 140V.

9.7.3 In order to ensure constant calibration, the holding coil is normally supplied from a separate constant 110V DC source.

9.7.4 The circuit breakers shall be suitable for operation from the above stated supplies.

9.7.5 The remote control equipment, control relays, indication lights, control switches and reclosing relays shown on drawings CEE-TBP-35 and 39 will be provided by Transnet Freight Rail.

9.7.6 All other items of equipment required to enable the breakers to operate correctly, without any alterations to the standard wiring circuitry provided by Transnet Freight Rail, shall be included in the tenderer offers.

9.7.7 The design of the breakers and control circuitry shall be such that the breakers shall "fail to safety", particularly on loss of the low voltage control supplies.

9.8 TESTS AND OSCILLOGRAMS

9.8.1 Short circuit tests shall be carried out on breakers connected to a 3kV DC system with similar fault currents to that which is specified in clause 6.3.7 and oscillograms thereof shall be submitted with the tenderers offers. For the purpose of the test the breakers shall be calibrated at 4 500A.

9.8.2 The following shall be clearly indicated on the oscillogram traces:

9.8.2.1 Commencement of short circuit.

9.8.2.2 Opening time, i.e. time from the application of the short circuit to initial opening of the arc breaking contacts.

9.8.2.3 Arcing time.

9.8.2.4 Arc voltage (Transient recovery voltage).

9.8.2.5 Rate of rise of current.

9.8.2.6 Prospective peak current.

10.0 TESTS BY TRANSNET FREIGHT RAIL AND TYPE TEST CERTIFICATES

10.1 Transnet Freight Rail reserves the right to test a circuit breaker, selected at random, for compliance with any or all of the following clauses.

10.1.1 Fault clearing test, clause 9.1.2.

10.1.2 A maintenance interval test (an in service test), clause 9.1.8.

10.1.3 Insulation tests, clause 9.2.2 to 9.2.5.

10.1.4 Temperature rise of the main contacts, clause 9.3.7.

10.1.5 Stability of calibration, clause 9.4.6.

10.1.6 Closing on to a steady (residual) load, clause 9.4.7.

10.1.7 Breaker "fail to safety" feature, clause 9.7.7.

10.2 The tenderer shall provide type test certificates to confirm that the breakers comply to the requirements as specified in clauses 10.1.1 to 10.1.7.

11.0 PACKING

11.1 Each circuit breaker shall be completely assembled and operationally checked before packing and dispatch.

11.2 The circuit breakers and arc chutes shall be packed separately.

11.3 The breakers shall be bolted down to substantial battens firmly secured to the packing cases to prevent movement of the breakers in the cases during transit. The packing cases shall be of substantial construction to prevent damage to the breaker by rough handling. The bases of the cases shall be suitable for handling with a fork lift truck.

11.4 The interiors of the cases shall be lined with waterproof paper or other suitable material.

12. INSPECTION

12.1 An Inspection Certificate will be issued by Technology Management – Electrical Technology to certify that material / equipment conforms to Transnet Freight Rail's requirement.

END

SCHEDULE OF DRAWINGS

LIST OF DRAWINGS

DRAWINGS ISSUED WITH THIS SPECIFICATION

DRAWING NUMBER	DESCRIPTION
CEE-TBP-35	Wiring diagram: H.S.C.B, Electronic Control Relay
CEE-TBP-39	Circuit diagram; H.S.C.B, Electronic Control Relay
CEE-TBP-40	Truck circuit diagram
CEE-TBP-41	Truck wiring diagram
CEE-TBP-42	Connection diagram for HSCB
CEE-TBP-44	Connection diagram for Ansaldo IR6003 HSCB
CEE-TCQ-63	Assembly of lightweight concrete cell with H.S.C.B. truck in position.
CEE-TCQ-69 Sh 1	Truck frame assembly H.S.C.B.

Appendix 2

SCHEDULE OF REQUIREMENTS

Supply of the 110V closing contactor 154X as depicted on drawing CEE-TBP-35 if required.

TECHNICAL DATA SHEET

(To be completed by tenderers and submitted as part of their tender)

1. Make of breaker: _____

2. Experience with tendered design of breaker: (Clause 9.1.3)

NUMBER SUPPLIED	WHERE INSTALLED	DATE SUPPLIED

3. Continuous current rating of breaker : _____

4 Rated voltage of breaker : _____

5 Mechanically latched Yes/No. _____

6 Magnetically latched Yes/No. _____

7 Main contact material _____

8 Arcing contacts fitted Yes/No. _____

9 Contact material of main contact (or arcing contact, if fitted)

_____

SPOORNET

A division of Transnet limited

TECHNICAL

RAILWAY ENGINEERING

SPECIFICATION

HOT DIP GALVANISING AND PAINTING OF ELECTRIFICATION STEELWORK

Circulation restricted to:

Technical

INDEX

1.0 SCOPE

1.1 This specification covers the hot dipped galvanising and painting of electrification steelwork.

1.2 The extent of work includes galvanising and painting of steelwork consisting of universal column masts with welded on bases up to 14 m in length and small part steelwork consisting of channel, angle and flat iron fittings, welded assemblies and tubular cantilevers.

2.0 REFERENCES

2.1 The following publications (latest edition) are referred to herein:

SABS 763: Hot Dipped Galvanising.

SABS 1091: National Colour Standards for Paint.

3.0 METHOD OF TENDERING

3.1 Tenderers shall indicate clause by clause compliance or non-compliance with the specification. This shall take the form of a separate document listing all the specification clause numbers indicating the individual statement of compliance or non-compliance.

3.2 The Schedule of Requirements, Quantities and Prices, Appendix 1 to this specification shall be fully completed by Tenderers. Failure to submit a fully completed sheet may preclude a tender from further consideration.

4.0 APPENDICES

The following appendices form an integral part of this specification:

Appendix 1: Schedule of Requirements, Quantities and Prices.

5.0 GALVANISING OF STEELWORK

5.1 The steelwork must be cleaned and hot dip galvanised to SABS 763 except for the following:

5.1.1 No ammonium chloride salts shall be used on withdrawal from the molten zinc.

5.2 After galvanising no passivation must take place. Quenching may be done with clean water. No sodium dicromate must be used.

5.3 All surface contamination of zinc oxide (zinc ash) must be removed by means of brushing.

6.0 PRIMER COATING

6.1 The hot dip galvanising shall be followed as soon, as is practical by the painting procedures as specified hereunder:

6.1.1 Prior to painting, all steelwork shall be cleaned with a solvent cleaner and washed down with clean water to remove all traces of solvent. The solvent cleaner used must be compatible with zinc (similar to Galv Clean).

6.1.2 The primer coating, a two-component polyamide cured epoxy primer e.g.: PLASCOGUARD GEHOPPENS PRIMER or equivalent shall be applied to a dry film thickness of 75 microns. Application shall be in accordance with the manufacturers

instructions.

6.1.3 The primer coating shall be allowed to cure for a minimum period of 48 hours before handling to facilitate coating of the rest of the surfaces as well as the application of the intermediate coat.

6.1.4 A coat of a two-component high-build micaceous iron oxide pigmented polyamide cured re-coatable epoxy e.g.: SIGMACOVER CM MIOCOAT or equivalent shall be applied to a wet film thickness of 75-85 microns. Application shall be in accordance with manufacturers instructions.

6.1.5 A further 48 hours period must be allowed for curing of the primer coatings before handling the steelwork for transportation purposes.

6.2 All care must be exercised during handling to prevent damage of the painted surfaces.

6.3 Loading of steelwork must be done in such a way to limit damage of surfaces to a minimum during transit.

6.4 Only non-metallic slings should be used, preferably nylon or cotton material.

6.5 Spoornet reserves the right to inspect the premises where this work is carried out at any time during the duration of galvanising and primer painting.

6.6 Spoornet shall inspect all steelwork at the Tenderers premises before dispatch of any such steelwork.

7.0 TOP COATING

7.1 The topcoat shall be applied directly after erection of the steelwork in accordance with procedures hereunder:

7.1.1 Damage of the primed surfaces shall be repaired, after erection, by the application of one or more coats of a two component high build micaceous iron oxide pigmented polyamide cured re-coatable epoxy coating e.g.: SIGMACOVER CM MIOCOAT or equivalent until the original film thickness is obtained.

7.1.2 A topcoat of a two-component aliphatic isocyanate cured acrylic finish e.g.: SIGMADUR GLOSS or equivalent shall be applied according to the paint manufacturers instructions to a minimum dry film thickness of 50 microns. The topcoat shall be determined by whether steelwork is for Spoornet or the South African Rail Commuter Corporation.

7.1.2.1 For Spoornet the colour shall be French Grey (SABS 1091: Code H30).

7.1.2.2 For the South African Rail Commuter Corporation the colour shall be Medium Sea Grey (SABS 1091: Code G24).

8.0 QUALITY

8.1 The tenderer shall submit a copy of a Quality Plan to be implemented during the process. The Quality Plan shall include stages for preparation of metalwork prior to galvanising, for the galvanising and for the painting process.

8.2 The Quality Plan shall furthermore make provision for the customer's requirements for inspection and acceptance points and witnessing of tests to establish whether requirements of SABS 763 in so far as preparation of steelwork prior to galvanising, galvanising and painting requirements as per this specification are complied with.

9.0 SUBSTITUTION

7.1 This instruction replaces Specification CEE.0183.95.

7.2 All clauses have been revised to suit latest requirements e.g.: removal of the Complies/Does not complies reference.

END

TENDERER'S SIGNATURE: _____

DATE: _____

FOR SPOORNET: _____

GRADE: _____

Appendix 1

SCHEDULE OF REQUIREMENTS, QUANTITIES AND PRICES

1.0

END

FOR SPOORNET: _____

GRADE: _____

SPOORNET

A division of Transnet limited

TECHNICAL

CONFIGURATION MANAGEMENT

SPECIFICATION

DRAWINGS, CATALOGUES, INSTRUCTION MANUALS AND SPARES LISTS FOR ELECTRICAL EQUIPMENT SUPPLIED UNDER CONTRACT

Circulation restricted to:

Technical

INDEX

1.0 SCOPE

This specification covers Spoornet's requirements for drawings, catalogues, and instruction manuals and spares lists of electrical equipment supplied under contract.

2.0 DEFINITIONS

2.1 "Design drawings for approval" defines those drawings, which have to be submitted to Spoornet for approval prior to manufacture of equipment.

2.2 "Installation drawings" defines those drawings, which are required for the installation of the equipment.

2.3 "As Built drawings" defines those drawings, which reflect all the various approved designs, layouts, etc., of the actual final accepted state of the equipment.

3.0 STANDARDS AND SPECIFICATIONS

3.1 The following standards and specifications are referred to:

CEE.0012: Method of Tendering

SABS 0111: Engineering Drawings.

BS 308: Engineering Drawing Practice.

NRS 002: Graphical Symbols for Electrical Diagrams.

IEC 617: Graphical Symbols for Diagrams.

ASHRAE: American Society of Heating Refrigeration Air-conditioning Engineers Standard.

3.1.1 The following Spoornet standard (Electrical) symbol drawings are listed for reference:

CEE-PA-19: Symbols for Electrical Installations.

CEE-PA-42: Symbols for Distribution and Transmission Layout.

CEE-PA-101: Symbols for Air-conditioning installations.

CEE-TA-62: Standard Electrification Symbols.

3.2 Tenderers and contractors shall ensure that they work to the latest issues and amendments of the above standards and specifications.

4.0 APPENDIX

The following appendix forms an integral part of this specification:

Appendix 1:SCHEDULE OF REQUIREMENTS

This appendix calls for specific requirements applicable to the contract.

5.0 METHOD OF TENDERING

5.1 Tendering shall be in accordance with Spoornet (Electrical) specification CEE.0012.

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

5.3 The Schedule of Requirements, Quantities and Prices, Appendix 1 to this specification shall be fully completed by Tenderers. Failure to submit a fully completed sheet may preclude a tender from further consideration.

6.0 LANGUAGE AND UNITS OF MEASURE

Drawings and documents shall be prepared in English and the ISO unit of measure. Other offers will be considered on merit.

7.0 DRAWINGS

7.1 Drawings shall be generated in either Microstation or any CAD format, which can be read by Microstation, but offers on other media will be considered on merit.

7.2 Drawings shall be prepared in such a manner that they fully comply with the requirements of SABS 0111 and/or BS 308.

7.3 Symbols, with their explanations used on the drawings but not covered by the NRS 002, IEC 617, ASHRAE or Spoornet's symbol drawings shall be furnished i.e. then included on the drawing or supplied on a separate symbol list which is to be cross referenced to the drawing.

7.4 Where the publications referred to in clause 3.1 are at variance, the practice detailed in SABS 0111 shall take preference.

7.5 Drawings shall be prepared for ISO; "A" series size sheets and shall not be greater than A1 size except as detailed below.

7.5.1 Where under exceptional circumstances the nature of the work is such that a size A1 is impractical, then the AO size may be used.

7.5.2 Long drawings, where necessary for wiring/circuit diagrams, cable run diagrams, track layouts, etc., shall be prepared with widths equal to the widths of the "A" series sheets as required, but preferably not exceeding the length of an A0 sheet.

7.6 All interrelated drawings shall be clearly and adequately cross-referenced.

7.7 The Contractor hereby grants to Transnet a non-exclusive licence, in accordance with the provisions of section 22 of the Copyright Act, 1978;

7.7.1 to copy any plan, diagram, drawing, specification, bill of quantities, design calculation or other similar document made by the Contractor, other than under the direction or control of Transnet, in connection with the extent of work;

7.7.2 to make free and unrestricted use thereof for its own purposes;

7.7.3 to provide copies thereof to consultants to Transnet to be used by them for the purpose of such consultations and consulting services and-

7.7.4 to provide other parties with copies thereof for the purpose of tenders invited by Transnet.

7.7.5 Such non-exclusive licence shall apply *mutatis mutandis* to any plan, diagram, drawing, specification, bill and/or schedule of quantities, design calculation or other similar document made, other than under the direction or control of Transnet, by any principal or sub-contractor of the Contractor. The provisions of this clause shall not apply to documents made, in the case of plant or equipment to be supplied, for the manufacturing process of such equipment, but only to the equipment supplied itself.

7.7.6 Transnet shall make no separate or extra payment in respect of any non-exclusive licence granted in terms hereof.

8.0 INFORMATION REQUIRED ON DRAWINGS

8.1 A title block shall be provided in the lower right hand corner of each drawing, indicating:

8.1.1 Descriptive title.

8.1.2 Contractor's drawing number.

8.1.3 Space for Spoornet's drawing number (as requested in clause 7.7).

8.1.4 Place of installation.

8.1.5 Contract / Order number.

8.1.6 Contractor's name.

8.1.7 Signature or name of approving officer (as requested in clause 8.0).

8.1.8 Approval date.

8.1.9 Issue number.

8.1.10 Projection symbol for multi-view drawings, if required.

8.2 Successful Tenderers can obtain a copy of Spoornet's standard title block (Microstation or DXF formats) free of charge by contacting the Documentation Management section.

8.3 On wiring and circuit diagrams, the following shall be specified:

8.3.1 Cable and wire sizes.

8.3.2 Values of resistance.

8.3.3 Breaking capacity of switches.

8.3.4 Ratings of equipment.

8.4 On each assembly or sub-assembly drawing, the following shall be given:

8.4.1 Description of item.

8.4.2 Quantity required for assembly depicted.

8.4.3 Material manufactured from.

8.4.4 The classification of the material according to the relevant SABS specification or other specifications referred to herein.

8.4.5 The class or process of finish and/or coating.

8.4.6 Where special parts are specified, the name of the manufacturer, the size, capacity and the name or catalogue number of each part shall be furnished.

8.4.7 The mass of finished item depicted on the drawing.

8.4.8 Dimensions from a proper reference surface.

8.4.9 Dimension tolerances.

8.5 *On electrification drawings, the following shall be specified:*

8.5.1 Kilometre distances.

8.5.1.1 Kilometre distances of all new and existing masts measured from the preceding kilometre post.

8.5.2 Civil

8.5.2.1 The following civil information shall be shown:

8.5.2.1.1 Bridges.

8.5.2.1.2 Tunnels.

8.5.2.1.3 Pipes.

8.5.2.1.4 *Culverts.*

8.5.2.1.5 Subways.

8.5.2.1.6 Manholes.

8.5.2.1.7 Off track platforms.

8.5.2.1.8 Water-furrows along track.

8.5.2.1.9 Service roads that may influence electrification.

8.5.2.1.10 Level crossings.

8.5.2.1.11 All banks and cuttings.

8.5.2.1.12 Retaining walls.

8.5.2.1.13 Gradient markers and gradients.

8.5.2.1.14 Boundary fences (where relevant).

8.5.2.1.15 The beginning and ending of transition and circular curves and the radius.

8.5.2.3 On all station plans the beginning and ending of the platforms to be indicated, as well as all buildings and structures on the platform which may effect electrification. All secondary platforms/structures/obstacles, which may effect electrification, must also be shown.

8.5.2.4 All points with stock rail joints, intersection of centre lines and all ends of point positions to be shown, as well as the type of point, e.g. 1:9 LH (left hand.

8.5.3 Electrical

8.5.3.1 The following electrical information shall be shown:

8.5.3.1.1 New and existing masts and structures with appropriate sizes.

8.5.3.1.2 Span lengths.

8.5.3.1.3 Tension lengths.

8.5.3.1.4 Mast to track centres.

8.5.3.1.5 Tension type (spring or weight).

8.5.3.1.6 Transmission lines, Transnet and Eskom (Showing crossing heights above rail level).

8.5.3.1.7 Telkom lines.

8.5.3.1.8 Height gauges.

8.5.3.1.9 Power and Lighting kiosks.

8.5.3.1.10 Electrical cables nearer than 3,2m from track centre, as well as cables crossing the track.

8.5.3.2 Wire profiles showing clearances/wire heights for all transmission and telecommunication lines that cross the tracks shall be shown on the drawing at the point of crossing, in either tabular or graphic format.

8.5.3.3 Wire profile for all bridges and tunnels shall be shown on separate drawings.

8.5.3.4 Important information that shall be noted are:

8.5.3.4.1 Basic span.

8.5.3.4.2 Ruling contact wire height.

8.5.3.4.3 Reference to bonding drawings.

8.5.3.4.4 Wire sizes.

8.5.3.4.5 Types of structures and foundations.

8.5.3.4.6 Tables for traction and transmission line (Showing wire heights).

8.5.3.4.7 Dropper chart.

8.5.3.4.8 Overlaps.

8.5.3.4.9 Jumpers.

8.5.3.4.10 Staggering.

8.5.3.4.11 References to switching diagram drawings.

8.5.3.4.12 Any other relevant information.

8.5.4 Signal.

8.5.4.1 The following signal information shall be shown:

8.5.4.1.1 Signal gantries (showing direction of aim).

8.5.4.1.2 Independent signals (showing direction of aim).

8.5.4.1.3 Signal kiosks.

8.5.4.1.4 Telephones.

8.5.4.1.5 Signal relay rooms.

8.5.4.1.6 Radio repeater rooms.

8.5.4.1.7 Signal cables nearer than 3,2m from track centre, as well as cables crossing the track.

8.5.5 Electrification information must be clearly indicated on drawings (see also drg no CEE-TA-62 for Standard Electrification Symbols).

8.7 The successful tenderer shall obtain Spoornet's drawing numbers from the Documentation Management section of Spoornet well in advance in writing, wherein details of all relevant drawings, i.e. titles and makers numbers are quoted. Against this information Spoornet will allocate its own numbers for inclusion by the Contractor on the original drawings.

9.0 CERTIFICATION OF DRAWINGS

The contractor against a date to certify that the drawing has been checked and is correct in all respects shall approve each drawing. This also includes changes.

10.0 CHANGES TO DRAWINGS

Any drawing returned to the Contractor for changes shall be re-submitted to Spoornet within 21 days with the appropriate changes endorsed thereon.

11.0 SUBMISSION OF TENDER DRAWINGS

The Tenderer shall submit drawings of all major items of equipment with the tender. The drawings shall be sufficiently detailed (e.g. safety factors) to enable suitability of the design to be judged and to enable Spoornet to prepare a reasonably accurate estimate of the cost of maintenance.

12.0 DRAWINGS TO BE SUPPLIED BY SUCCESSFUL TENDERER

12.1 Two prints of each design drawing for approval to be submitted prior to commencement of work or manufacture of any equipment to Spoornet. This includes drawings of general layouts, cable routes, schematic diagrams, foundations, equipment etc.

12.2 Two prints of each installation and/or erection drawing to be submitted to Spoornet. This includes drawings of modular steel buildings, structures etc. and shall be delivered at the same time the delivery of the equipment commences.

12.3 The successful tenderer shall supply one complete set of approved (signed) "As Built" working drawings as well as the electronic files thereof. Drawings shall be fully dimensioned, fully detailed, clear and neat. The set shall comprise all electrical and mechanical drawings considered necessary by Spoornet and shall include drawings of all renewable parts or items. "As Built" drawings of all enclosures, structures and foundations shall also be supplied.

12.4 All relevant "As Built" drawings required shall be delivered to Spoornet within 90 days of completion of the installation and delivery of equipment.

12.5 Until all relevant drawings called for in the contract are delivered, the contract will be considered incomplete.

13.0 CATALOGUES

13.1 Tenderers shall submit a separate quotation for the supply of the itemised part catalogues when specified in the Schedule of Requirements. The size shall be A4 (297 mm x 210 mm). Consideration shall be given on merit of the supply of these catalogues electronically (PDF format).

13.2 The information contained in the catalogues shall be classified into convenient sectors and be indexed. Thumb tabs shall be provided for quick reference to sections. All apparatus shall be illustrated by means of photographs or detailed sketches on which both the parts and the catalogue numbers of the parts are clearly shown. Catalogues shall have exploded views of components for clarity where needed.

13.3 The following information shall be given in tabular form:

13.3.1 Designation of apparatus or item of equipment.

13.3.2 Description of part including information such as dimensions, sizes, resistance values, stranding, material, current ratings, etc.

13.3.3 Catalogue number.

13.3.4 Manufacturer's name.

13.3.5 "As Built" drawing and item number where applicable.

13.3.6 Quantity of parts required for each piece of apparatus.

13.3.7 Illustrating photographs or sketch number.

13.3.8 Nato registration where applicable.

13.4 In a suitable section of the catalogue the following information shall be given:

13.4.1 Index to "As Built" Drawings.

13.4.1.1 "As Built" drawing number.

13.4.1.2 Heading.

13.4.1.3 Parts shown on drawing.

13.4.2 Index to catalogue numbers.

13.4.2.1 Catalogue numbers in numerical order.

13.4.2.2 Catalogue volume number, where applicable.

13.4.2.3 Section in which part is listed.

13.4.2.4 Page number.

13.4.3 Special tools.

13.4.3.1 Designation and description of special tools.

13.4.3.2 Catalogue number.

13.5 Each volume shall be neatly bound in hard serviceable cover on which the contract numbers volume number and titles are printed. All the information in the catalogues shall be given in a clear legible manner. The catalogues shall include all items of equipment to be supplied by the successful tenderer.

13.6 *Catalogues shall be delivered before date of completion of the contract.*

14.0 INSTRUCTION MANUALS

14.1 Tenderers shall submit a separate quotation for the supply of the number of copies of instruction manuals specified in the Schedule of Requirements. The size shall be A4 (297 mm x 210 mm). Consideration shall be given on merit of the supply of these catalogues electronically (PDF format).

14.2 The successful tenderer shall submit draft instruction manuals for approval prior to final printing/compiling and delivery.

14.3 The approved instruction manuals shall be delivered before commissioning the equipment. If this cannot be met, the successful tenderer shall furnish at least three copies of preliminary instruction manuals, suitable for the use of maintenance staff, until the final instruction manuals are to hand (which shall be before the date of completion of the contract).

14.4 The construction, method of operation and purpose of all items of equipment shall be fully explained by means of descriptions and photographs, sketches, drawings or circuit diagrams showing all details.

14.5 The information contained in the instruction manuals shall be classified into convenient sections and indexed. Where multiple models are produced each model shall be described in a separate section in such a manner that models not applicable can be omitted. Where possible the sections shall be subdivided as follows:

14.5.1 Installation and commissioning.

14.5.2 General description and method of operation.

14.5.3 Maintenance and inspection.

14.5.4 Overhaul and repair of equipment.

14.5.5 Technical and maintenance data.

14.5.6 Test procedure flow charts.

14.5.7 Fault finding and trouble shooting.

14.6 The method of calibrating, setting or adjusting all equipment requiring such attention shall be described and where necessary illustrated. The necessary data shall be given in each case to enable the equipment to be checked by measurement if required.

14.7 Full step-by-step instructions regarding the servicing and repair of the equipment shall be given together with all the necessary data such as dismantling and assembling procedures, working clearances, tolerances, limits, fits, maximum permissible wear, recommended lubricants, use of special tools, insulation and winding data, spring pressures and tensions, brush data, fuse data, etc. Recommended servicing/rework/replacement of parts frequencies shall also be included in the maintenance and inspection section of the instruction manual.

14.8 Any delay in delivery of the complete supply of satisfactory instruction manuals/preliminary manuals as provided for in this clause, will subject the Contractors to a deduction from the contract sum, of a penalty as defined in the tender, counting from the specified delivery time until such time as the said manuals are delivered.

15.0 COMBINED DOCUMENTS

If desired the catalogues and instruction manuals specified in clauses 12.O and 13.O may be combined into single volumes. Tenderers shall state whether or not it is their intention to do so. In this case the delivery shall be as specified in clause 13.3, alternatively the conditions described in clause 13.8 applies.

16.0 SPARES LIST

16.1 To enable Spoornet to catalogue and timeously acquire all spares required, the following information shall be submitted before commissioning of equipment:

16.1.1 An itemised schedule of the spares (with reference to alternatives) which are recommended for normal maintenance purposes.

16.1.2 The quantity recommended to be held against each item on the spares list and where sets are supplied, the types and quantity per type to make up a set.

16.1.3 A full and complete ordering description and number of each individual spare with drawing number if relevant.

16.1.4 Where the ordering description and number differs from that of the original manufacturer's catalogue, description and number, the original manufacturer's name, description, type and ordering number shall be listed as well as all other relevant data available.

16.1.5 The national stock number - Nato - number of each spare where the particular spare was imported from a Nato country and where a national stock number was allocated.

16.2 Initially the spares list containing the above information will suffice, but this list shall not in any way replace or supersede the spare parts catalogue mentioned in clause 12.O.

17.0 PACKING OF DRAWINGS, CATALOGUES, INSTRUCTION MANUALS AND SPARES LISTS

All items shall be packed in such a way that they are received in good condition.

18.0 SUBSTITUTION

This specification replaces specification CEE.0224.94

TENDERER'S SIGNATURE: _____

DATE: _____

FOR SPOORNET:_____

GRADE: _____

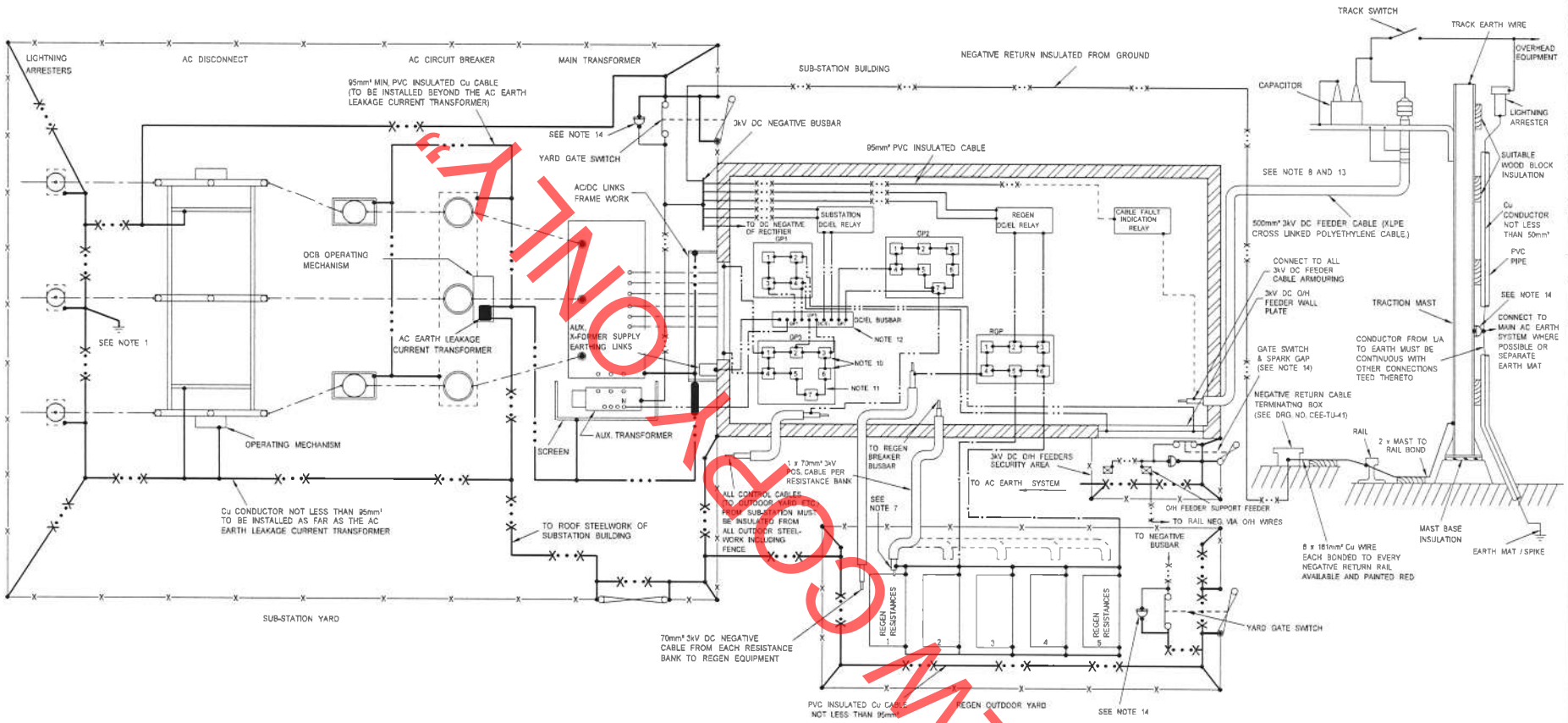
END

SCHEDULE OF REQUIREMENTS

FOR SPOORNET: _____

GRADE: _____

END



NOTES

1. DEEP EARTH OR TRENCH SYSTEM SEE CODE OF PRACTICE: EARTH SYSTEMS FOR ELECTRIC LIGHT AND POWER AND TRACTION INSTALLATIONS. ALSO TO BE CONNECTED TO SUPPLY AUTHORITY EARTH SYSTEM.
2. THE OVERALL RESISTANCE OF A LIGHTNING ARRESTER EARTH SYSTEM EITHER AC OR DC WHEN DISCONNECTED FROM THE EQUIPMENT EARTHING CIRCUITS MUST NOT EXCEED 5 OHMS.
3. THE INSTALLED EARTHING SYSTEM SHOULD BE LOCATED DIRECTLY BENEATH THE AC OR DC LIGHTNING ARRESTER OR AS CLOSE TO THIS POSITION AS POSSIBLE. UNNECESSARY BENDS IN THE DOWN LEADS FROM THE LIGHTNING ARRESTERS SHOULD BE AVOIDED.
4. ALL UNDERGROUND EARTHING CONNECTIONS MUST BE EXOTHERMIC WELDED OR CRIMPED TINNED CABLE LUGS OR BRASS CLAMPS IN ACCORDANCE TO SPECIFICATION BBB3059.
5. ALL CORNER AND GATE POSTS TO BE DIRECTLY EARTHED.
6. THE SWITCH ATTACHED TO THE SUB-STATION OUTDOOR YARD GATE. THE 3kV DC O/H FEEDER SECURITY AREA GATE AND THE REGEN RESISTANCE ENCLOSURE GATE ARE TO BE SO MOUNTED THAT THE SWITCH IS OPEN WHEN THE GATE IS CLOSED AND IS CLOSED WHEN THE YARD GATE IS OPEN.
7. CABLE ARMOURING TO BE EARTHED TO REGEN DC/EL BUSBAR AT RESISTANCE BANKS.
8. WHERE A CABLE FAULT INDICATION RELAY IS INSTALLED THE ARMOURING OF THE 3kV DC TRACK FEEDER CABLES SHALL BE BLOCK JOINTED AT THE MAST.
9. WHERE NO CABLES FAULT INDICATION RELAY IS INSTALLED THE ARMOURING OF THE 3kV DC FEEDER CABLES SHALL BE BLOCK JOINTED IN THE 3kV DC BUSBAR CHAMBER.
10. CONNECTIONS NEED NOT BE IN THE NUMERICAL ORDER AS SHOWN IN DC/EL (SUBSTATION AND REGEN) GROUPS.
11. ALL INTERCONNECTIONS OF THE EARTH LEAKAGES TO BE 95mm² OR EQUIVALENT PVC INSULATED CABLE.
12. SUBSTATION DC/EL BUSBAR SHALL BE MARKED ACCORDING TO GROUP NUMBERS FOR EASY REFERENCE.
13. FOR END BOX ASSY EARTHING DETAIL SEE DRG NO CEE-TCL-78.
14. THE SPARK GAP ASSEMBLY SHALL COMPLY TO THE ASSEMBLY DRAWING BBB0908 AND SPECIFICATION BBB1616.

LEGEND (EQUIPMENT)

GP1 - BUSBAR CHAMBER GROUP.
1. BREAKER CELL(S).
2. UNDERVOLTAGE POTENTIAL DEVIDER SUPPORT BRACKET.
3. DOOR FRAME.
4. CHEQUER PLATES WHERE APPLICABLE.
5. 3kV O/H FEEDER WALL PLATE.

GP2 - SUBSTATION AUXILIARIES GROUP.
1. BATTERY CHARGER.
2. TELECONTROL PANEL.
3. POWER AND LIGHTING DISTRIBUTION BOX AND STEEL TUBING.
4. UNDERVOLTAGE RELAY STEEL BOX.
5. ALL STEEL ENTRY DOORS.
6. CHEQUER PLATES WHERE APPLICABLE.
7. LT CONTROL PANEL.

GP3 - HT BAY GROUP.
1. RECTIFIER STEELWORK.
2. WAVE FILTER STEELWORK.
3. REACTOR STEELWORK.
4. POSITIVE ISOLATOR STEELWORK.
5. BAY FENCES STEELWORK.
6. FAN FRAMEWORK.
7. CHEQUER PLATES WHERE APPLICABLE.
8. ANODE WALL PLATE.

RGP - REGEN GROUP.
1. REGEN CONTROL PANEL.
2. BAY GATE.
3. BAY GATE EARTH LINK.
4. ALL STEEL DOORS AND FRAMES.
5. POTENTIAL DEVIDER SUPPORT BRACKET.
6. CHEQUER PLATES WHERE APPLICABLE.
7. REGEN RESISTANCE BOXES.

LEGEND (SYSTEMS)

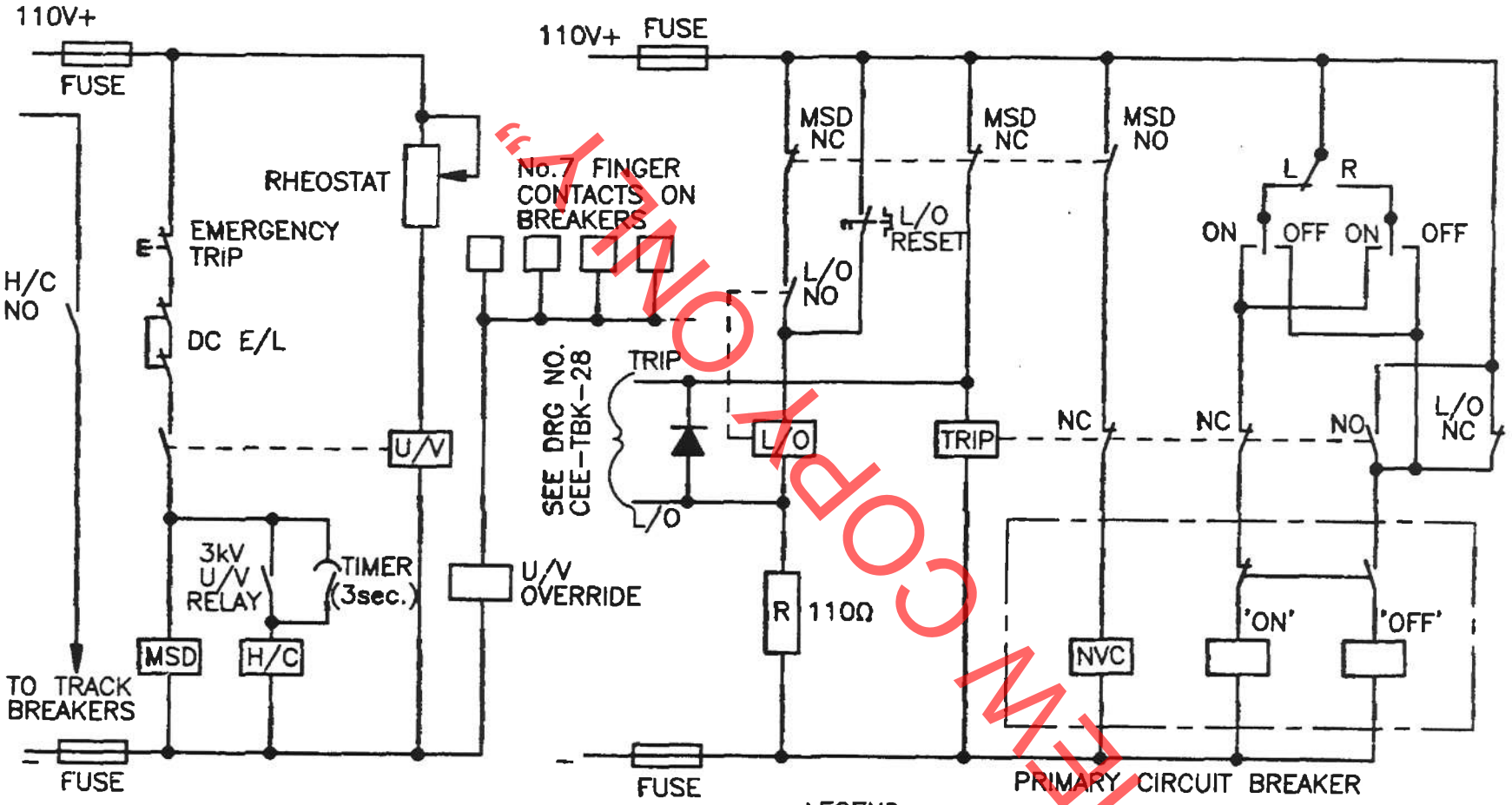
- REGENERATIVE DC EARTH LEAKAGE SYSTEM
- SUBSTATION DC EARTH LEAKAGE SYSTEM
- DC NEGATIVE SYSTEM
- AC EQUIPMENT EARTH LEAKAGE SYSTEM
- AC EARTH SYSTEM
- SECURITY FENCE

AMENDMENTS		
NO	NAME	DATE
6	FM EYGELAAR	95-04-26
DRAWING REVISED. DO REF: T95/025		
7	FM EYGELAAR	95-08-24
SUBSTATION DC EARTH LEAKAGE SYSTEM IN BUILDING REVISED. DO REF: T95/043		
8	LD BORCHARD	96-01-24
NOTES REVISED. DO REF: T98/004		
9	B O SCHULZ	2001-05-25
NOTE 14 ADDED. DO REF: CDO/1197		
10	LD BORCHARD	2008-07-31
NOTE 8 & 9 REVISED. DO REF: CDO/8238 ECP NO: BBD4921		
11	Digitally signed by Ludwig Borchard Date: 2011.03.01 12:25:54 +02'00'	
TITLE AND NOTE 4 REVISED. DO REF: CDO/7245 ECP NO: BBD8165 & BBD8634		

DO REF: J71/196	GEN. TOL: LIN± - ANG± -	
DRN: D. WEIDEMAN	CKD: E. JURGENSEN	DATE: 73-08-20
ENG: -	T. C. BROOK	for CHIEF ENG.
CENTRAL DRAWING OFFICE	TRANSNET freight rail	

3kV DC EARTHING ARRANGEMENT SYSTEM FOR TRACTION SUBSTATIONS

DIMENSIONS: mm
SCALE: NTS
A1
DRAWING NO CEE-TBD-7
SHEET - OF -



LEGEND:
H/C – MAIN H/C CONTACTOR COIL
L/O – LOCKOUT RELAY COIL
NVC – NO VOLT COIL
MSD – MASTER SHUTDOWN RELAY COIL
NO – NORMALLY OPEN
NC – NORMALLY CLOSED

AMENDMENTS		
NO	NAME	DATE

DIMENSIONS: mm
SCALE: NTS

A4

DO REF: T98/005	GEN TOL: LIN± —— ANG± ——	
DRN: M SITHOLE	CKD: JVT	DATE: 98-01-21
ENG:LO BORCHARD	LO BORCHARD for CHIEF ENG	

INFRASTRUCTURE (ELECTRICAL)

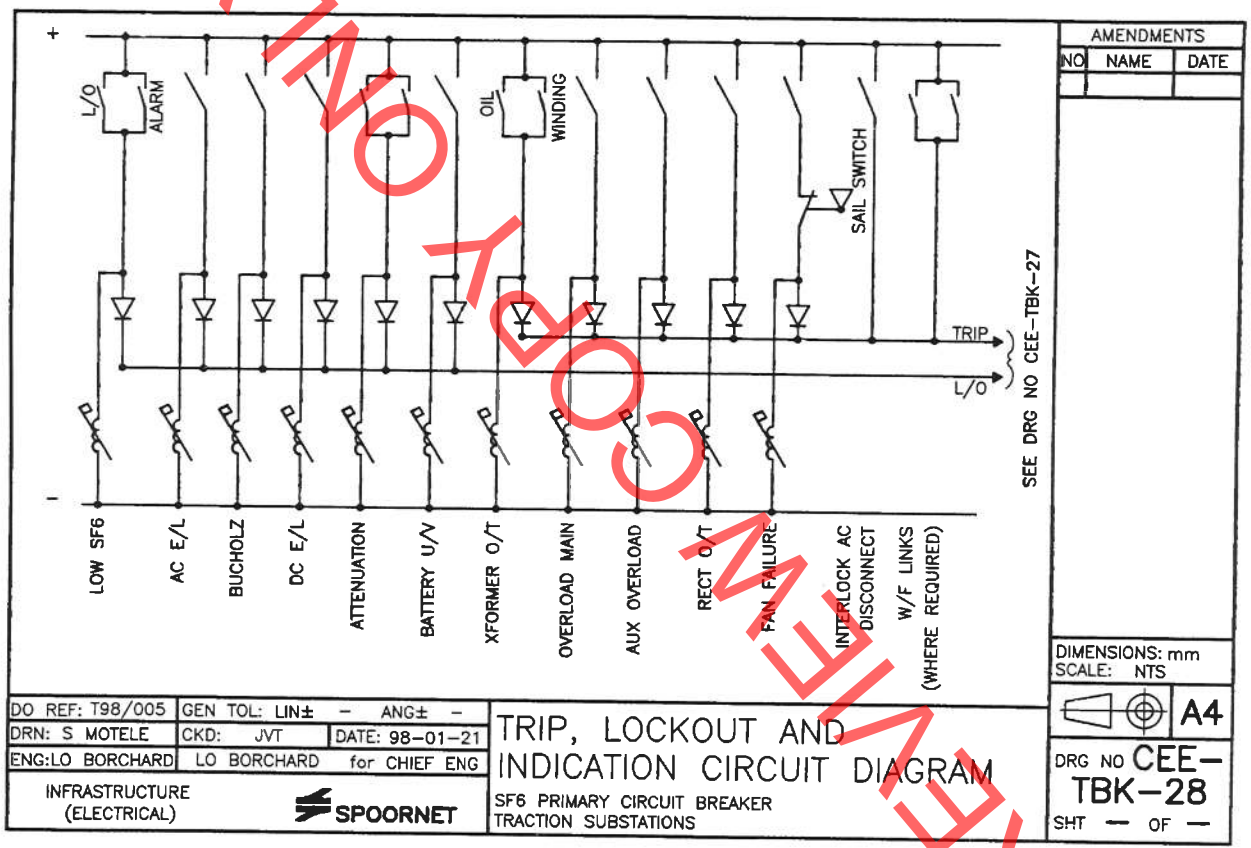
SPOORNET

CONTROL CIRCUIT DIAGRAM: NO-VOLT COIL PROTECTION

SF6 PRIMARY CIRCUIT BREAKER
TRACTION SUBSTATIONS

DRG NO CEE-TBK-27

SHT — OF —



3 4 4 3

Site Information

The works shall be performed at IREAGH3KV DC TRACTION SUBSTATIONS.

freight rail

MINIMUM COMMUNAL HEALTH REQUIREMENTS IN AREAS OUTSIDE THE JURISDICTION OF A LOCAL AUTHORITY : TEMPORARY FACILITIES FOR CONTRACTOR'S PERSONNEL

1. CAMPS

1.1 Prior to the erection of any camp, the Contractor shall submit to the Employer's Deputy, for his approval, details of his proposals as to the site, water supply, sanitation, and size and type of buildings. Where the site is on private land, the Contractor shall submit the written approval for the use of the site of the relevant statutory authority and of the owner and occupier of the land (as applicable).

1.2 Camps must not be erected on land infested with field rodents.

1.3 Adequate drainage shall be provided to carry off storm and waste water.

1.4 Buildings shall be built to a neat and orderly pattern.

1.5 All buildings shall have smooth, hard, impervious floors, graded to provide effective drainage and to permit washing.

1.6 Camps shall be maintained by the Contractor at his own expense in a clean and tidy condition. The Contractor shall take such steps as the Employer's Deputy and landowner/occupier may demand to prevent the creation of a nuisance.

1.7 When so instructed by the Employer's Deputy, the Contractor shall, at his own expense, erect suitable screens between the camp and any public road, thoroughfare or railway line.

1.8 After removal of a camp, the Contractor shall, at his own expense, restore the site to its original condition to the satisfaction of the Employer's Deputy and of the landowner and occupier where the site is on private land.

2. HOUSING

2.1 Every living room shall have cross ventilation, both constant and occasional. Where only one window is provided, it shall not be in the same wall as the door.

2.2 Dimensions of living rooms shall be sufficient to allow 3.5 square metres of floor area and 11 cubic metres of air space for each person over the age of 10 years. The floor area of any living room shall not be less than 7,8 square metres.

2.3 Flat-roofed quarters shall have a minimum roof height of 3 metres above floor level. For quarters with pitched roofs, the wall height shall be not less than 2,6 metres above the floor with a minimum height above floor of 3 metres at the top of the pitch.

2.4 Doors shall not be less than 2m x 0,75m and must be halved.

2.5 Windows of each living room shall have an area not less than one twelfth of the floor area and shall be capable of opening to at least half their full area.

2.6 In areas where malaria is prevalent, doors and windows must be fitted with gauze screens.

2.7 Cooking shelters shall comprise roofed structures, three sides of which shall be enclosed by a weatherproof material, approved by the Employer's Deputy to a height of at least **1m** above ground level.

2.7.1 Sleeping quarters shall not accommodate more than 8 persons per room.

2.7.2 Pegboards shall be carried on metal or concrete supports and shall be separated by partitions not less than 0,4 metres high extending to within 150mm of the end of the bunk. Pegboards shall be removable for cleaning.

3. WATER SUPPLY AND ABLUTION FACILITIES

3.1 The Contractor shall ensure that an adequate and conveniently situated supply of potable water is provided.

3.2 Separate buildings for ablution facilities shall be provided. Where approval has been obtained for the housing of both males and females, separate facilities for each sex shall be provided. The proportion shall be 1 cubicle for 20 persons.

3.3 Waste water shall be hygienically disposed of.

4. SANITATION

4.1 Separate buildings for latrine facilities shall be provided. Where housing are provided for both males and females, separate facilities for each sex shall be provided. The proportions shall be at least one squatting seat for every 15 persons or less in the case of pit latrines, or one for every 10 persons or less in case of pail latrines.

Latrines shall be fly proof and sited at least 10 metres from any other building, and shall not face on any public road, thoroughfare, railway line or residential property. Pits shall not be less than 2,5 metres deep and sited not less than 120 metres from nearest underground water source.

4.2 Latrines shall be so constructed, situated and maintained, and night soil so disposed of as to prevent access by animals, breeding of flies, pollution of streams and domestic water supplies, and other nuisances. Where a night soil removal service is operated by a competent authority, use of such service shall be obligatory, and the use of pit latrines and atria pits will not be permitted.

4.3 At least one refuse bin of adequate size with close fitting lid shall be provided for each building. Refuse bins shall be emptied and cleaned out daily.

4.4 Labour shall be employed on camp sanitation duties on the following basis:-

4.4.1 Where the number of persons living at the camp is 20 or less - one unit.

4.4.2 For additional numbers over 20 living at the camp - one unit per 100 or part thereof.

4.5 Unless refuse is removed by a competent authority, it shall be disposed of in pits and covered over daily with a layer of earth or ash of sufficient thickness to prevent depredations by rodents and the breeding of flies.

4.6 Adequate measures shall be taken against all vermin and insects responsible for the spread of disease. Any instructions of a competent health authority shall be carried out promptly and implicitly.

4.7 Buildings and bedboards shall be treated whenever necessary with an approved insecticide.

4.8 The Contractor shall permit and facilitate inspection of the camp and structures on the site by the staff of Transnet or any other competent authority, and shall comply with any reasonable request by such staff or any other competent authority to eliminate any unsanitary condition.

4.9 Any outbreak of infectious disease shall immediately be reported telephonically and confirmed in writing to the Employer's Deputy.

4.10 The keeping of animals of any sort is not permitted.

4.11 The Contractor shall have on hand at the camp the necessary tools, disinfectants and cleaning materials to maintain and clean the sanitary facilities.

5. RATIONS

Rations, where supplied by the Contractor, shall be stored in a suitable and rodent proof building with sufficient shelving.

P02b-06 (JLH)

TRANSNET SOC LIMITED

(Registration no. 1990/000900//06)

SAFETY ARRANGEMENTS AND PROCEDURAL COMPLIANCE WITH THE OCCUPATIONAL HEALTH AND SAFETY ACT (ACT 85 OF 1993) AND APPLICABLE REGULATIONS

1. General

1.1 The Contractor and Transnet SOC Limited (hereinafter referred to as "Transnet") are individual employers, each in its own right, with their respective duties and obligations set out in the Occupational Health and Safety Act, Act 85 of 1993 (the Act) and applicable Regulations.

1.2 The Contractor accepts, in terms of the General Conditions of Contract and in terms of the Act, his obligations as an employer in respect of all persons in his employ, other persons on the premises or the Site or place of work or on the work to be executed by him, and under his control. He shall, before commencement with the execution of the contract work, comply with the provisions set out in the Act, and shall implement and maintain a Health and Safety Plan as described in the Construction Regulations, 2003 and as approved by Transnet, on the Site and place of work for the duration of the Contract.

1.3 The Contractor accepts his obligation to complying fully with the Act and applicable Regulations notwithstanding the omission of some of the provisions of the Act and the Regulations from this document.

1.4 Transnet accepts, in terms of the Act, its obligations as an employer of its own employees working on or associated with the site or place of work, and the Contractor and Project Manager or his deputy shall at all times, co-operate in respect of the health and safety management of the site, and shall agree on the practical arrangements and procedures to be implemented and maintained during execution of the Works.

1.5 In the event of any discrepancies between any legislation and this specification, the applicable legislation will take precedence.

2. Definitions

2.1 In this Specification any word or expression to which a meaning has been assigned in the Construction Regulations, shall have the meaning so assigned to it, unless the context otherwise indicates: -

2.2 The work included in this Contract shall for the purposes of compliance with the Act be deemed to be "**Construction Work**", which, in terms of the Construction Regulations, 2003 means any work in connection with: -

(a) the erection, maintenance, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure;

(b) the installation, erection, dismantling or maintenance of fixed plant where such work includes the risk of a person falling;

(c) the construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or

(d) the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work;

2.3 **"competent person"** in relation to construction work, means any person having the knowledge, training and experience specific to the work or task being performed: Provided that where appropriate qualifications and training are registered as per the South African Qualifications Authority Act, 1995 these qualifications and training shall be deemed to be the required qualifications and training;

2.4 **"contractor"** means principal contractor and "subcontractor" means contractor as defined by the Construction Regulations, 2003.

2.5 **"fall protection plan"** means a documented plan, of all risks relating to working from an elevated position, considering the nature of work undertaken, and setting out the procedures and methods applied to eliminate the risk;

2.6 **"health and safety file"** means a file, or other record in permanent form, containing the information required to be kept on site in accordance with the Act and applicable Regulations;

2.7 **"Health and Safety Plan "** means a documented plan which addresses the hazards identified and include safe work procedures to mitigate, reduce or control the hazards identified;

2.8 **"Risk Assessment"** means a programme to determine any risk associated with any hazard at a construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard;

2.9 "**the Act**" means the Occupational Health and Safety Act No. 85 of 1993.

3. Procedural Compliance

3.1 The Contractor who intends to carry out any construction work shall, before carrying out such work, notify the Provincial Director in writing if the construction work:-

(a) includes the demolition of a structure exceeding a height of 3 metres; or

(b) includes the use of explosives to perform construction work; or

(c) includes the dismantling of fixed plant at a height greater than 3m,

and shall also notify the Provincial Director in writing when the construction work exceeds 30 days or will involve more than 300 person days of construction work and if the construction work:-

(a) includes excavation work deeper than 1m; or

(b) includes working at a height greater than 3 metres above ground or a landing.

3.2 The notification to the Provincial Director shall be on a form similar to Annexure A of the Construction Regulations, 2003, also shown in Annexure 1 of this Specification. The Contractor shall ensure that a copy of the completed notification form is kept on site for inspection by an inspector, Project Manager or employee.

3.3 The Contractor shall, in accordance with the Act and applicable Regulations, make all the necessary appointments of competent persons in writing on a form similar to Annexure 2 of this Specification and deliver copies thereof to the Project Manager. Copies should also be retained on the health and safety file.

3.4 Subcontractors shall also make the above written appointments and the Contractor shall deliver copies thereof to the Project Manager.

3.5 In the case of a self-employed Contractor or any subcontractor who has the appropriate competencies and supervises the work himself, the appointment of a construction supervisor in terms of regulation 6.1 of the Construction Regulations, 2003 will not be necessary. The Contractor shall in such a case execute and sign a declaration, as in Annexure 3, by which he personally undertakes the duties and obligations of the "Chief Executive Officer" in terms of section 16(1) of the Act.

3.6 The Contractor shall, before commencing any work, obtain from the Project Manager an access certificate as in Annexure 4 executed and signed by him, permitting and limiting access to the designated site or place of work by the Contractor and any subcontractors under his control.

3.7 Procedural compliance with Act and Regulations, as above, shall also apply to any subcontractors as employers in their own right. The Contractor shall furnish the Project Manager with full particulars of such subcontractors and shall ensure that they comply with the Act and Regulations and Transnet's safety requirements and procedures.

4. Special Permits

Where special permits are required before work may be carried out such as for hotwork, isolation permits, work permits and occupations, the Contractor shall apply to the Project Manager or the relevant authority for such permits to be issued. The Contractor shall strictly comply with the conditions and requirements pertaining to the issue of such permits.

5. Health and Safety Programme

5.1 The Tenderer shall, with his tender, submit a Health and Safety Programme setting out the practical arrangements and procedures to be implemented by him to ensure compliance by him with the Act and Regulations and particularly in respect of: -

(i) The provision, as far as is reasonably practical, of a working environment that is safe and without risk to the health of his employees and subcontractors in terms of section 8 of the Act;

(ii) the execution of the contract work in such a manner as to ensure in terms of section 9 of the Act that persons other than those in the Contractor's employment, who may be directly affected by the contract work are not thereby exposed to hazards to their health and safety;

(iii) ensuring, as far as is reasonably practical, in terms of section 37 of the Act that no employee or subcontractor of the Contractor does or omits to do any act which would be an offence for the Contractor to do or omit to do.

5.2 The Contractor's Health and Safety Programme shall be based on a risk assessment in respect of the hazards to health and safety of his employees and other persons under his control that are associated with or directly affected by the Contractor's activities in performing the contract work and shall establish precautionary measures as are reasonable and practical in protecting the safety and health of such employees and persons.

5.3 The Contractor shall cause a risk assessment contemplated in clause 5.2 above to be performed by a competent person, appointed in writing, before commencement of any Construction Work and reviewed during construction. The Risk Assessments shall form part of the Health and Safety programme to be applied on the site and shall include at least the following:

(a) The identification of the risks and hazards that persons may be exposed to;

(b) the analysis and evaluation of the hazards identified;

(c) a documented Health and Safety Plan, including safe work procedures to mitigate, reduce or control the risks identified;

(d) a monitoring and review plan.

5.4 The Health and Safety Plan shall include full particulars in respect of: -

(a) The safety management structure to be instituted on site or place of work and the names of the Contractor's health and safety representatives and members of safety committees where applicable;

(b) the safe working methods and procedures to be implemented to ensure the work is performed in compliance with the Act and Regulations;

(c) the safety equipment, devices and clothing to be made available by the Contractor to his employees;

(d) the site access control measures pertaining to health and safety to be implemented;

(e) the arrangements in respect of communication of health and safety related matters and incidents between the Contractor, his employees, subcontractors and the Project Manager with particular reference to the reporting of incidents in compliance with Section 24 and General Administrative Regulation 8 of the Act and with the pertinent clause of the General Conditions of Contract forming part of the Contract and

(f) the introduction of control measures for ensuring that the Safety Plan is maintained and monitored for the duration of the Contract.

5.4 The Health and Safety programme shall be subject to the Project Manager's approval and he may, in consultation with the Contractor, order that additional and/or supplementary practical arrangements and procedures be implemented and maintained by the Contractor or that different working methods or safety equipment be used or safety clothes be issued which, in the Project Manager's opinion, are necessary to ensure full compliance by the Contractor with his obligations as an employer in terms of the Act and Regulations. The Project Manager or his deputy shall be allowed to attend meetings of the Contractor's safety committee as an observer.

5.5 The Contractor shall take reasonable steps to ensure that each subcontractor's Health and Safety Plan is implemented and maintained on the construction site: Provided that the steps taken, shall include periodic audits at intervals mutually agreed to between the them, but at least once every month.

5.6 The Contractor shall stop any subcontractor from executing any construction work, which is not in accordance with the Contractor's, and/or subcontractor's Health and Safety Plan for the site or which poses a threat to the health and safety of persons.

5.7 The Contractor shall ensure that a copy of the Health and Safety Plan is available on site for inspection by an inspector, Project Manager, agent, subcontractor, employee, registered employee organisation, health and safety representative or any member of the health and safety committee.

5.8 The Contractor shall consult with the health and safety committee or, if no health and safety committee exists, with a representative group of employees, on the development, monitoring and review of the Risk Assessment.

5.9 The Contractor shall ensure that all employees under his control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the Risk Assessment.

5.10 The Contractor shall ensure that all subcontractors are informed regarding any hazard as stipulated in the Risk Assessment before any work commences, and thereafter at such times as may be determined in the Risk Assessment.

5.11 The Contractor shall ensure that all visitors to a construction site undergoes health and safety induction pertaining to the hazards prevalent on the site and shall be provided with the necessary personal protective equipment.

6. Fall Protection Plan

6.1 In the event of the risk and hazard identification, as required in terms of clause 5.3 of this Specification, revealing risks relating to working from an elevated position the contractor shall cause the designation of a competent person, responsible for the preparation of a fall protection plan;

6.2 The Contractor shall implement, maintain and monitor the fall protection plan for the duration of Contract. The Contractor shall also take such steps to ensure the continued adherence to the fall protection plan.

6.3 The fall protection plan shall include:-

(a) A Risk Assessment of all work carried out from an elevated position;

(b) the procedures and methods to address all the identified risks per location;

(c) the evaluation of the employees physical and psychological fitness necessary to work at elevated positions;

(d) the training of employees working from elevated positions; and

(e) the procedure addressing the inspection, testing and maintenance of all fall protection equipment.

7. Hazards and Potential Hazardous Situations

The Contractor and the Project Manager shall immediately notify one another of any hazardous or potentially hazardous situations which may arise during performance of the Contract by the Contractor or any subcontractor and, in particular, of such hazards as may be caused by the design, execution and/or location and any other aspect pertaining to the contract work.

8. Health and Safety File

8.1 The Contractor shall ensure that a health and safety file is opened and kept on site and shall include all documentation required as per the Act and applicable regulations, and made available to an inspector, the Project Manager, or subcontractor upon request.

8.2 The Contractor shall ensure that a copy of the both his Health and Safety Plan as well as any subcontractor's Health and Safety Plan is available on request to an employee, inspector, contractor or the Project Manager.

8.3 The Contractor shall hand over a consolidated health and safety file to the Project Manager upon completion of the Construction Work and shall in addition to documentation mentioned in the Act and applicable Regulations include a record of all drawings, designs, materials used and other similar information concerning the completed structure.

ANNEXURE 1

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993

Regulation 3(1) of the Construction Regulations

NOTIFICATION OF CONSTRUCTION WORK

1(a) Name and postal address of principal contractor: _____

(b) Name and tel. no of principal contractor's contact person: _____

2. Principal contractor's compensation registration number: _____

3.(a) Name and postal address of client: _____

(b) Name and tel no of client's contact person or agent: _____

4.(a) Name and postal address of designer(s) for the project: _____

(b) Name and tel. no of designer(s) contact person: _____

5. Name and telephone number of principal contractor's construction supervisor on site appointed in terms of regulation 6(1). _____

6. Name/s of principal contractor's construction sub-ordinate supervisors on site appointed in terms of regulation 6(2). _____

7. Exact physical address of the construction site or site office: _____

8. Nature of the construction work: _____

9. Expected commencement date: _____

10. Expected completion date: _____

11. Estimated maximum number of persons on the construction site:

_____

12. Planned number of contractors on the construction site accountable to the principle contractor:

_____

13. Name(s) of contractors already chosen.

_____
_____
_____
_____
_____
_____
_____

_____ _____

Principal Contractor **Date**

_____ _____

Client **Date**

* THIS DOCUMENT IS TO BE FORWARDED TO THE OFFICE OF THE DEPARTMENT OF LABOUR **PRIOR TO COMMENCEMENT** OF WORK ON SITE.

* **ALL PRINCIPAL CONTRACTORS** THAT QUALIFY TO NOTIFY MUST DO SO EVEN IF ANOTHER PRINCIPAL CONTRACTOR ON THE SAME SITE HAD DONE SO PRIOR TO THE COMMENCEMENT OF WORK.

ANNEXURE 2

(COMPANY LETTER HEAD)

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT 85 OF 1993) :

SECTION/REGULATION: _____

REQUIRED COMPETENCY: _____

In terms of _____ I, _____

representing the Employer) do hereby appoint _____

As the Competent Person on the premises at _____

(physical address) to assist in compliance with the Act and the applicable Regulations.

Your designated area/s is/are as follows :-

_____

_____

_____

Date : _____

Signature :- _____

Designation :- _____

ACCEPTANCE OF DESIGNATION

I, _____ do hereby accept this Designation and acknowledge that I understand the requirements of this appointment.

Date : _____

Signature :- _____

Designation :- _____

ANNEXURE 3

(COMPANY LETTER HEAD)

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT 85 OF 1993) :

DECLARATION

In terms of the above Act I, _____ am personally assuming the duties and obligations as Chief Executive Officer, defined in Section 1 of the Act and in terms of Section 16(1), I will, as far as is reasonably practicable, ensure that the duties and obligations of the Employer as contemplated in the above Act are properly discharged.

Signature :- _____

Date : _____

ANNEXURE 4

(LETTER HEAD OF BUSINESS DIVISION OR UNIT OF TRANSNET SOC LIMITED)

SITE ACCESS CERTIFICATE

Access to : _____ (Area)
Name of Contractor/Builder :- _____
Contract/Order No.: _____

The contract works site/area described above are made available to you for the carrying out of associated works
In terms of your contract/order with (company) _____

Kindly note that you are at all times responsible for the control and safety of the Works Site, and for persons under your control having access to the site.

As from the date hereof you will be responsible for compliance with the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended, and all conditions of the Contract pertaining to the site of the works as defined and demarcated in the contract documents including the plans of the site or work areas forming part thereof.

Signed : _____ ***Date :*** _____

_____
PROJECT MANAGER

ACKNOWLEDGEMENT OF RECEIPT

Name of Contractor/Builder :- _____ ***I, do hereby acknowledge and accept the duties and obligations in respect of the Safety of the site/area of Work in terms of the Occupational Health and Safety Act; Act 85 of 1993.***

_____

Name : _____ ***Designation :*** _____

Signature : _____ ***Date :*** _____

TRANSNET

freight rail

E7/1 (July 1998)

SPECIFICATION FOR WORKS ON, OVER, UNDER OR ADJACENT TO RAILWAY LINES AND NEAR HIGH VOLTAGE EQUIPMENT

(This Specification shall be used in Transnet Contracts)

CONTENTS

ANNEXURES

1 DEFINITIONS

The following definitions shall apply :

Authorised Person. A person whether an employee of Transnet or not, who has been specially authorised to undertake specific duties in terms of Freight Rail's publication SAFETY INSTRUCTIONS: HIGH-VOLTAGE ELECTRICAL EQUIPMENT, and who holds a certificate or letter of authority to that effect.

Barrier. Any device designed to restrict access to "live" high-voltage electrical equipment.

Bond. A short conductor installed to provide electrical continuity.

Contractor. Any person or organisation appointed by Transnet to carry out work on its behalf.

Dead. Isolated and earthed.

Electrical Officer (Contracts). The person appointed in writing by the responsible Electrical Engineer in Transnet as the person who shall be consulted by the Contractor in all electrical matters to ensure that adequate safety precautions are taken by the Contractor.

Executive Officer. The person appointed by Transnet from time to time as the Executive Officer to act according to the rights and powers held by and obligations placed upon him in terms of the Contract.

High-Voltage. A voltage normally exceeding 1 000 volts.

Live. A conductor is said to be "live" when it is at a potential different from that of the earth or any other conductor of the system of which it forms a part.

Near. To be in such a position that a person's body or the tools he is using or any equipment he is handling may come within 3 metres of live exposed high-voltage electrical equipment.

Occupation. An authorisation granted by Transnet for work to be carried out under specified conditions on, over under or adjacent to railway lines.

Occupation Between Trains. An occupation during an interval between successive trains.

Project Manager. The person or juristic person appointed by Transnet from time to time as the Project Manager, to administer the Contract according to the powers and rights held by and obligations placed upon him in terms of the Contract.

Responsible Representative. The responsible person in charge, appointed by a contractor, who has undergone specific training (and holds a certificate) to supervise staff under his control to work on, over, under or adjacent to railway lines and in the vicinity of high-voltage electrical equipment.

Technical Officer. The person or juristic person appointed by Transnet from time to time as the Technical Officer, to administer the Contractor's performance and execution of the Works according to the powers and rights held by and obligations placed upon the Technical Officer in terms of the Contract.

Total Occupation. An occupation for a period when trains are not to traverse the section of line covered by the occupation.

Work on. Work undertaken on or so close to the equipment that the specified working clearances to the live equipment cannot be maintained.

Work Permit. A combined written application and authority to proceed with work on or near dead electrical equipment.

PART A - GENERAL SPECIFICATION

2. AUTHORITY OF OFFICERS OF TRANSNET

2.1 The Contractor shall co-operate with the officers of Transnet and shall comply with all instructions issued and restrictions imposed with respect to the Works which bear on the existence and operation of Transnet's railway lines and high-voltage equipment.

2.2 Without limiting the generality of the provisions of 2.1, any duly authorised representative of Transnet, having identified himself, may stop the work if, in his opinion, the safe passage of trains or the safety of Transnet assets or any person is affected. **CONSIDERATIONS OF SAFETY SHALL TAKE PRECEDENCE OVER ALL OTHER CONSIDERATIONS**.

3. CONTRACTOR'S REPRESENTATIVES

3.1 The Contractor shall nominate Responsible Representatives of whom at least one shall be available at any hour for call-out in cases of emergency. The Contractor shall provide the Technical Officer with the names, addresses and telephone numbers of the representatives.

3.2 The Contractor guarantees that he has satisfied himself that the Responsible Representative is fully conversant with this specification and that he shall comply with all his obligations in respect thereof.

4. OCCUPATIONS AND WORK PERMITS

4.1 Work to be done during total occupation or during an occupation between trains or under a work permit shall be done in a manner decided by the Technical Officer and at times to suit Transnet requirements.

4.2 The Contractor shall organise the Works in a manner, which will minimise the number and duration of occupations and work permits required.

4.3 Transnet will not be liable for any financial or other loss suffered by the Contractor arising from his failure to complete any work scheduled during the period of an occupation or work permit.

4.4 The Contractor shall submit to the Technical Officer, in writing, requests for occupations or work permits together with details of the work to be undertaken, at least 14 days before they are required. Transnet does not undertake to grant an occupation or work permit for any particular date, time or duration.

4.5 Transnet reserves the right to cancel any occupation or work permit at any time before or during the period of occupation or work permit. If, due to cancellation or change in date or time, the Contractor is not permitted to start work under conditions of total occupation or work permit at the time arranged, all costs caused by the cancellation shall be born by the Contractor except as provided for in clauses 4.6 to 4.8.

4.6 When the Contractor is notified less than 2 hours before the scheduled starting time that the occupation or work permit is cancelled, he may claim reimbursement of his direct financial losses caused by the loss of working time up to the time his labour and plant are employed on other work, but not exceeding the period of the cancelled occupation or work permit.

4.7 When the Contractor is notified less than 2 hours before the schedule starting time, or during an occupation or work permit, that the duration of the occupation or work permit is reduced, he may claim reimbursement of his direct financial losses caused by the loss of working time due to the reduced duration of the occupation or work permit.

4.8 Reimbursement the Contractor for any loss of working time in terms of 4.6 and 4.7, shall be subject to his claims being submitted within 14 days of the event with full details of labour and plant involved, and provided that the Technical Officer certifies that no other work on which the labour and plant could be employed was immediately available.

4.9 Before starting any work for which an occupation has been arranged, the Contractor shall obtain from the Technical Officer written confirmation of the date, time and duration of the occupation.

4.10 Before starting any work for which a work permit has been arranged, the Responsible Representative shall read and sign portion C of form No. T.1276 signifying that he is aware of the limits within which work may be undertaken. After the work for which the permit was granted has been completed, or when the work permit is due to be terminated, or if the permit is cancelled after the start, the same person who signed portion C shall sign portion D of the T.1276 form, thereby acknowledging that he is aware that the electrical equipment is to be made "live". The Contractor shall advise all his workmen accordingly.

5. SPEED RESTRICTIONS AND PROTECTION

5.1 When speed restrictions are imposed by Transnet because of the Contractor's activities, the Contractor shall organise and carry out his work so as to permit the removal of the restrictions as soon as possible.

5.2 When the Technical Officer considers protection to be necessary the Contractor shall, unless otherwise agreed, provide all protection including flagmen, other personnel and all equipment for the protection of Transnet's and the Contractor's personnel and assets, the public and including trains. Transnet will provide training free of charge of the Contractor's flagmen and other personnel performing protection duties. The Contractor shall consult with the Technical Officer, whenever he considers that protection will be necessary, taking into account the minimum permissible clearances set out in appendixes 1 to 4.

5.3 The Contractor shall appoint a Responsible Representative to receive and transmit any instruction, which may be given by Transnet personnel providing protection.

6. ROADS ON TRANSNET PROPERTY

The provision of clause 25 of the E.5, General Conditions of Contract, or clause 23 of the E.5 (MW), General Conditions of Contract for Maintenance Works, shall apply to the use of existing roads on Transnet's property.

7. CLEARANCES

7.1 No temporary works shall encroach on the appropriate minimum clearances set out in Annexure 1 BE97-01 Sheets 1,2, 3 and 5 of 5.

8. STACKING OF MATERIAL

8.1 The Contractor shall not stack any material closer than 3 m from the centre line of any railway line without prior approval of the Technical Officer.

9. EXCAVATION, SHORING, DEWATERING AND DRAINAGE

9.1 Unless otherwise approved by the Technical Officer any excavation adjacent to a railway line shall not encroach on the hatched area shown in Figure 1.

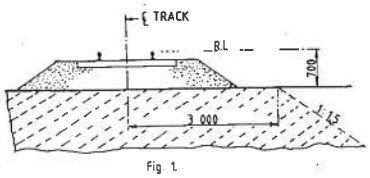


Fig 1

9.2 The Contractor shall provide at his own cost any shoring, dewatering or drainage of any excavation unless otherwise stipulated elsewhere in the Contract.

9.3 Where required by the Technical Officer, drawings of shoring for any excavation under or adjacent to a railway line shall be submitted and permission to proceed obtained, before the excavation is commenced.

9.4 The Contractor shall prevent ingress of water to the excavation but where water does enter, he shall dispose of it as directed by the Technical Officer.

9.5 The Contractor shall not block, obstruct or damage any existing drains either above or below ground level unless he has made adequate prior arrangements to deal with drainage.

10. FALSEWORK FOR STRUCTURES

10.1 Drawings of falsework for the construction of any structure over, under or adjacent to any railway line shall be submitted to the Technical Officer and his permission to proceed obtained before the falsework is erected. Each drawing shall be given a title and a distinguishing number and shall be signed by a registered professional engineer certifying that he has checked the design of the falsework and that the drawings are correct and in accordance with the design.

10.2 After the falsework has been erected and before any load is applied, the Contractor shall submit to the Technical Officer a certificate signed by a registered professional engineer certifying that he has checked the falsework and that it has been erected in accordance with the drawings. Titles and numbers of the drawings shall be stated in the certificate. Notwithstanding permission given by the Technical Officer to proceed, the Contractor shall be entirely responsible for the safety and adequacy of the falsework.

11. PILING

11.1 The Technical Officer will specify the conditions under which piles may be installed on Transnet property.

12. UNDERGROUND SERVICES

12.1 No pegs or stakes shall be driven or any excavation made before the Contractor has established that there are no underground services, which may be damaged thereby.

12.2 Any damage shall be reported immediately to the Technical Officer, or to the official in charge at the nearest station, or to the traffic controller in the case of centralised traffic control.

13. BLASTING

13.1 The provisions of clause 23 of the E.5, General Conditions of Contract or clause 21 of the E.5 (MW), General Conditions of Contract for Maintenance Work, shall apply to all blasting operations undertaken in terms of the Contract.

13.2 The Contractor shall provide proof that he has complied with the provisions of clauses 10.17.1 to 10.17.4 of the Explosives Regulations (Act 26 of 1956 as amended).

13.3 Blasting within 500m of a railway line will only be permitted during intervals between trains. A person appointed by the Technical Officer, assisted by flagmen with the necessary protective equipment, will be in communication with the controlling railway station.
Only this person will be authorised to give the Contractor permission to blast, and the Contractor shall obey his instructions implicitly regarding the time during which blasting may take place.

13.4 The flagmen described in 13.3, where provided by Transnet, are for the protection of trains and Transnet property only, and their presence does not relieve the Contractor in any manner of his responsibilities in terms of Explosives Act or Regulations, or any obligation in terms of this Contract.

13.5 The person described in 13.3 will record in a book provided and retained by Transnet the dates and times:

(i) when each request is made by him to the controlling station for permission to blast;

(ii) when blasting may take place;

(iii) when blasting actually takes place; and

(iv) when he advises the controlling station that the line is safe for the passage of trains.

13.6 Before each blast the Contractor shall record in the same book, the details of the blast to be carried out. The person appointed by the Technical Officer and the person who will do the blasting shall both sign the book whenever an entry described in 13.5 is made.

13.7 The terms of clause 27 hereof shall be strictly adhered to.

14. RAIL TROLLEYS

14.1 The use of rail trolleys or trestle trolleys on a railway line for working on high voltage equipment will be permitted only if approved by the Technical Officer and under the conditions stipulated by him.

14.2 All costs in connection with such trolley working requested by the Contractor shall, unless otherwise agreed, be borne by the Contractor, excluding the costs of any train protection services normally provided free of charge by Transnet.

15. SIGNAL TRACK CIRCUITS

15.1 Where signal track circuits are installed, the Contractor shall ensure that no material capable of conducting an electrical current makes contact between rails of a railway line/lines.

15.2 No signal connections on track-circuited tracks shall be severed without the Technical Officer's knowledge and consent.

16. PENALTY FOR DELAYS TO TRAINS

16.1 If any trains are delayed by the Contractor and the Technical Officer is satisfied that the delay was avoidable, a penalty will be imposed on the Contractor of R5 000 per hour or part thereof for the period of delay, irrespective of the number of trains delayed.

PART B - ADDITIONAL SPECIFICATION FOR WORK NEAR HIGH-VOLTAGE ELECTRICAL EQUIPMENT

17. GENERAL

17.1 This specification is based on the contents of Freight Rail's publication SAFETY INSTRUCTIONS, HIGH-VOLTAGE ELECTRICAL EQUIPMENT, as amended, a copy of which will be made available on loan to the Contractor for the duration of the contract. These instructions apply to all work near live high-voltage equipment maintained and/or operated by Transnet, and the onus rests on the Contractor to ensure that he obtains a copy.

17.2 The Contractor's attention is drawn in particular to the contents of Part I, Sections 1 and 2 of the Safety Instructions : High-Voltage Electrical Equipment.

17.3 The Safety Instructions : High-Voltage Electrical Equipment cover the minimum safety precautions which must be taken to ensure safe working on or near high-voltage electrical equipment, and must be observed at all times. Should additional safety measures be considered necessary because of peculiar local conditions, these may be ordered by and at the discretion of the Electrical Officer (Contracts).

17.4 This specification must be read in conjunction with and not in lieu of the Safety Instructions : High-Voltage Electrical Equipment.

17.5 The Contractor shall obtain the approval of the Electrical Officer (Contracts) before any work is done which causes or could cause any portion of a person's body or the tools he is using or any equipment he is handling, to come within 3 metres of any live high-voltage equipment.

17.6 The Contractor shall regard all high-voltage equipment as live unless a work permit is in force.

17.7 Safety precautions taken or barriers erected shall comply with the requirements of the Electrical Officer (Contracts), and shall be approved by him before the work to be protected is undertaken by the Contractor. The Contractor shall, unless otherwise agreed, bear the cost of the provision of the barriers and other safety precautions required, including the attendance of Transnet staff where this is necessary.

17.8 No barrier shall be removed unless authorised by the Electrical Officer (Contracts).

18. WORK ON BUILDINGS OR FIXED STRUCTURES

Before any work is carried out or measurements are taken on any part of a building, fixed structure or earthworks of any kind above ground level situated within 3 metres of live high-voltage equipment, the Electrical Officer (Contracts) shall be consulted to ascertain the conditions under which the work may be carried out.

18.2 No barrier erected to comply with the requirements of the Electrical Officer (Contracts) shall be used as temporary staging or shuttering for any part of the Works.

18.3 The shuttering for bridge piers, abutments, retaining walls or parapets adjacent to or over any track may be permitted to serve as a barrier, provided that it extends at least 2,5 metres above any working level in the case of piers, abutments and retaining walls and 1,5 metres above any working level in the case of parapets.

19. WORK DONE ON OR OUTSIDE OF ROLLING STOCK, INCLUDING LOADING OR UNLOADING

19.1 No person shall stand, climb or work whilst on any platform, surface or foothold higher than the normal unrestricted places of access, namely -

(i) the floor level of trucks;
(ii) external walkways on diesel, steam and electric locomotives, steam heat vans, etc. and
(iii) walkways between coaches and locomotives.

When in these positions, no person may raise his hands or any equipment or material he is handling above his head.

19.2 In cases where the Contractor operates his own rail mounted equipment, he shall arrange for the walkways on this plant to be inspected by the Electrical Officer (Contracts) and approved, before commencement of work.

19.3 The handling of long lengths of material such as metal pipes, reinforcing bars, etc should be avoided, but if essential they shall be handled as nearly as possible in a horizontal position below head height.

19.4 The Responsible Representative shall warn all persons under his control of the danger of being near live high-voltage equipment, and shall ensure that the warning is fully understood.

19.5 Where the conditions in 19.1 to 19.3 cannot be observed the Electrical Officer (Contracts), shall be notified. He will arrange for suitable Safety measures to be taken. The Electrical Officer (Contracts), may in his discretion and in appropriate circumstances, arrange for a suitable employee of the Contractor to be specially trained by Freight Rail and at its costs, as an Authorised Person to work closer than 3 metres from live overhead conductors and under such conditions as may be imposed by the Senior responsible Electrical Engineer in Transnet.

20. USE OF EQUIPMENT

20.1 Measuring Tapes and Devices

20.1.1 Measuring tapes may be used near live high-voltage equipment provided that no part of any tape or a person's body comes within 3 metres of the live equipment.

20.1.2 In windy conditions the distance shall be increased to ensure that if the tape should fall it will not be blown nearer than 3 metres from the live high-voltage equipment.

20.1.3 Special measuring devices longer than 2 metres such as survey staves and rods may be used if these are of non-conducting material and approved by the responsible Electrical Engineer in Transnet, but these devices must not be used within 3 metres of live high-voltage equipment in rainy or wet conditions.

20.1.4 The assistance of the Electrical Officer (Contracts) shall be requested when measurements within the limits defined in 20.1.1 to 20.1.3 are required.

20.1.5 The restrictions described in 20.1.1 to 20.1.3 do not apply on a bridge deck between permanent parapets nor in other situations where a barrier effectively prevents contact with the live high-voltage equipment.

20.2 Portable Ladders

20.2.1 Any type of portable ladder longer then 2 metres may only be used near live high-voltage equipment under the direct supervision of the Responsible Representative. He shall ensure that the ladder is always used in such a manner that the distance from the base of the ladder to any live high-voltage equipment is greater than the fully extended length of the ladder plus 3 metres. Where these conditions cannot be observed, the Electrical Officer (Contracts) shall be advised, and he will arrange for suitable safety measures to be taken.

21. CARRYING AND HANDLING MATERIAL AND EQUIPMENT

21.1 Pipes, scaffolding, iron sheets, reinforcing bars and other material, which exceeds 2 metres in length, shall be carried completely below head height near live high-voltage equipment. For maximum safety two or more persons so as to maintain it as nearly as possible in a horizontal position should carry such material. The utmost care must be take to ensure that no part of the material comes within 3 metres of any live high-voltage equipment.

21.2 Long lengths of wire or cable shall never be run out in conditions where a part of a wire or cable can come within 3 metres of any live high-voltage equipment unless the Electrical Officer (Contracts) has been advised and has approved appropriate safety precautions.

21.3 The presence of overhead power lines shall always be taken account of especially when communications lines or cables or aerial cables, stay wires, etc. are being erected above ground level.

22. PRECAUTIONS TO BE TAKEN WHEN ERECTING OR REMOVING POLES, ANTENNAE, TREES ETC.

22.1 A pole may be handled for the purpose of erection or removal near high-voltage equipment under the following conditions:

(i) If the distance between the point at which the pole is to be erected or removed and the nearest live high-voltage equipment is more than the length of the pole plus 3 metres, the work shall be supervised by the Responsible Representative.

(ii) If the distance described in (i) is less than the length of the pole plus 3 metres, the Electrical Officer (Contracts) shall be consulted to arrange for an Authorised Person to supervise the work and to ensure that the pole is earthed where possible. The pole shall be kept in contact with the point of erection, and adequate precautions shall be taken to prevent contact with live high-voltage equipment.

22.2 The cost of supervision by an Authorised Person and the provision of earthing shall, unless otherwise agreed, be borne by the Contractor.

22.3 The provisions of clauses 22.1 and 22.2 shall also apply to the erection or removal of columns, antennae, trees, posts, etc.

23. USE OF WATER

23.1 No water shall be used in the form of a jet if it can make contact with any live high-voltage equipment or with any person working on such equipment.

24. USE OF CONSTRUCTION PLANT

24.1 "Construction plant" entails all types of plant including cranes, piling frames, boring machines, excavators, draglines, dewatering equipment and road vehicles with or without lifting equipment.

24.2 When work is being undertaken in such a position that it is possible for construction plant or its load to come within 3 metres of live high-voltage equipment, the Electrical Officer (Contracts) shall be consulted. He will arrange for an Authorised Person to supervise the work and to ensure that the plant is adequately earthed. The Electrical Officer (Contracts) will decide whether further safety measures are necessary.

24.3 The cost of any supervision by an Authorised Person and the provision of earthing shall, unless otherwise agreed, be borne by the Contractor.

24.4 When loads are handled by cranes, non-metallic rope hand lines shall be used, affixed to such loads so as to prevent their swinging and coming within 3 metres of live high-voltage equipment.

24.5 Clauses 24.1 to 24.4 shall apply mutatis mutandis to the use of maintenance machines of any nature.

25. WORK PERFORMED UNDER DEAD CONDITIONS UNDER COVER OF A WORK PERMIT

25.1 If the Responsible Representative finds that the work cannot be done in safety with the high-voltage electrical equipment live, he shall consult the Electrical Officer (Contracts) who will decide on the action to be taken.

25.2 If a work permit is issued the Responsible Representative shall -

(i) before commencement of work ensure that the limits within which work may be carried out have been explained to him by the Authorised Person who issued the permit to him, and that he fully understands these limits.

(ii) sign portion C of the permit before commencement of work;

(iii) explain to all persons under his control the limits within which work may be carried out, and ensure that they fully understand these limits;

(iv) care for the safety of all persons under his control whilst work is in progress; and

(v) withdraw all personnel under his control from the equipment on completion of the work before he signs portion D of the work permit.

26. **TRACTION RETURN CIRCUITS IN RAILS**

26.1 DANGEROUS CONDITIONS CAN BE CREATED BY REMOVING OR SEVERING ANY BOND.

26.2 Broken rails with an air gap between the ends, and joints, at which fishplates are removed under "broken bond" conditions, are potentially lethal. The rails on either side of an air gap between rail ends on electrified lines shall not be touched simultaneously until rendered safe by Transnet personnel.

26.3 The Contractor shall not break any permanent bonds between rails or between rails and any structure. He shall give the Technical Officer at least 7 days written notice when removal of such bonds is necessary.

26.4 No work on the track which involves interference with the traction return rail circuit either by cutting or removing the rails, or by removal of bonds shall be done unless the Electrical Officer (Contracts) is consulted. He will take such precautions as may be necessary to ensure continuity of the return circuit before permitting the work to be commenced.

27. **BLASTING**

27.1 The Contractor shall obtain the permission of the Electrical Officer (Contracts) before blasting, and shall give at least 14 days notice of his intention to blast.

27.2 No blasting shall be done in the vicinity of electrified lines unless a member of Transnet's electrical personnel is present.

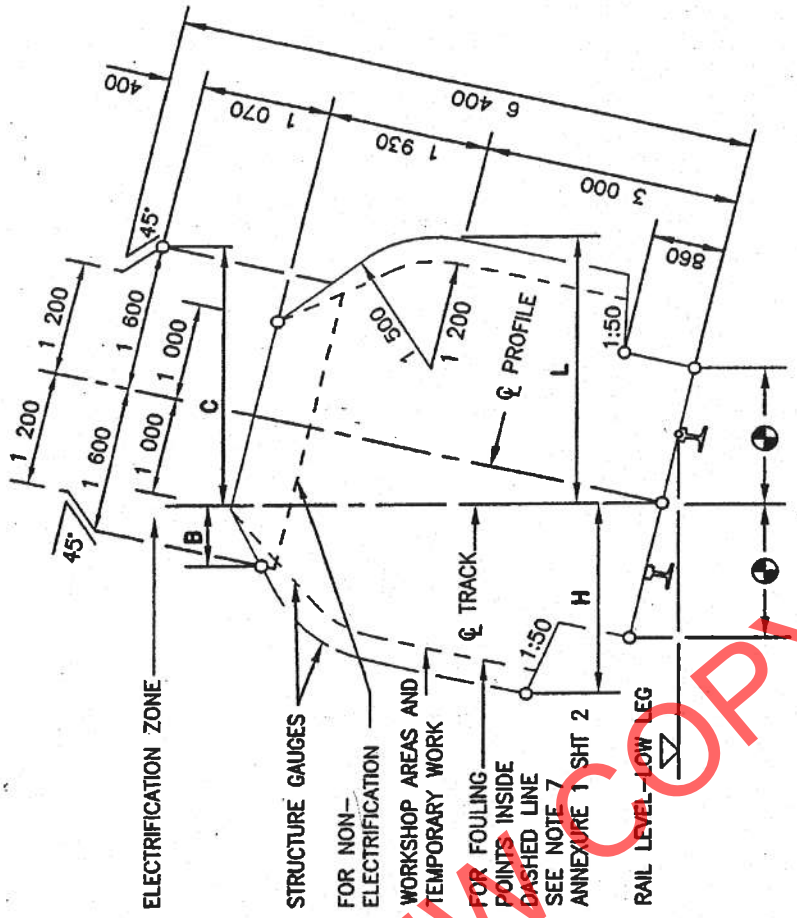
27.3 The terms of clause 13 hereof shall be strictly adhered to.

28. **HIGH-VOLTAGE ELECTRICAL EQUIPMENT NOT MAINTAINED AND/OR OPERATED BY TRANSNET**

Where the work is undertaken on or near high-voltage electrical equipment which is not maintained and/or operated by Transnet, the Occupational Health and Safety Act No. 85 of 1993, and Regulations and Instructions, or the Mines Health and Safety Act (Act 29 of 1996), shall apply.
Such equipment includes: -
(i) Eskom and municipal equipment;
(ii) the Contractor's own power supplies; and
(iii) electrical equipment being installed but not yet taken over from the Contractor.

ANNEXURE 1
SHEET 1 of 5
AMENDMENT

HORIZONTAL CLEARANCES : 1 065mm TRACK GAUGE



RADIUS (m)	WITH CANT		NO CANT	WITH CANT	
	H (mm)	L (mm)	H & L	B (mm)	C (mm)
90	2 730	3 090	2 780	1 130	2 100
100	2 700	3 030	2 750	1 140	2 050
120	2 650	2 970	2 700	1 160	2 010
140	2 620	2 920	2 660	1 175	1 990
170	2 590	2 870	2 630	1 190	1 970
200	2 570	2 820	2 600	1 205	1 950
250	2 550	2 790	2 580	1 230	1 920
300	2 540	2 760	2 560	1 250	1 900
350	2 530	2 730	2 540	1 270	1 890
400	2 520	2 710	2 530	1 290	1 875
500	2 510	2 680	2 520	1 320	1 850
600	2 500	2 660	2 510	1 340	1 830
800	2 490	2 620	2 500	1 365	1 790
1 000	2 480	2 600	2 490	1 380	1 760
1 200	2 480	2 580	2 490	1 200	1 730
1 500	2 480	2 550	2 480	1 415	1 700
2 000	2 480	2 500	2 480	1 440	1 660
3 000	2 470	2 470	2 470	1 500	1 600
>5 000	2 460	2 460	2 460	1 600	1 600

REMARKS:

1. H AND **B** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. L AND **C** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR WORKSHOP AREAS AND TEMPORARY WORK, CLEARANCES **H** AND **L** MAY BE REDUCED BY 300mm.
5. ◓ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.
6. ALSO REFER TO REMARKS 4 TO 8 OF ANNEXURE 1 SHEET 2.

BE 97–01 Sht 1 of 5 DATE : JUNE 2000

ANNEXURE 1
SHEET 2 of 5
AMENDMENT

VERTICAL CLEARANCES :
1 065mm TRACK GAUGE

LOCATION		NOT ELECTRIFIED	ELECTRIFIED (PRESENT OR FUTURE)	
			3KV & 25kV	50kV
	RADIUS (mm)	S (mm)	V (mm)	V (mm)
ALL AREAS OTHER THAN THOSE INDICATED BY * BELOW	100	4 470	5 050	5 400
	300	4 410	5 020	5 370
	600	4 370	5 000	5 350
	1 000	4 350	4 990	5 340
	1 500	4 310	4 960	5 310
	2 000	4 290	4 940	5 290
	>3 000	4 270	4 930	5 280
* OVER OR NEAR POINTS AND CROSSING IF REQUIRED BY ELECTRICAL IRRESPECTIVE OF RADIUS			5 650	6 000

REMARKS:

1. V IS THE REQUIRED VERTICAL CLEARANCE EXCEPT WHERE REDUCED CLEARANCE S APPLIES.
2. S IS THE MINIMUM VERTICAL CLEARANCE FOR STRUCTURES AND TEMPORARY WORK OVER NON-ELECTRIFIED LINES.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR APPLICATION AT CURVES
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 3m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON-TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 15m ALONG STRAIGHTS.
5. NEW STRUCTURES: SEE BRIDGE CODE.
6. TUNNELS: SEE DRAWING BE 82-35.
7. FOULING POINTS: SEE CLAUSE 8.1.
8. CLEARANCES ARE BASED ON 15m BOGIE CENTRES AND 2,2m VECHILE BODY LENGTH.
9. ◓ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.

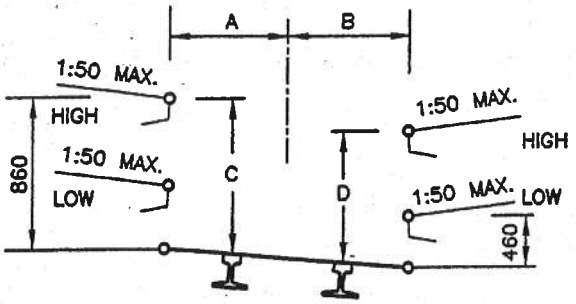
BE 97-01 Sht 2 of 5 DATE : JUNE 2000

ANNEXURE 1
SHEET 3 of 5
AMENDMENT

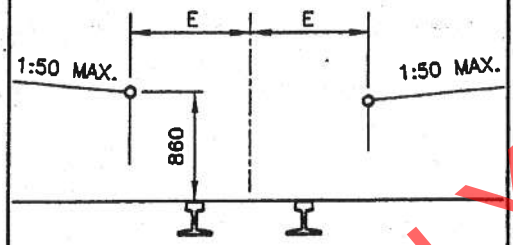
CLEARANCES : PLATFORMS

PLATFORMS : TRACK GAUGE 1 065mm

PASSENGERS



GOODS



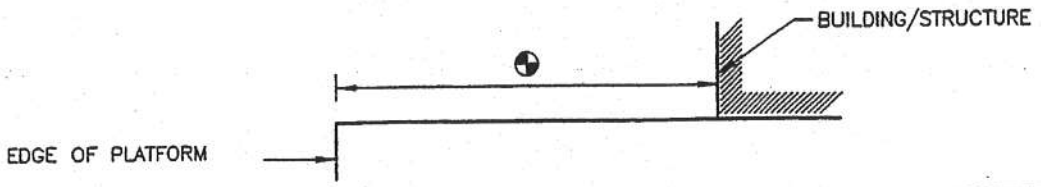
(NO CANT)

RADIUS (m)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
90	1 690	1 820	890	810	1 840
100	1 650	1 790	890	810	1 810
120	1 610	1 740	890	810	1 760
140	1 580	1 700	890	810	1 720
170	1 550	1 660	890	810	1 690
200	1 530	1 630	890	820	1 670
250	1 520	1 600	890	820	1 640
300	1 520	1 580	890	830	1 620
350	1 520	1 560	880	830	1 600
400	1 520	1 550	880	840	1 590
500	1 520	1 540	880	850	1 580
600	1 520	1 530	870	850	1 570
800	1 520	1 520	860	860	1 560
1 200	1 520	1 520	860	860	1 550
2 000	1 520	1 520	860	860	1 540
3 000	1 520	1 520	860	860	1 530
STRAIGHT	1 520	1 520	860	860	1 520

REMARKS:

1. NO CANT TO BE APPLIED EXCEPT WHEN THE GOODS PLATFORM IS ON A RUNNING LINE.
2. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
3. ⊕ 8m TO MAIN STATION-BUILDINGS AND 3m TO ALL OTHER STRUCTURES.
4. TOLERANCES : SEE CLAUSE 8.0.10.

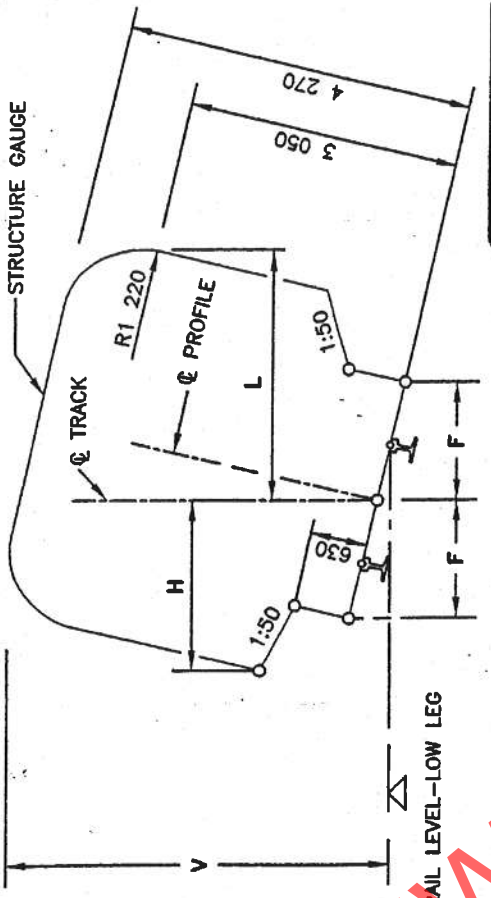
STRUCTURES ON PLATFORMS : 1 065mm AND 610mm TRACK GAUGE



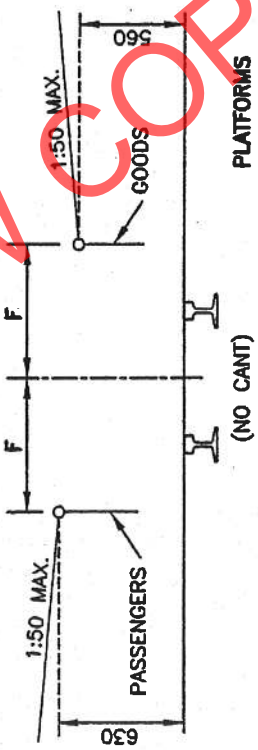
BE 97-01 Sht 3 of 5 DATE : JUNE 2000

ANNEXURE 1
SHEET 5 of 5
AMENDMENT

CLEARANCES : 610mm TRACK GAUGE



CLEARANCES



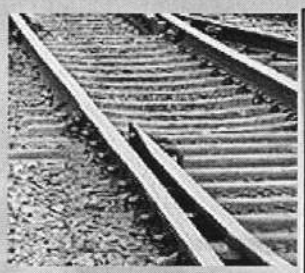
RADIUS (m)	WITH CANT H (mm)	WITH CANT L (mm)	NO CANT H & L (mm)	V (mm)
50	2 370	2 490	2 400	4 320
70	2 310	2 420	2 330	4 310
100	2 260	2 370	2 280	4 310
140	2 220	2 340	2 250	4 310
200	2 200	2 300	2 220	4 300
300	2 190	2 270	2 200	4 300
500	2 180	2 230	2 190	4 290
700	2 170	2 200	2 180	4 270
1 000	2 170	2 170	2 170	4 270
>2 000	2 160	2 160	2 160	4 270

RADIUS (m)	F (mm)
50	1 550
60	1 510
80	1 460
100	1 430
120	1 410
140	1 390
170	1 380
200	1 370
250	1 360
300	1 350
600	1 330
1 000	1 320
>2 000	1 320
STRAIGHT	1 310

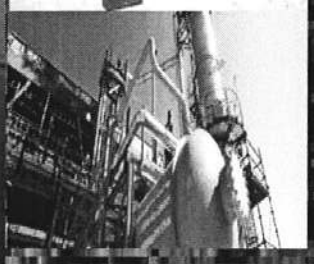
REMARKS:

1. H IS THE MINIMUM HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. L IS THE MINIMUM HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. V IS THE MINIMUM VERTICAL CLEARANCE.
4. FOR APPLICATION AT CURVES:
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 2m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON–TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 18m ALONG STRAIGHTS.
5. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
6. ALSO REFER TO REMARKS 5, 6 AND 7 OF ANNEXURE 1 SHEET 2.
7. CLEARANCES ARE BASED ON 9 700mm BOGIE CENTRES AND 13 700mm VEHICLE BODY LENGTH.
8. SEE ANNEXURE 1 SHEET 3 FOR STRUCTURES ON PLATFORMS.

BE 97–01 Sht 5 of 5 DATE : JUNE 2000



Transnet Procedure Manual
Contract Works / Contractors Public Liability
Principal Controlled Insurance
2010 /2011



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Procedure Manual
Principal Controlled Insurance 2010 / 2011

Introduction

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Introduction

TRANSNET LIMITED insure all Projects / Contracts on a Principal Controlled Insurance Programme basis (including the Assembly and/or Erection of Plant and Machinery) in respect of Contract Works and Contractors Public Liability.

Philosophy of the programme

- Transnet Limited and its Operating Divisions and Specialist Units wish to control the risk exposures in this regard.
- Transnet Limited, as a large organization, bulk-buys - resulting in preferential rates and cover.
- Simplified administration.
- Eliminates potential problems which usually occur when individual Contractors are responsible to arrange separate insurance.
- Includes the Contractor and/or Subcontractors as an insured party.

- It is therefore important that Tender and eventual Contract documents reflect the fact that Transnet as the Principal (i.e. the Employer) arranges certain covers which incorporates cover on behalf of Contractor's
- and / or Subcontractor's.
- The concept does not relieve the contracting parties of their responsibilities for, amongst others, care of the works and liabilities to third parties

Insurance Responsibilities

Insurance Responsibilities

1. Cover arranged by Transnet as the Principal (Employer)

1.1 Insurance Cover Applicable To All Contracts

1.1.1	**Contract Works Cover**	Covering fortuitous physical loss or damage to the works, temporary works and materials for incorporation into the works whilst in transit and whilst at the contract site. Limited to **R100,000,000** any one contract. **(Inclusive of VAT)**
1.1.2	**Contractors Public Liability Cover**	Covering legal liability arising out of or connection with the performance of the works on the contract site or sites designated by the Principal for purposes of the performance of the contract. Limited to **R10,000,000** any one occurrence.
1.1.3	**Riot / Strike Cover (Contract Works)**	Provided by: **SASRIA** (*South African Special Risks Insurance Association*) in respect of risks with RSA. **NASRIA** (*Namibian Special Risks Insurance Association*) in respect of risks within Namibia.

1.2 Additional Insurances (Optional)

1.2.1	**Marine Transit Cover**	Covering imports until delivered and checked on site.
1.2.2	**Project Delay Cover**	Covering consequential financial exposures due to delays following indemnifiable loss or damage to the works.
1.2.3	**Removal of Lateral Support**	Covering legal liability incurred in respect removal of or weakening of or interference with support to land or property or buildings adjacent to, on or in the vicinity of the Contract site. Limit of indemnity **R25,000,000** any one occurrence.

- The above information (including limits of insurance purchased) should be clearly spelt out in Tender and eventual Contract documentation including the deductible (excess) which are applicable and the fact that Contractor's and/or Subcontractor's are responsible for the deductible.

2. Cover to be arranged by Contractor's/Subcontractor's

All Contractor's/Subcontractor's still remain fully responsible to arrange insurance in respect of the following:

- As prescribed by the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 as amended.
- Employers Common Law Liability.
- Own plant, machinery, equipment and tools.
- Motor Vehicles Liability.
- Professional Indemnity (Defective Design).

- This should also be clearly spelt out in Tender and eventual Contract documentation.

3. Cover to be arranged by Consulting Engineers, Architects & Other Professionals

Professional Indemnity (defects in Design, Plan or Specification).

Please ensure that Professional Service Providers do not contract out of their liability in this regard. (Please refer to Transnet Group Insurance for recommendation and approved limits).

Summary of Cover

General

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Summary of Cover

The Insured Parties

- Transnet Limited and / or its Affiliated / Subsidiary / Associated Companies as Principal or Employer.
- All Contractor's undertaking work for or on behalf of the Principal in execution of the Contract.
- All Subcontractor's employed by the Contractor and all other Subcontractor's (whether nominated or otherwise) engaged in the fulfillment of the Contractor.
- To the extent required by any Contract or Agreement suppliers manufacturers vendors or other persons engaged on the contract sites but only to the extent of loss damage or liability originating at the Contract Site (other than while the Property Insured is in transit) arising out of the performance of their Contract Site obligations.

Cover

- Contract Works – as detailed herein.
- Contractors Public Liability – as detailed herein.

Insured Contracts

- All contracts up to a maximum value of R100,000,000 **(Inclusive of VAT)**any one contract.
- Limited to a maximum contract period of 36 months followed by a maximum Defects Liability / Maintenance period of 12 months.

Excluded Contracts

- Where the contract value exceeds R100,000,000 **(Inclusive of VAT)**
- Where the contracted duration of the contract exceeds 36 months.
- Where contracted Defects Liability / Maintenance period exceeds 12 months.
- Contracts involving harbor wet risks*, dams, tunneling, mining, shaft sinking, underground work, quarrying, alterations to water courses being River Diversions or Coffer Dams.
- Contracts outside of the territorial limits.

* NOTE

Harbor Wet Risks defined as:-

"Harbor Wet Risks shall mean all work entailing or involving work in or upon water whether partially or fully submerged such as but not limited to quay walls, seawalls, caissons, breakwaters, jetties, piers, deepening widening and dredging of ports and other off shore risks"

- Contracts involving construction and erection of Petrochemical Plant(s) but this exclusion is limited to contracts involving Petrochemical Manufacturing Plant such as Sasol and the like
- On an existing airport runway or airstrip or in or on any aircraft.

Contract Site

Any location upon which the Insured Contract(s) is to be executed or carried out as more fully defined in the Insured Contract(s) documents together with so much of the surrounding area as may be designated for the performance of the Insured Contract(s).

Territorial Limits

The Republic of South Africa and to the extent permitted by the applicable Insurance Acts the territories of Lesotho, Namibia, Swaziland, Botswana, Zimbabwe and Mozambique.

N.B.
In terms of local legislation enacted in some of the above territories it is required that insurance cover be placed within their local markets. It is therefore important that the Broker be advised timeously (prior to Tender documents being issued) should any contracts, whether as Principal or Contractor, take place in any of the above territories.

If Contracts are to take place in any territories not listed above, the Broker also needs to be advised of same at feasibility stage.

Cover Limitations / Warranties

Unsealed / Unprimed Base Course

- Unsealed / unprimed base course – cover limited to a maximum of 5,000 metres.

Open Trench

- Open trench – cover limited to a maximum indemnity of 5,000 metres.

> **It is essential that the above limitations are brought to the attention of Contractor's. Where this restriction is not practical, specific arrangements for cover can be made with Underwriters. They will, however, require detailed underwriting information and an additional premium may be charged.**

Laid Pipes

- Pipes with a diameter not exceeding 500mm, and all pipes intended for the transportation of Petroleum Products or Fuel Gasses irrespective of diameter, are to be end capped on the termination of each days work to avoid ingress of mud silt water debris detritus and the like.
- Pipes with a diameter exceeding 500mm are to be capped on the termination of each days work with steel mesh to allow ingress of water to avoid floatation but avoiding ingress of large debris or detritus.

NB If above not conformed with cover is forfeited.

Rail Track Re-Profiling

- The maximum speed of any grinding unit shall not exceed 11.00km per hour.
- All Guards, Curtains, Spark Deflectors are to be in place and correctly positioned prior to the commencement of each grind.
- Maximum grinding distance in any one execution shall not exceed 10,000 metres.
- Any changes in prevailing weather conditions must be recorded and appropriate remedial action taken.
- The Insured Parties are to comply with all Fire Fighting requirements as set out in the Project Specification For Track Maintenance With An On Track Grinding / Profiling Machine and any amendments / deviations to this Project Specification are to be advised to the Insurer prior to work being undertaken.

NB If above not conformed with cover is forfeited.

- **It is essential that the above Warranties are brought to the attention of Contractor's.**

Used Plant – Basis of Loss Settlement

Insured property which has operated under service conditions prior to attachment of cover:-

- Up to 5 years – cost of repair / reinstatement / replacement.
- In excess of 5 years - agreed value (calculated on basis of each life year (or part thereof) on present day New Replacement Value reduced proportionally over 20 years subject to residual of 20%).

Claims Reporting

- All incidents that could give rise to claim under the Principal Controlled Insurances, **HAVE TO BE** reported to the Broker / Insurer within a **90** (Ninety) day period.

  Failing this, all benefits in terms of the Policy shall be voidable from date of occurrence.

- All claims must be registered in terms of requirements applicable to Risk Console unique claim number condition.

> - **It is essential that the above Condition is brought to the attention of Contractors in Tender / Contract Documents.**

Rating Structure

- The rates include both Contract Works and Contractors Public Liability cover per current policy limits, terms and conditions.
- Minimum premium requirement are:-

Track Re-profiling	R8,000
Burning of Fire Breaks	R8,000
Chemical Vegetation Control	R4,000
Vegetation Rehabillitation	R4,000
Ballast Tamping	R4,000
Geotechnical & Exploratory	R4,000
All Other	R6,000
SASRIA	R 500

(Above are inclusive of VAT)

- To extend the contract period beyond 36 months will attract an additional premium.

  (See Administrative Procedures herein).

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Summary of Cover

Contract Works Insurance

AON

1. Contract Works Insurance

Synopsis of Cover

Fortuitous Physical loss of or damage:

- During dismantling of property in connection with the Insured Contracts.
- Whilst in transit, including loading and unloading, or whilst temporarily stored at any premises en route to or from The Contract Site within the Territorial Limits;
- During the preparation of The Contract Site and thereafter until the Property Insured has been officially accepted by the Employer and becomes his responsibility by means of a Notice of Completion Certificate or similar evidence of legal transfer of risk in the whole or permanent works under the Insured Contract to the Employer;
- Where testing and commissioning of Property Insured is conducted by the Employer "completion" for purposes of this insurance to occur only after successful completion of all testing and commissioning of the whole of the permanent works under the Insured Contract;
- Where the permanent property insurance arranged by the Employer indemnify the Insured for completed portions of the Property Insured prior to completion of the whole of the permanent works under the Insured Contract, this insurance in respect of such completed portions of the Property Insured shall cease except as provided below;
- Work uncompleted or outstanding in terms of any certificate of completion, certificate of handover or similar document shall continue to be insured until its completion and the inception of the Contractual Defects Liability or Maintenance Period (as may be described in the Insured Contract) for such uncompleted or outstanding work where after the provisions of (g) below shall apply in respect of such work;
- During the Contractual Defects Liability or Maintenance Period (as may be described in the Insured Contract) pertaining to any part of the permanent works but only in respect of loss or damage:

  i) arising from a cause occurring prior to commencement of such period of maintenance or defects liability period

  ii) arising from any act or omission of the Insured their Servants, Agents, Suppliers or Subcontractors in pursuance of the Insured's obligations.

  for which the Insured Contractor is responsible under the Contract.

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Contract Period Limitation

Maximum Contract period	36 months
Maximum Defects Liability / Maintenance Period	12 Months

Limits of indemnity

Contract Works (Any One Contract)	R100,000,000
Work done on Marine vessels	R10,000,000
Surrounding Property	R10,000,000
Surrounding Property – Worked Upon	R50,000,000
Surrounding Property – Watercraft	R10,000,000
Removal to Gain Access	R1,000,000
Documentation	R100,000
Debris Removal	R2,500,000
Claims Preparation Costs	R500,000
Maximum testing / commissioning period	60 days
Maximum un-sealed / un-primed base course limitation	5,000 metres
Maximum open trench limitation	5,000 metres

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Deductibles

The deductible (excess) is the amount which the Contractor and/or Sub-Contractor is responsible for and this obligation must be reflected in the Tender and/or Contract Documents and the responsibility for same made clear.

The deductibles apply to each and every occurrence and in respect of all Contracts.

The deductibles are:

Loss or damage arising out of major perils (where the term shall include storm, rain, tempest, wind, flood, theft and / or malicious damage, subsidence, collapse, earthquake, testing, commissioning	R 25,000
Loss or damage arising from any other cause	R 15,000
Removal of Debris	R 25,000
Loss or damage to Surrounding Property	R 25,000
Loss or damage to Surrounding Property – Worked Upon	R 75,000
Loss or damage to Documentation	R 5,000
Road Reserve / Servitude	R250,000

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All Contracts Entailing Trenching and / or Layer Works

Following additional Deductibles apply over and above the aforestated deductibles: - i.e. in excess of 1,000 metres

Up to a maximum of 3,000metres	20% of loss / minimum R50,000
Up to a maximum of 5,000metres	20% of loss / minimum R100,000

- **It is essential that this is brought to the attention of Contractor's. Where this restriction is not practical, specific arrangements for cover can be made with underwriters. They will, however, require detailed underwriting information and an additional premium may be charged.**

Property Insured

The actual Contract Works and all material intended for incorporation into the Works (*including Free Issue Material* the value of which has to be included in the Contract Value declared*) and Temporary Works.

N.B.
Temporary works does not include mobile plant, constructional aids, equipment, structures or works (not being part of the permanent works) which are not intended to be removed from the Contract Site on completion of the Contract (other than scaffolding shuttering and formwork as well as construction equipment specifically designed and/or constructed for the Insured Contract and which is not intended for immediate re-use on another contract) or have no residual value at completion of the Contract (other than scrap value), solely due to their specialised nature.

* **Note:** Where Transnet for the purposes of the Contract issues materials 'free of charge' to the Contractor such materials shall be and remain the property of the Transnet. Free Issue Material shall mean any material provided by or on Transnet's behalf which is to be used in the provision of the Service or incorporated into the Contract.

Main Exceptions

- The amount of the policy deductible.
- Loss or damage of money or the like.
- Aircraft, waterborne vessels or craft.
- Construction plant, tools or equipment.
- Losses by disappearance / shortage discovered by taking of routine inventory.
- Defective material workmanship design plan or specification (but resultant damage covered).

- Cost of re-design, improvement, betterment or alteration.
- Consequential loss.
- Liquidated damages or penalties for delay in connection with guarantee or performance or efficiency.

- Air transit (unless in territorial limits).
- Ocean transit or whilst in storage thereafter (unless immediately inspected by an independent party after offloading from vessel).
- During the Contractual Defects Liability or Maintenance Period (as may be described in the Insured Contract) pertaining to any part of the permanent works but only in respect of loss or damage:
  i) arising from a cause occurring prior to commencement of such period of maintenance or defects liability period
  ii) arising from any act or omission of the Insured his Servants or Agents, in the course of the work carried out in pursuance of the Insured's obligations with regard to maintenance under the Contract.
- Wear, tear, gradual deterioration rust, corrosion or oxidation and normal up-keep.
- Electrical or mechanical breakdown or explosion to machinery or plant which has operated under load conditions prior to commencement of the Insured Contract or which has occurred after the Testing / Commissioning Period specified in the Policy.
- Damage to any property insured due to ingress of mud, silt, water, debris unless pipe ends have been sealed on termination of each days work by means of end caps as prescribed in the policy.
- Damage to any unsealed / unprimed or base course in excess of limitations as stated in the policy.
- Damage to any open trench in excess of the limitations as stated in the policy.
- War, asbestos and nuclear risks.
- Sinking (whether partial or in whole) of any watercraft arising out of or in consequence of any work undertaken below the load line (international load line / plimsoll line).

Summary of Cover

Contractors Public Liability Insurance

2. Contractors Public Liability Insurance

Insured Contracts

- All contracts up to a maximum value of R100,000,000 **(Inclusive of VAT)** any one contract.
- Limited to a maximum contract period of 36 months followed by a maximum Defects Liability / Maintenance period of 12 months.

Synopsis of Cover

Legal Liability to pay as compensation for and in consequence of:

- Accidental death of or injury to or illness or disease contracted by any person.
- Accidental loss of / or physical damage to tangible property.

Occurring during the period of insurance and arising out of or in connection with the performance of the Insured Contract(s).

- **First Party Property*** Extension will apply to the Lateral Support policy extensions.

*** Note:** Coverage for the insured's personal and real property.

Type Of Contract

All Contracts undertaken including:-

- Chemical Vegetation Control
- Vegetation Rehabilitation
- Ballast Tamping
- Rail Track Re-profiling including the contract works
- Burning of Fire Breaks
- Geotechnical and Exploratory Works

N.B.

The above noted contract types attract specific differentiated rates and are insured by way of a separate policy.

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Limits Of Indemnity

Contractors Public Liability	R10,000,000 any one occurrence / unlimited for the Period of Insurance
Removal of Lateral Support	R25,000,000 unlimited for the Period of Insurance (provided on request only
Statutory Legal Defence Costs	R500,000 any one occurrence
Arrest / Assault / Defamation	R500,000 any one occurrence
Emergency Medical Expenses	R500,000 any one occurrence
Prevention of Access	R500,000 any one occurrence
Trespass / Nuisance	R500,000 any one occurrence
Claims Preparation Costs	R500,000 any one occurrence

Deductibles

The deductible (excess) is the amount which the Contractor and/or Sub-Contractor is responsible for and this obligation must be reflected in the Tender and/or Contract Documents and the responsibility for same made clear.

The deductibles apply to each and every occurrence and in respect of all Contracts.

The deductibles are:

Loss of or damage to public utilities	R25,000
Spread of fire	R250,000
Spread of fire – track re-profiling	R250,000
Loss of or damage to any other property	R25,000
Loss of or damage arising from removal of lateral support	R25,000
Loss of or damage arising from the burning of fire breaks	R250,000
Loss of or damage arising out of vegetation control including but not limited to the use of pesticides and or herbicides	R250,000

Main Exceptions

- The amount of the policy deductible.
- Death or injury to own employees.
- Motor vehicle liabilities under legislation or as defined in Multi-lateral Motor Vehicles Accident Fund No. 93 of 1989 as amended.
- Claims in connection with ownership or use of aircraft or watercraft.
- Property belonging to the Insured or in his care custody and control (as defined in the Policy).
- Property forming part of Contract Works.
- Liquidated damages or penalties for delays or in respect of performance or efficiency guarantees.
- Liability arising out of defects in workmanship materials design plan or specification in any part of the Property insured.
- Arising from or in connection with design plan or specification.
- Gradual pollution and contamination.
- Sudden unintended and unforeseen seepage, pollution or contamination including the cost of removing, nullifying or cleaning up in respect of both ocean and harbour going watercraft outside of dry dock.
- After completion and handover (inclusive of the contractual Defects / Maintenance period).
- Punitive damages.
- Ownership hiring or leasing of any airport or airstrip.
- War, asbestos and nuclear risks.

Cover Limitations / Warranties

Rail Track Re-Profiling

- The maximum speed of any grinding unit shall not exceed 11.00km per hour.
- All Guards, Curtains, Spark Deflectors are to be in place and correctly positioned prior to the commencement of each grind.
- Maximum grinding distance in any one execution shall not exceed 10,000 metres.
- Any changes in prevailing weather conditions must be recorded and appropriate remedial action taken.
- The Insured Parties are to comply with all Fire Fighting requirements as set out in the Project Specification For Track Maintenance With An On Track Grinding / Profiling Machine and any amendments / deviations to this Project Specification are to be advised to the Insurer prior to work being undertaken.

NB: Failure to thoroughly pre-plan and document the safety measures to be adopted with specific regards tp the incidence of fires being initiated during the execution of the work will invalidate indemnity provided in respect of fire arising out of track re-profiling works.

- It is essential that this requirement is brought to the attention of Contractor's. Where this restriction is not practical, specific arrangements for cover can be made with underwriters. They will, however, require detailed underwriting information and an additional premium may be charged.

Other Limitations

- Indemnity for removal of lateral support is limited to R25,000,000.

  If a higher limit of indemnity is required, the Employers Insurance Broker's personnel needs to be advised and underwriting information will need to be provided in advance (i.e prior to Tender stage) and this will entail an additional premium.

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Administrative Procedures

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Administrative Procedures

Arranging Insurance cover

The Operating Divisions and Specialist Units must

Prior to the commencement of each Contract:-

- Complete the Declaration Form per Part A as per Annexure 1 herein.
- Date and sign the Declaration Form.
- Submit the Declaration Form to the Broker.
- **In addition, if the Declaration is being submitted after the commencement date, a separate letter is required stating that, after specific enquiry, The Insured is not aware of any incidents which may give rise to claim/s under this policy. (No Known Incidents Declaration).**

  On receipt of late declarations which are not accompanied by a "No Known Incidents Declaration", the Insurance declaration will not be accepted and no cover will be in force.
- Record the Declaration on the Contract Monthly Register and submit this Register at the end of each month to Transnet Group Insurance and the Broker.

On receipt of the Declaration Form the Broker will submit it to the Insurer and the following documents will be issued and provided to the Operating Divisions and Specialist Units:-

- An Insurance Certificate and a SASRIA Coupon evidencing cover.
- A Debit Note in respect of the premiums due (based on agreed rates).

NB **In terms of SASRIA Regulations, where the Contract Value exceeds R2 million, the physical address of the contract is mandatory. If no physical address i.e. where Track is being worked upon, the start and end points are required.**

Prior to the expiry of each Declarations estimated completion date:-

- Confirm to the Broker that the contract will be completed on time.
- On completion submit to the Broker a Declaration of the final contract value per Part B as per Annexure 1 herein.

NB If the original completion date is not going to be achieved, the period of insurance on the Declaration document will need to be extended and the Broker needs to be notified **prior to original completion date.**

The Operating Divisions and Specialist Units **(prior to the expiry date of the certificate period)** has to advise the Broker in writing to extend the period of insurance and provide the new estimated completion date.

NB **If a completion date needs to be extended and the Broker is not advised prior to the original completion date, all SASRIA cover will cease on the originally declared completion date as there is no hold covered arrangement with SASRIA.**

A new SASRIA Coupon will then only be issued for the extension period from the date when the Insurer is advised in writing by the Broker.

Under these circumstances the new SASRIA Coupon will be subject to an additional premium, subject to the minimum premium.

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This process needs to be followed by the Operating Divisions and Specialist Units until the time of completion is achieved.

Once the Contract has been completed:-

- The Operating Divisions and Specialist Units have to declare the final contract value to the Broker per Part B as per Annexure 1 herein.
- The deposit premium will then be adjusted accordingly.

Failure by the Operating Divisions and Specialist Units to conform to the above procedure will result in cover being voided.

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Contracts that require specific arrangements

All contracts that fall outside the scope of this Principal Controlled Insurance Programme have to be advised to the Broker prior to Tender and specific "One Off" cover will need to be negotiated. These will be:

- Where the Contract Value exceeds R100,000,000 **(Inclusive of VAT)**
- Where the Contracted period exceeds 36 months.
- Where the Contracted Defects Liability Maintenance period exceeds 12 months.
- Other excluded Contracts as described on Page 8 /9 herein.
- Contracts involving harbor wet risks*, dams, tunneling, mining, quarrying, shaft sinking, underground work, alterations to water courses being river diversions or coffer dams.
- Contracts outside of the Territorial Limits.

In this regard contact the Employers Insurance Broker's personnel as detailed on Page 33 herein.

Contracts where cover limitations will be exceeded or where cover warranties cannot be complied with need to be discussed with the Employers Insurance Broker's personnel prior to contract award date to enable the Broker to make specific arrangements with Underwriters. This will however require detailed Underwriting Information and an additional premium may be charged.

- **In order to ensure that Contractor's and site staff are aware of procedures a copy of this Procedure Manual must be supplied to the contract administrators and each Contractor on award of contract.**

* **Note:** Harbour Wet Risks shall mean all work entailing or involving work in or upon water whether partially or fully submerged such as but not limited to quay walls, wharfs seawalls, caissons, breakwaters, jetties, piers, deepening or widening and dredging of ports and other off-shore risks

Important Considerations

Important Considerations

Cognizance must be taken of the following important considerations:-

- For contracts involving assembly or erection of plant and machinery or repairs maintenance or overhaul thereto, **THE FULL NEW REPLACEMENT VALUE OF THE PLANT/MACHINERY** involved must be declared **AND NOT ONLY THE CONTRACT VALUE,** for example.:
  - Cranes (*repairs or final assembly*)
  - Machinery being moved
  - Maintenance or new works on existing Portnet Vessels whilst moored or in dry dock

- Specific arrangements are in place to cover certain contracts where the exposure to own damage (*damage to the works*) is nil or negligible, but where a high third party liability exposure exists. For example:
  - Chemical control of vegetation
  - Vegetation rehabilitation
  - Ballast tamping
  - Re-profiling of Track
  - Burning of Fire Breaks
  - Geotechnical and Exploratory Works

  Contracts of this nature must be clearly identified on the Declaration Form.

- Contract value must include the replacement value of any Free Issue Material provided.

- VAT must be added to all contract value declarations in order to comply with local legislation.

- All policy limits and deductibles are Vat inclusive.

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Claims Procedure

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Claims Procedure

In the event of any incident or occurrence, which is likely, to give rise to a claim under the Insurance arranged by the Principal the following procedures shall be adhered to in addition to any statutory or other requirements contained in the Contract.

All incidents that could give rise to claim under the Principal Controlled Insurances, **HAVE TO BE** reported to the Broker / Insurer within a **90** (Ninety) day period from date of loss.

IMMEDIATELY advise **Aon Construction & Engineering Risks (Attention Sandra Botha).**

At the same time complete the **Incident Advice Form (Annexure 2 herein)** and submit to **Aon Construction & Engineering Risks.**

- Losses involving **theft or malicious damage** must be reported to the police and a police reference number obtained and recorded.
- The Employer, Contactor(s) or Sub-Contractor(s) shall allow free access to Insurers' Loss Adjuster(s) and / or Employer's Insurance Broker for the purpose of investigation and assessing the loss or damage.
- The Employer, Contractor(s) shall **not** deal direct with the Insurers other than by co-operating with their Loss Adjuster(s) and / or the Employers Insurance Broker.
- No **Admission of Liability** shall be made by the Employer, Contractor(s) or Sub-Contractor(s) in the event of damage, loss or injury to third party property or persons.
- Letters from claimants should be passed to **Aon Construction & Engineering Risks** as soon as possible via the Employer if necessary.
- In the event of immediate repairs being necessary in the interest of safety, the Contractors may with the Employer's permission proceed with such repairs.
- The Employer shall immediately advise Sandra Botha at **Aon Construction & Engineering Risks**.
- Other than in the circumstances described above the Contractor shall not proceed with the making good of any loss without the prior authorization of the Employer who shall advise the Insurer's appointed Loss Adjuster(s) and Sandra Botha of **Aon Construction & Engineering Risks**.
- Upon commencement of the making good of any loss, the Contractor shall keep separate records of the costs involved in making good such loss and these records must be authenticated by the Employer for submission to the Insurer's or their Loss Adjuster(s). Such records shall include, inter alia, the entire cost of labour, materials, transport and equipment.
- The basis upon which the Insurers will indemnify loss or damage is the cost of repair or replacement of the loss or damage including, inter alia, transport and overheads.
- On completion of the making good of any loss the records of the costs involved having been authenticated by the Employer shall be sent to the Insurer's via their Loss Adjuster(s) and copied to **Aon Construction & Engineering Risks** (Mrs. Sandra Botha) for processing.

- Upon the amount of the loss or damage being agreed upon by the Insurer's Loss Adjuster(s) and the Contractor, an "Agreement of Loss" form will be signed by the Contractor and Employer.
- The amount agreed upon by the Insurers, the Contractor and the Employer shall be paid by the Insurers to the Employer net of the deductible, who will arrange for the payment to be made to the Contractor as appropriate after deduction of the first amount payable.

- **All incidents which could give rise to a claim under the insurances arranged by the Principal / Employer must be notified to the Broker without delay, per the procedures set out above**

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Aon South Africa Personnel

Construction and Engineering Division

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Aon South Africa Personnel

Construction and Engineering Division

Aon South Africa personnel are at all times available for advice, please feel free to contact :-

- George Davis
  Senior Accounts Executive
  Tel No. (011) 944 7103
  Fax No. (086) 505 9558
  E-Mail george_davis@aon.co.za

- Judy Bath
  Account Administrator
  Tel No. (011)944 7053
  Fax No. (086)505 9553
  E-Mail judy_bath@aon.co.za

- Sandra Botha
  Claims Manager
  Tel No. (011)944-7118
  Fax No. (086)556 7169
  E-Mail sandra_botha@aon.co.za

AON

Annexure 1

Transnet Principal Controlled Construction Insurance Programme Contract Award Declaration (Part A) And Contract Completion Declaration (Part B)

TRANSNET PRINCIPAL CONTROLLED INSURANCE PROGRAMME
CONTRACT DECLARATION

CONTRACT NUMBER.....

PURCHASE ORDER NUMBER.....

Send to
Aon South Africa (Pty) Ltd
Construction and Engineering
PO Box 1874
Parklands
2121
Attention : Judy Bath
Tel No. (011) 944-7053
Fax No. 086 505 9553
E-Mail: judy_bath@aon.co.za

From (Operating Unit/Specialist Div).....
Postal Address .....
.....
.....
Represented by .....
E-Mail Address .....
Tel No. .....
Fax No. .....

PART A – CONTRACT AWARD INFORMATION

TYPE OF CONTRACT **MARK WITH AN 'X' IF APPLICABLE:**	LONG TERM MAINTENANCE / MULTIPLE WORKS CONTRACT with a SERVICE LEVEL AGREEMENT		OTHER	

NAME OF CONTRACTOR

CONTRACT AWARD DATE

CONTRACT COMMENCEMENT DATE

EXPECTED CONTRACT COMPLETION DATE

DESCRIPTION OF CONTRACT WORKS

PHYSICAL ADDRESS WHERE CONTRACT IS TAKING PLACE (COMPULSARY FOR ALL CONTRACTS R2M AND OVER)

MAINTENANCE PERIOD *(MONTHS)*

CONTRACT VALUE AT AWARD

IF PLANT AND MACHINERY INCLUDE REPLACEMENT VALUE

ESTIMATED VALUE OF FREE ISSUED SUPPLIED TO CONTRACTOR

DOES THIS CONTRACT ENTAIL WORK IN RESPECT OF THE FOLLOWING CATEGORIES WHERE THE EXPOSURE TO OWN DAMAGE (DAMAGE TO WORKS) IS NIL OR NEGLIGIBLE

[I]	CHEMICAL CONTROL OF VEGETATION	YES/NO
[II]	VEGETATION REHABILITATION	YES/NO
[III]	BALLAST TAMPING	YES/NO
[IV]	TRACK RE-PROFILING	YES/NO
[V]	BURNING OF FIRE BREAKS	YES/NO
[VI]	GEOTECHNICAL AND EXPLORATORY WORKS	YES/NO

OPTIONAL INSURANCE REQUIRED

[I]	IS REMOVAL OF LATERAL SUPPORT COVER REQUIRED?	YES/NO
[II]	DOES THIS CONTRACT EVIDENCE AN EXPOSURE WHICH CAN BE COVERED BY PROJECT DELAY INSURANCE?	YES/NO
[III]	WILL THE EMPLOYER/CONTRACTOR/SUB-CONTRACTOR MAKE ANY DIRECT IMPORTS OF REQUIREMENTS FOR THE CONTRACT THAT REQUIRE MARINE IMPORT INSURANCE?	YES/NO

IF SO DETAILS NEED TO BE PROVIDED TO THE BROKER SO THAT THIS FORM OF COVER CAN BE ARRANGED

SIGNATURE ..... DATE: .....

AON

TRANSNET PRINCIPAL CONTROLLED INSURANCE PROGRAMME
CONTRACT COMPLETION DECLARATION

ORIGINAL CONTRACT NO. .....
PURCHASE ORDER NO. .....

PART B – CONTRACT COMPLETION DECLARATION
CONTRACT NUMBER
TITLE OF CONTRACT
CONTRACT COMPLETION DATE
ENDORSEMENT/CERTIFICATE NUMBER
EXPIRY OF MAINTENANCE PERIOD
FINAL CONTRACT VALUE
ACTUAL VALUE OF FREE ISSUE SUPPLIED TO CONTRACTOR

SIGNATURE:..... DATE:.....

Annexure 2

Incident Advice Form

ALL INCIDENTS HAVE TO BE REPORTED WITHIN 90 DAYS OF OCCURRENCE

TRANSNET PRINCIPAL CONTROLLED INSURANCE PROGRAMME

INCIDENT ADVICE FORM
TRANSNET UNIQUE CLAIM NUMBER .....

Send to
Aon South Africa (Pty) Ltd
Construction and Engineering
PO Box 1874
Parklands
2121
Attention : Sandra Botha
Tel No. (011) 944 7118
Fax No. (086) 556 7169
E-Mail: Sandra_botha@aon.co.za

From .....
Represented by .....

Tel No. .....
Fax No. .....

PRINCIPAL (*PER CONTRACT DOCUMENT*

CONTRACT NUMBER

ORIGINAL DECLARATON NO.

TITLE OF CONTRACT

ORIGINAL CONTRACT COMMENCEMENT DATE

DATE OF LOSS OR DAMAGE

DATED REPORTED TO SITE AGENT

REPORTED BY

REPORTED TO BY

DATE

LOCALITY OF INCIDENT

DETAILS OF HOW THE LOSS OR DAMAGE OCCURRED

DETAILS AND NATURE OF LOSS OR DAMAGE TO CONTRACT WORKS / TO THIRD PARTY PROPERTY

DETAILS OF OTHER DEATH OR INJURY TO PARTIES

ESTIMATED COST (*SEPARATE RECORDS OF ALL COSTS MUST BE KEPT)*

WHO OR WHAT APPEARS TO BE RESPONSIBLE FOR THE CAUSE OF THE LOSS / DAMAGE

PERSON WHOM ASSESSOR SHOULD CONTACT DESIGNATION:

TELEPHONE (*LANDLINE)* CELLPHONE NO.

E-MAIL ADDRESS

ALL INCIDENTS HAVE TO BE REPORTED WITHIN 90 DAYS OF OCCURRENCE

SIGNED BY: ..... SIGNATURE: .....

COMPANY: ..... DATE: .....

AON

TRANSNET

Annexure 3

Annual Contract Works & Contractors Public Liability And Lateral Support Policy Wording

AON

Annexure 4

Annual Contractors Public Liability Policy Wording

In respect of Contracts entailing:-

- **Chemical Vegetation Rehabilitation**
- **Vegetation Rehabilitation**
- **Ballast Tamping**
- **Rail Track Re-Profiling**
- **Burning of Fire Breaks**
- **Geotechnical and Exploratory Works**