
Part C1: Agreement and Contract Data

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Contract Data

The Employer is

Name Transnet Limited Trading as Transnet Freight Rail.....
Address Nzasm Building, Room 210, Corner Paul Kruger and Minnaar Street, Pretoria.....
Telephone (012) 315 2059 Fax No. (012) 315-2125.....
E-mail Yvonne.scannell@Transnet.net

The work is

DESIGN, SUPPLY, INSTALL, TEST AND COMMISSION OF 11KV OUTDOOR POLE MOUNTED AUTO CLOSER AT IMPALA 11KV INFED SUBSTATION UNDER THE CONTROL OF DEPOT ENGINEER NELSPRUIT.....

The sites are

11KV IMPALA TRACTION SUBSTATION

The starting date is

TO BE ADVISED.....

The completion date is

TO BE ADVISED.....

The reply period is

TWO WEEKS..... weeks

The defects date is

52 Weeks after completion.....

The defect correction period is

Immediately after defects date.

The delay damages are

R5, 000.00..... per day

The assessment day is the

13th (THIRTEENTH)..... of each month

The retention is

10% (ten percent) ON THE TOTAL VALUE OF THE CONTRACT...

Does the United Kingdom Housing Grants, Construction and Regeneration Act (1996) apply?

No.....

The Adjudicator is

Name To be advised if disputes arises.....
Address
Telephone Fax No.
E-mail

Contract Data

The interest rate on late payment is two percent (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...R2,000,000.00 (two million Rand) 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

This project specification covers Transnet freight rail's requirements for the supply, install, test and commission of 11kV outdoor pole mounted auto closer at Impala 11kV infeed substation under the control of the Depot Engineer, Nelspruit.

- 1.1 The Contractor shall not make use of any sub-Contractor to perform the works or parts thereof without prior permission from the Employer's Deputy.
- 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's Deputy / Supervisor. 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's Deputy / Supervisor 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's Deputy / Supervisor.
- 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.
- 1.4.6 The Contractor's Health and Safety Programme shall be subject to agreement by the Employer's Deputy / Supervisor, 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.
- 1.4.7 In addition to compliance with clause 1.4 hereof, the Contractor shall report all incidents in writing to the Employer's Deputy / Supervisor. 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.
- 1.4.8 The Contractor shall make necessary arrangements for sanitation, water and electricity at these relevant sites during the installation of the equipments.
- 1.4.9 A penalty charge of **R5,000.00** per day will be levied for late completion.
- 1.4.10 10% retention money will be retained and will be released 12 months after the completion date of the contract.
- 1.4.11 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's Deputy or Supervisor must countersign such delays. Other delays such as non-availability of equipment from 3rd party suppliers must be communicated to the Employer's Deputy or Supervisor in writing.
- 1.4.12 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's Deputy or Supervisor and must be countersigned by the Contractor.
- 1.4.13 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's Deputy or Supervisor on the day of energising or handing over.
- 1.4.14 All processes or the manufacture and assembly of the product components must be subjected to a quality assurance system.

- 1.4.15 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 party suppliers/Manufacturers.
- 1.4.16 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.
- 1.4.17 The Contractor will remain liable for contractual delivery dates irrespective of deficiencies discovered during workshop inspections.

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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: (**Amount in words, VAT inclusive**)

.....

Total price in numbers(VAT inclusive): R.....

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

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Part C2.1: Pricing Data Price Instructions

2.0 PRICING INSTRUCTIONS

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. 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.
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.
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.
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.
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.
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).
8. The following abbreviations are used in the Price list:

Hr	=	Hour
Ea	=	Each
Quant	=	Quantity
OCB	=	Oil circuit breaker
GCB	=	Gas circuit breaker
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.

- 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.
- 11 Where no quantity has been provided against an item in the Price list, the Contractor shall use their discretion and provide the quantity.
- 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.
- 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.
- 14 Contractor shall ensure that provision (financial as well as time) for excavations in a range of soil types is made for in their tenders.
- 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).
- 16 The Contractor shall also arrange forward cover within two weeks after contract award on all imported items.
- 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.
- 18 The total in the Price list shall be exclusive of VAT.
- 19 Transnet Freight Rail payment terms: 30 days from month end statement.

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**Contract Data
Price List**

Item No.	Description	Unit	Qty	Rate	Amount
A	Impala 11kV substation				
1	Design, supply, test and commission 11kv outdoor pole mounted auto closer with control and communications cubicle, sensitive earth fault protection, group option G1(Measurement), group option G2(History & Records), group option G3(Communication) , WSOS operating system and associated cables.	sum	1		
2	Testing & commissioning	sum	1		
3	P's and G's	sum	1		
A	Total price for (Excl. VAT)			R	

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Part C3: Scope of Work

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Contract Data

Works Information

3.0 DESCRIPTION OF WORK

3.1 SCOPE

This specification covers Transnet Freight Rail requirements for the supply of 11kv outdoor pole mounted auto re-closer with protective devices and associated cables. Equipment is required for installation at the 11kv in feed from Eskom site to trip the supply the case of faults from Transnet line.

4.0 General requirements for outdoor auto re-closer circuit breaker

- 4.1 The automatic re-closer circuit breaker shall consist of the automatic re-closer and control cubicle, housing the control/protection circuit and it's associated low voltage auxiliary supply connected electrically together by a control cable which will form a remotely controlled unit.
- 4.2 The pole-mounted three phase triple pole automatic re-closer circuit breaker shall be designed, manufactured and tested in accordance with SANS 62271-111 and SANS62271-200.
- 4.3 Local and remote controls of the automatic re-closer circuit breakers shall be in accordance with NRS 036-1.
- 4.4 An earthing stud of earthing purposes shall be provided with equipment.
- 4.5 The design of the equipment shall make provision for the safety of the person concerned in the normal operation and maintenance of the equipment and shall be controlled by pole mounted Advanced Controlled (ADVC)

5.0 Outdoor pole mounted auto re-closer circuit breaker

- 5.1 The automatic re-closer shall be mounted on the H-mast and connected electrically direct to lightning arresters and drop-out fuses before terminating to live conductors.
- 5.2 The automatic re-closer circuit breaker consist of permanent source side voltage transformer, current transformer, switchgear operating mechanism and load side voltage transformer enclosed in a stainless steel tank.
- 5.3 The automatic re-closer circuit breaker must be designed for the outdoor purposes and shall be made from stainless steel.
- 5.4 The stainless steel tank shall be filled in with SF6 (sulphur hexafluoride) gas and shall be provided/fitted with a gas.
- 5.5 The automatic re-closer circuit breaker shall be provided with 'open and close' indicators on a conspicuous position and must be made to be easily operated from the ground by employing an approved hook stick.

6.0 Auto re-closer relay

- 6.1 The auto re-closer relay shall operate automatic.
- 6.2 This system shall consist of instantaneous and time lag over-current and earth and earth fault relays and auto re-closing relay.
- 6.3 The auto re-closer will lock-out after it tripped three times with a three second interval if the fault is not cleared.
- 6.4 If the fault clears during the re-closing cycle the auto re-closer relay shall reset to initial condition.
- 6.5 The auto re-closer system shall be inhibited in the event of a sensitive earth fault operation.

7.0 Drawings, instruction manuals and spare part catalogues.

- 7.1 All as built drawings shall be supplied in electronic format (Microstation/Acad).
- 7.2 The successful Contractor shall be required to submit all drawings (paper prints), within four weeks of award of tender, to the Employer's Deputy or Technical Officer for approval. No construction or manufacturing activity will be allowed prior to the associated drawings having been approved.
- 7.3 During the duration of the contract period, the successful Contractor will be required to inform the Employer's Deputy or Supervisor (contracts) of any changes to these drawings and will have to resubmit the affected drawings for approval prior to it being used on this contract.
- 7.4 All drawings, catalogues, instruction book and spares lists shall be in accordance with Transnet Freight Rail's specification CEE.0224.2002.
- 7.5 All final as built drawings shall be provided to Transnet Freight Rail within four weeks after commissioning.

8.0 Site Tests

- 8.1 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.
- 8.2 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.
- 8.3 Functional on-site tests shall be conducted on all items of equipment and circuitry to prove the proper functioning and installation thereof.
- 8.4 The Contractor shall submit a detailed list of on-site tests for the approval of the Employer's Deputy or Supervisor.
- 8.5 The Contractor shall arrange for the Supervisor or his representative to be present to witness the on-site tests.
- 8.6 The on-site tests and subsequent commissioning **will not commence until ALL CONSTRUCTION** work has been completed. Construction staff, material and equipment shall be removed from site prior to the commencement of testing. Testing and commissioning of the power plants equipment will not be allowed to take place in a

construction site environment.

8.7 The on-site tests shall include the following:

- 8.7.1 Test for the functionality of all electrical circuitry.
- 8.7.2 Trip tests on relays
- 8.7.3 Test on equipment as per manufacturers instruction
- 8.7.4 Insulation

8.8 At the completion of the on-site tests, the Employer's Deputy or Supervisor or his representative shall either sign the tests sheets (supplied by the Contractor) as having witnessed the satisfactory completion thereof, or hand to the Contractor a list of defects requiring rectification.

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

8.10 Acceptance by the Employer's Deputy or Supervisor of satisfactory completion of on-site tests in no way relieves the Contractor of his obligation to rectify defects which may have been overlooked or become evident at a later stage.

9.0 Commissioning of equipment

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

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

9.3 The commissioning of protection equipment by Transnet Freight Rail will in no way absolve the Contractor from any of his responsibilities during the guarantee period.

9.4 It is the Contractor's responsibility to satisfy himself or herself that the commissioning of the protection equipment has been carried out in a satisfactory manner, and in no way compromises the proper operation of the equipment supplied in terms of the contract.

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

10.0 Guarantee and defects

10.1 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.

10.2 The Contractor shall be issued with a completion certificate with the list of all defects to be repaired within immediately after commissioning.

10.3 The guarantee period for this outdoor equipment shall expire: a period of 12 months commencing on the date of completion of the contract.

10.4 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.

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

10.6 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.

- 10.7 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's Deputy or Supervisor and at the cost of the Contractor.
- 10.8 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.

11.0 Quality and inspection

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

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Contract Data

Works Information

12. Specifications

- | | | |
|------|----------------|---|
| 12.1 | SANS 1091 | National colour standard |
| 12.2 | SANS 763 | Hot dip galvanised zinc coating. |
| 12.3 | SANS 10142 | Wiring Code |
| 12.4 | SANS 60273 | Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1kV. |
| 12.5 | SANS 62271-102 | |

13. Transnet Freight Rail:

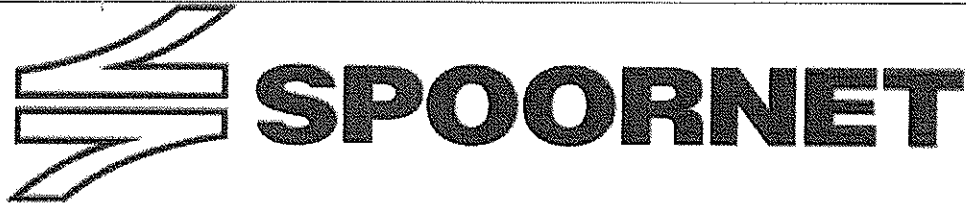
- | | | |
|------|--------------------|---|
| 13.1 | BBC 0111 Version 1 | Pole mounted auto re-closer circuit breaker. |
| 13.2 | CEE-TBD-00007 | Earthing arrangement for traction substations. |
| 13.3 | CEE-TBK-0027 | Control circuit diagrams – No volt operations. |
| 13.4 | BBC 0198 version 1 | Specifications for the supply of cables. |
| 13.5 | CEE-0023.90 | Specifications for installation of cables. |
| 13.6 | CEE-0183.2002 | Hot dip galvanising and painting of electrical equipment. |
| 13.7 | CEE-0224.2002 | Drawings catalogues instruction manuals and spares list for electrical equipment supplied under contract. |

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

- 13.8 Occupational Health and Safety Act No. 85 of 1993 (Available at depot for referral)
- 13.9 Constraints on how the Contractor Provides the Works.
- 13.10 The constraints shall be as specified in the specifications of the particular equipment.

14. Requirements for the programme

- | | | |
|------|-----------------------|--|
| 14.1 | Programme of work | :To be submitted by successful Contractor |
| 14.2 | Format | : Bar chart |
| 14.3 | Information | : How work is going to be executed and commissioned |
| 14.4 | Submission | : Not Applicable |
| 14.5 | Site diary | : Successful Contractor to supply in triplicates carbon copies |
| 14.6 | Site instruction book | : Successful Contractor to supply in triplicates carbon copies |



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)

Authors: Engineering Technician (level 1)
Section: Technology
Management B.L. Ngobeni

Approved: Engineering Technician (level 3)
Section: Technology
Management D.O. Schulz

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

Date: 5 September 2005

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- Engineering & Technology: Technology Management

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1.0 SCOPE

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

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

2.0 STANDARDS

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

2.1 SOUTH AFRICAN NATIONAL STANDARDS

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

3.0 APPENDIX

The following appendix forms an integral part of this specification.

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

4.0 TENDERING PROCEDURE

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

5.0 MEDIUM VOLTAGE CABLES

5.1 IMPREGNATED PAPER INSULATED.

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

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

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

7.0 QUALITY ASSURANCE

- 7.1 Spornet 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 Spornet 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 Spornet for inspections to be carried out before delivery of the equipment.

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SCHEDULE OF REQUIREMENTS

(To be completed by the client)

1.0 MEDIUM VOLTAGE CABLES

1.1 PAPER IMPREGNATED LEAD SHEATHED (PILC)

1.1.1 Rated Voltage (V):

1.1.2 Number of cores:

1.1.3 Length of cables (m):

1.1.4 Size of conductors (mm²):

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 (mm²):

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 (mm²):

END



A Division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT

SPECIFICATION

INSTALLATION OF LOW AND MEDIUM VOLTAGE CABLES

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Date: 31 May 2012

Circulation Restricted To:
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Transnet and Relevant Third Parties

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1.0 SCOPE

- 1.1 This specification covers Transnet Freight Rail's requirements for the installation, laying, terminating, jointing, testing and commissioning of low and high voltage cables.

2.0 APPENDICES

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

- 2.1 Appendix 1 - "Scope of Work" - to be completed by Transnet Freight Rail (Client).
 2.2 Appendix 2 - "Schedule of Requirements" – (to be completed by Tenderer).
 2.3 Appendix 3 – "Normative SANS references"

3.0 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.

3.1 British Standards

BS 5467: Electric cables – thermosetting insulated, armoured cables for voltages of 600/1000V and 1900/3300V.

BS 6480: impregnated paper – installed lead or lead alloy sheathed electric cables of rated voltages up to and including 33 000V

3.2 South African National Standards

SANS 32: Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants.

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 121: Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.

SANS 1339: Electric cables - Cross-linked polyethylene (XLPE) insulated cables for rated voltages 3,8/6,6 kV to 19/33 kV

SANS 10142-1: The wiring of premises Part 1: Low-voltage installations.

SANS 10142-2: The wiring of premises Part 2: Medium-voltage installations above 1 kV A.C not exceeding 22 kV A.C and up to and including 3 000 kW installed capacity.

3.3 Transnet Freight Rail Instructions

BBD 8210 - General work and works on, over, under or adjacent to a railway lines and near high voltage equipment

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.

Electrical Safety Instructions 2012 - High Voltage Electrical Equipment

3.4 Transnet Freight Rail Drawings

CEE PA-0105 - Precast concrete slab cover for cable protection.

CEE-PK-14 - Electrical cable route marker.

CEE-MA-307 – Route marker electrical cables.

FG 263 - Accommodation of cables in Railway formations

3.5 Statutory Requirements

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

- 3.6 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.

4.0 TENDERING METHODS

- 4.1 Tenderer 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 tenderer to elaborate on their response to a clause.
- 4.2 A statement of non-compliance shall be motivated by the tenderer.
- 4.3 Tenderer shall complete Appendix 2 – “Schedule of requirements”.
- 4.4 Tenderer shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 4.5 Failure to comply with clauses 4.1, 4.2, 4.3 and 4.4 could preclude a tender from consideration.

5.0 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:	-10°C to +55 °C.
Relative humidity:	10% to 90%
Lightning Conditions:	12 ground flashes per square kilometre per annum.
Pollution:	Heavily salt laden or polluted with smoke from industrial sources.

6.0 GENERAL REQUIREMENTS

- 6.1 The tenderer shall submit all drawings in accordance with Transnet Freight Rails Specification CEE.0089
- 6.2 Where joints and terminations are to be done by others, the contractor shall submit detailed instructions regarding the procedure recommended by the cable manufacturer.
- 6.3 The electrical installation shall conform to the requirements of SANS 10142 part 1 and 2 and shall be to the satisfaction of Transnet Freight Rail.
- 6.4 Galvanising where specified shall be in accordance with SANS 32 and SANS 121.
- 6.5 Work on the high voltage equipment shall be carried out in accordance with the Transnet Freight Rail's Safety Instructions 2012 - High Voltage Electrical Equipment.
- 6.6 All work done must comply with the requirements of Occupational Health and Safety Act and Regulations, Act 85, 1993

SURVEYS

- 6.7 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 Transnet Freight Rail's drawings to determine a suitable route.
- 6.8 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 Depot Maintenance Manager (Electrical) for approval.
- 6.9 The Contractor shall submit in triplicate plans of the cable routes selected to the Depot Maintenance Manager (Electrical) for approval. Plans may be submitted in sections as the survey progresses.

- 6.10 No excavation of any section of the cable route shall commence before the Contractor is in possession of the relevant approved plans and the Depot Maintenance Manager (Electrical) has authorised the commencement of work on the section concerned.
- 6.11 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.
- 6.12 The cable route plans shall include the following information:
- 6.12.1 Overall length, type, size and voltage of each cable.
- 6.12.2 Accurate indication of the position of each cable joint by indicating two distances to each joint from permanent structures.
- 6.12.3 Pipes and chambers provided.
- 7.0 EXCAVATIONS**
- 7.1 Excavations shall be carried out in strict compliance with the specification BBD 8210 for general work and works on, over, under or adjacent to a railway lines and near high voltage equipment.
- 7.2 Trenching procedure shall be programmed in advance, approved by the Depot Maintenance Manager (Electrical) and shall not be departed from except with the consent of the Depot Maintenance Manager (Electrical).
- 7.3 The Contractor will be advised of any known buried services such as cables, pipes, etc. in the vicinity of the cable route.
- 7.3.1 When trenching the contractor shall take all necessary precautions to prevent damage to underground services.
- 7.3.2 On encountering any uncharted service, the Contractor shall promptly advise the Depot Maintenance Manager (Electrical) who will give the necessary instructions. Additional excavations shall be paid for at scheduled rates.
- 7.4 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 Depot Maintenance Manager (Electrical), who shall arrange for the necessary repairs. The Contractor shall be responsible for the cost of repairs.
- 7.5 The removal of obstructions along the cable routes shall be subject to the approval of the Depot Maintenance Manager (Electrical) and shall be paid for at the agreed rates.
- 7.6 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 Depot Maintenance Manager (Electrical) to arrange for the necessary supervision. The cost of such supervision shall not be charged to the Contractor.
- 7.7 Excavations crossing oil pipe lines shall not commence until an authorised representative is present on site. The Depot Maintenance Manager (Electrical) shall be advised 14 days in advance when such excavations will take place.
- 7.7.1 Cable crossings of oil pipe lines shall only be at right angles.
- 7.8 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.
- 7.9 Power driven mechanical excavators may be used for trenching operations. Transnet Freight Rail shall not be responsible for any damage to other Services in close proximity when using mechanical excavators.
- 7.10 The Contractor shall provide shuttering in places where the danger exists of the trench collapsing, and causing damage to formations or other nearby structures.
- 7.10.1 Shuttering shall be paid for at scheduled rates.

- 7.11 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.
- 7.11.1 Trenches shall have no sharp objects which may cause damage to the cable during laying or backfilling.
- 7.12 The unfinished depth of trenches unless otherwise stated shall be as follows:
- 7.12.1 HV cables and associated pilot cables = 1 000 mm.
- 7.12.2 LV cables and separate pilot cables = 750 mm.
- 7.13 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.
- 7.13.1 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 SANS 97 and SANS 1339.
- 7.13.2 Trenching in railway formations shall be in accordance with Transnet Freight Rail's drawing FG 263.
- 7.14 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.
- 7.14.1 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.
- 7.15 When excavating close to railway tracks, the ballast must be covered by tarpaulins or other sheeting to prevent soiling.
- 7.16 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.
- 7.17 Transnet Freight Rail 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.

8.0 CABLE LAYING

8.1 GENERAL

- 8.1.1 All possible care shall be exercised in handling cables on site.
- 8.1.2 Any drum of cable showing signs of damage shall not be used.
- 8.1.3 The outer covering (insulation) of cables shall not be damaged in any way and cables shall not be bent at radii less than allowed by the manufacturer.
- 8.1.4 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 the contractor.
- 8.1.5 Cable pulling and laying shall be done manually unless otherwise approved by the Depot Maintenance Manager (Electrical). No cable shall be subjected to a tension exceeding that stipulated by the cable manufacturer.

8.2 IN TRENCHES

- 8.2.1 High Voltage cables shall be spaced at a minimum of 300 mm apart (centre to centre).
- 8.2.2 Low Voltage cables shall be spaced at a minimum of 150 mm apart (centre to centre).
- 8.2.3 Pilot cables shall be laid beside the associated power cables.
- 8.2.4 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.

- 8.2.5 Pilot cables, when they are routed separately from their associated power cables, may be run next to one another.
- 8.2.6 Single core low voltage cables to be clamped in trefoil formation.
- 8.2.7 Where the cable cannot be laid down at the specified depth, prior authority shall be obtained from the Depot Maintenance Manager (Electrical) 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.
- 8.2.8 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.
- 8.2.9 Suitable rollers may be used during the laying of cables.
- 8.2.10 Cables shall be visually inspected for damage during and after laying. Any damage shall be reported immediately to the Depot Maintenance Manager (Electrical) who will issue the necessary instructions.
- 8.3 IN SLEEVE PIPES
- 8.3.1 All cables crossing beneath roads and pavements shall be enclosed in cement or PVC pipes with a minimum internal diameter of 150mm. The Depot Maintenance Manager (Electrical) 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.
- 8.3.2 Pipes shall maintain or exceed the specified cable spacing.
- 8.3.3 Only one High Voltage cable shall be laid per pipe.
- 8.3.4 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.
- 8.3.5 All cables crossings underneath railway tracks shall be in pipes in accordance with Transnet Freight Rail's drawing FG 263.
- 8.4 IN DUCTS AND BUILDINGS
- 8.4.1 Concrete ducts and pipes within buildings will be provided by others.
- 8.4.2 Before installing cables, the ducts are to be inspected to ensure that they are suitable and clean as not to damage the cables.
- 8.4.3 The cables are to be neatly positioned and cross overs are to be avoided.
- 8.4.4 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.
- 8.4.5 The Contractor shall supply all cable trays, racks, wooden cleats or other supports required to adequately support cables not laid in ducts.
- 8.4.6 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 SANS 32 and SANS 121 when used within 50 km of the sea or inland exposed conditions.
- 8.4.7 Where cable enters buildings sufficient measures shall be installed to ensure no moisture/water is digressing into the ducts. A sealing system based rubber modules from multi removable layers may be used.
- 8.5 UNDER BRIDGES AND IN TUNNELS
- 8.5.1 Where a cable route can only be against the concrete wall of a bridge or tunnel the cable shall be supported on:
- 8.5.1.1 Suitable brackets at 750 mm intervals or.

- 8.5.1.2 Straining wire secured at maximum 1 200 mm intervals.
- 8.5.2 Brackets shall be of robust design and shall be galvanised and painted in accordance with Transnet Freight Rail's specification CEE.0045.
- 8.5.3 The height of the cable route on the brackets or strain wire shall be determined and agreed upon on site.
- 8.5.4 The brackets or strain wire shall be supplied and installed by the contractor.
- 8.6 CROSSING OF PIPELINES AND OTHER CABLES
- 8.6.1 Cables shall pass beneath pipelines with a 300 mm minimum clearance between the top of any cable and the bottom of any oil pipe.
- 8.6.1.1 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.
- 8.6.2 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 Transnet Freight Rail's drawing CEE PA-0105 shall be placed between the two cables parallel to the lower cable.
- 8.7 IN RAILWAY FORMATIONS
- 8.7.1 Cables to be accommodated in railway formations shall be laid in accordance with Transnet Freight Rail's drawing FG 263.
- 8.8 SECURED TO POLES
- 8.8.1 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.
- 8.8.2 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.
- 8.8.3 Straps and pipes shall be supplied and installed by the Contractor.
- 8.9 EXPOSED CONDITIONS
- 8.9.1 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 SANS 32 and SANS 121.
- 8.9.2 These pipes or boxed sections shall be firmly secured to the bank or cut, at regular intervals.
- 8.9.3 All such material shall be supplied and installed by the Contractor.
- 8.9.4 Stake routes shall only be supplied when specifically called for in Appendix 1.
- 9.0 CABLE TERMINATIONS**
- 9.1 GENERAL
- 9.1.1 All cables shall be terminated and connected to the respective equipment, whether provided by the Contractor or by others.
- 9.1.2 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.
- 9.1.3 Termination of cables on outdoor equipment shall not be done during inclement weather conditions.

- 9.1.4 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.
- 9.1.5 All materials necessary for cable termination shall be provided by the Contractor.
- 9.1.6 The contractor shall ensure that correct phase rotation is maintained throughout.
- 9.1.7 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.
- 9.2 HV Cables
- 9.2.1 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 Depot Maintenance Manager (Electrical). This bond shall be easily removable for testing purposes.
- 9.2.2 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.
- 9.3 LV Cables (and Pilot Cables)
- 9.3.1 All cut ends of cables are to be sealed with suitable tape, or other approved means until they are ready to be terminated.
- 9.3.2 The cables shall terminate in compression type glands, brass or bronze, suitable for PVC SWA ECC cables.
- 9.3.2.1 The glands shall be fitted with neoprene shrouds or corrosion guard to prevent the ingress of moisture and dust at the point of cable entry.
- 10.0 CABLE JOINTS**
- 10.1 General
- 10.1.1 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.
- 10.1.2 Jointing shall not be carried out during inclement weather.
- 10.1.3 The cores of cables shall be jointed number to number or colour to colour.
- 10.1.4 The joints shall not impair the anti-electrolysis characteristics of the cables.
- 10.1.5 The conductor bridging the armouring shall be adequate to carry the prospective earth fault current.
- 10.1.6 A through joint shall only be permitted after every full drum length of cable.
- 10.1.7 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.
- 10.1.8 Transnet Freight Rail reserves the right to be present during jointing operations to familiarise themselves with any special techniques.
- 10.1.9 No joint shall be situated inside a cable pipe.
- 11.0 COVERING, BACKFILLING AND REINSTATEMENT**
- 11.1 Filling of trenches shall not commence before the Depot Maintenance Manager (Electrical) or his authorised representative has inspected and approved the cables and cable joints in situ in the section of trench concerned.

- 11.2 Trenches in railway formations shall be backfilled and reinstated in accordance with Transnet Freight Rail's drawing FG 263.
- 11.3 All other trenches shall be backfilled and reinstated as follows:
- 11.3.1 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.
- 11.3.1.1 Only soil with a thermal resistivity of 1,5 degrees C.m/watt, or lower may be used for this purpose.
- 11.3.1.2 When necessary imported fill shall be arranged by the Contractor and paid for at scheduled rates.
- 11.3.1.3 The backfill material shall be free from rubble/stones or foreign material.
- 11.3.2 HV cables shall, where likely to be mechanically damaged as decided by the Depot Maintenance Manager (Electrical), be protected by concrete slabs (to Drawing CEE PA-0105) to be supplied and laid by the Contractor on top of the sifted soil. These slabs shall be laid close-buffed, 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.
- 11.3.3 Reinforced resin protection trench covers might also be used instead of concrete slabs. These covers shall be made of material which is flame retardant, non toxic and corrosion resistant.
- 11.3.4 The minimum dry densities of backfilling after compaction shall be not less than 1600 kg/cubic metre.
- 11.3.5 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 Depot Maintenance Manager (Electrical). 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.
- 11.3.5.1 Backfilling at pipe entries shall be such as not to stress or damage the cable during compaction from the top.
- 11.3.6 A continuous plastic cable warning tape, to drawing 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.
- 11.4 The back filled trench shall be maintained in a thoroughly safe condition by the contractor for the duration of the contract.
- 11.5 All back filling of road crossings shall be mechanically rammed.
- 11.6 Final surfacing of roads shall be restored by others unless called for under "Scope of Work", Appendix 1.
- 11.7 Concrete cable route markers shall be provided and installed by the contractor in accordance with drawing CEE-PK-14.
- 11.8 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.

12.0 MEASUREMENTS

- 12.1 All measurements for payment purposes shall be made jointly by representatives of the Contractor and Transnet Freight Rail and shall be agreed upon by both parties. The Contractor shall be responsible for obtaining the Depot Maintenance Manager (Electrical)'s signed approval of such measurements.

- 12.2 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.
- 12.3 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".
- 12.4 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.
- 12.5 The classification of different types of ground for measurement purposes shall be as follows:
- 12.5.1 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.
- 12.5.2 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.

13.0 TESTS

- 13.1 The costs of all post-installation tests shall be borne by the Contractor.
- 13.2 The Contractor shall be responsible for remedial work necessary due to damages caused during tests.
- 13.3 Transnet Freight Rail 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.
- 13.4 Test instruments shall be of the accuracy class. Calibration certificates from a recognised testing authority shall be available for inspection and shall not be older than one year.
- 13.5 Time measurements shall be carried out using an approved digital timer.
- 13.6 The final commissioning site tests will be carried out by Transnet Freight Rail.
- 13.6.1 A suitably qualified staff member of the Contractor shall assist Transnet Freight Rail during the tests and shall carry out any remedial work where necessary.
- 13.7 The contractor shall notify the Depot Maintenance Manager (Electrical) in writing 4 weeks before the commissioning date and shall have carried out the following site tests before such date:
- 13.7.1 Prove the continuity and insulation resistance of the multicore pilot cables.
- 13.7.2 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.
- 13.7.3 The following voltages withstand tests on each completed cable run:
- 13.7.3.1 Paper insulated cables:
- (i) Rating up to 12,7/22 kV shall be tested in accordance to SANS 97.
- (ii) Rating 19/33 kV shall be tested in accordance to BS 6480.
- The extruded PVC impermeable serving shall withstand a test voltage of 10 kV DC between armouring and earth for 1 minute.
- The insulation between armouring and lead sheath shall withstand a test voltage of 4 kV DC for 1 minute.

13.7.3.2 XLPE Insulated Cables:

All cables rated up to 19/33 kV shall be tested in accordance to SANS 1339, and cables rated up to 1,9/3,3 kV shall be tested in accordance to BS 5467.

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.

- 13.7.4 The Contractor shall submit three copies of certified test reports to the Depot Maintenance Manager (Electrical) within three weeks after completion of the tests.

14.0 GUARANTEE

- 14.1 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.
- 14.2 The guarantee period shall commence the day the installation is formally handed over to and accepted by Transnet Freight Rail.
- 14.3 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.
- 14.4 Any defects that may become apparent during the guarantee period shall be rectified to the satisfaction of, and free of cost to Transnet Freight Rail.
- 14.5 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.
- 14.6 Should the Contractor fail to comply with the requirements stipulated above, Transnet Freight Rail shall be entitled to undertake the necessary repair work or effect replacement of defective apparatus or materials, and the Contractor shall reimburse Transnet Freight Rail the total cost of such repair or replacement, including the labour costs incurred in replacing defective material.

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15.0 APPENDIX 1

SCOPE OF WORK

(To be filled by the client)

1.0 Site inspection required (Yes/No).....

Date :

Time :

Client's Signature:

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16.0 APPENDIX 2

SCHEDULE OF REQUIREMENTS

(To be filled by Tenderer)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
1.0	Route surveys		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		/m		
5.0	Concrete slabs supplied and installed		each		
6.0	Plastic cable warning tape supplied and installed		/m		
7.0	150 mm dia. half round concrete pipes supplied and installed		/m		
8.0	150 mm dia. Cement or PVC pipes supplied and installed		/m		
9.0	Cutting of checker Plates		/m cut		
10.0	Backfilling of trenches with soil		/cubic metre		
11.0	Backfilling of trenches with 10:1 soil/cement mix		/cubic metre		
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		

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
16.0	Installation of cables				
16.1	Installed in trenches				
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				
16.2.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
16.2.2	Low Voltage Cables		/m		
	..... Core.....		mm sq		
	..... Core.....		mm sq		
	..... Core.....		mm sq		
	..... Core.....		mm sq		
16.3	Installed in ducts				
16.3.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
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				
17.1.1	High Voltage Cables		/m		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
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				
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		

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ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
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				
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).				

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
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				
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		

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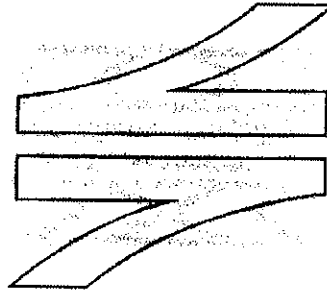
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT RATE	TOTAL
19.0	Cable joints complete (Supply material, terminate and connect up)				
19.1	PVC to PVC		each		
	240 mm sq				
	185 mm sq				
	120 mm sq				
	95 mm sq				
	16 mm sq				
	Other sizes				
19.2	XLPE to XLPE		each		
	240 mm sq				
	185 mm sq				
	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.....

17.0 APPENDIX 3

- SANS 1411 – 1: Materials of insulated electric cables and flexible cords Part 1: Conductors.
- SANS 1411 – 2: Materials of insulated electric cables and flexible cords Part 2: Polyvinyl chloride (PVC).
- SANS 1411 – 3: Materials of insulated electric cables and flexible cords Part 3: Elastomers.
- SANS 1411 – 4: Materials of insulated electric cables and flexible cords Part 4: Cross-linked polyethylene (XLPE).
- SANS 1411 – 5: Materials of insulated electric cables and flexible cords Part 5: Halogen-free, flame-retardant materials.
- SANS 1411 – 6: Materials of insulated electric cables and flexible cords Part 6: Armour.
- SANS 1411 – 7: Materials of insulated electric cables and flexible cords Part 7: Polyethylene (PE).
- SANS 1507 – 1: Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 1: General.
- SANS 1507 – 2: Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 2: Wiring cables.
- SANS 1507 – 3: Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 3: PVC Distribution cables
- SANS 1507 – 4: Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 4: XLPE Distribution cables
- SANS 1507 – 5: Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 5: Halogen-free distribution cables.
- SANS 10198 – 1: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 1: Definitions and statutory requirements.
- SANS 10198 – 2: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 2: Selection of cable type and methods of installation.
- SANS 10198 – 3: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 3: Earthing systems - General provisions.
- SANS 10198 – 4: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 4: Current ratings.
- SANS 10198 – 5: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 5: Determination of thermal and electrical resistivity of soil.
- SANS 10198 – 6: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 6: Transportation and storage.
- SANS 10198 – 7: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 7: Safety precautions.



SPOORNET

A division of Transnet limited

**TECHNICAL
RAILWAY ENGINEERING
SPECIFICATION**

**HOT DIP GALVANISING AND PAINTING OF
ELECTRIFICATION STEELWORK**

Circulation restricted to:

Technical

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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: _____

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Appendix 1

SCHEDULE OF REQUIREMENTS, QUANTITIES AND PRICES

1.0

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END

FOR SPOORNET:

GRADE:
