
Part C1: Agreement and Contract Data

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Contract Data

The Employer is:

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

The work is: THE DESIGN, SUPPLY, INSTALL, TEST AND COMMISSION OF 6.6KV SWITCHGEAR AT WITBANK DISTRIBUTION SUBSTATION UNDER THE CONTROL OF THE DEPOT ENGINEER, WITBANK.

The sites are: WITBANK DISTRIBUTION 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: 52 weeks week after completion of project

The defect correction period is: immediately after defects date.

The delay damages are: R5, 000.00 per day (penalties)

The assessment day is the: 13th (thirteenth) of each month

The retention is : 10(ten)% of the total value of the contract (Excl VAT)

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 **2% (two percent)** 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 **R1,000,000.00 (one 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

This project specification covers Transnet Freight Rail's requirements for the design; supply, install; test and commission 6.6kV switchgear at Witbank distribution substations in Witbank depot.

- 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.
- 1.5 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.
- 1.6 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.
- 1.7 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 R5,000.00 per day will be levied for late completion.***
- 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'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.
- 1.11 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's Deputy or Supervisor 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's Deputy or Supervisor 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 Contractor shall ensure that equipment to be supplied are suitable installation for coastal areas. All porcelain equipment should be coated with insulating coating before commissioning.
- 1.18 Transnet Freight Rail reserves the right to award the contract based on delivery period due to the urgency of this substation.
- 1.19 Transnet Freight Rail reserves the right to award the contract in portions pertaining different work execution specialisation.

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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 R.....
(Enter the total of the prices in numbers from the price list, inclusive of VAT)

State amount in words (Incl. of VAT):

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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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 |
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.

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**Pricing Data
Price List**

| Item | Description | Unit | Qty | Rate | Amount |
|----------|---|------|-----|------|--------|
| A | Witbank 6.6kV Distribution sub-station | | | | |
| 1 | Dismantle and remove old equipment from site on to Witbank depot. | sum | 1 | | |
| 2 | Supply 3 phase, 6.6kV switchgear in accordance with specification BBB 4182 VER.3 complete with protection relays. | ea | 4 | | |
| 3 | Supply 6.6kV cable incomer and three feeders | sum | 1 | | |
| 4 | Supply battery charger 110V with batteries. | ea | 1 | | |
| 5 | Supply control panel | ea | 1 | | |
| 6 | Supply control cables to connect new switchgear to tele-control equipment. | sum | 1 | | |
| 7 | Supply termination kits per cable installation. | sum | 1 | | |
| 8 | Modify checker plates to correct switchgear size and re-paint checker plated black. | sum | 1 | | |
| 9 | Supply grey paint for substation floor. | sum | 1 | | |
| 10 | Supply substation earthing in accordance with Drawing No. CEE-PA-23. | sum | 1 | | |
| 11 | Installation, testing and Commissioning. | sum | 1 | | |
| 12 | Catalogues, manuals and drawings. | set | 3 | | |
| 13 | P's and G's (Site establishment, civil work, etc.). | sum | 1 | | |
| A | Sub Total (Excl. VAT)= | | | | |
| B | VAT @14% = | | | | |
| C | Gross Total (Incl. VAT) = | | | | |

Part C3: Scope of Work

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Contract Data

Works Information

3.0 DESCRIPTION OF WORKS

3.1 EMPLOYER'S OBJECTIVE

3.1.1 The main objective of Transnet Freight Rail is to replace old 6.6 kV switchgears with new 6.6kV switchgears at Witbank distribution substation at Witbank depot.

3.1.2 The switchgear panels must be withdraw-able vacuum type.

3.2 EXTENT OF THE WORKS

The Contractor shall perform the following:

3.2.1 WITBANK 6.6 KV SUBSTATION

- *Disconnect, dismantle and remove the existing old 6.6kV switchgears. The Contractor shall then transport the switchgears to Witbank depot.*
- *The Contractor shall supply and install 3 phase, 6.6kV switchgear in accordance with specification BBB 4182 complete with protection relays. It required that switchgear to be supplied to be completely insulated from the ground and other existing steel work inside the Traction Substation.*
- *The Contractor shall supply control cables to connect new switchgear to tele-control equipment.*
- *Supply termination kits per cable installation. All cabling and wiring shall be in accordance with specification BBC 0198 version 1 and SANS 10142-1.*
- *Contractor shall re-use existing trenches and modify checker plates to correct switchgear size and re-paint checker plated black.*
- *Supply paint and paint substation floor grey and substation wall white.*
- *Redo substation earthing in accordance with Drawing No. CEE-PA-23. 95 mm² earthing cables shall be used instead of a 10 mm² as indicated in the drawing.*
- *Contractor shall make provision for temporal power supply for his/her tools and equipment i.e. standby generator.*
- *Contractor shall supply install 6.6kv cables to and from structures and switchgears.*

3.2.1.1 Newly installed switchgears has to be installed with their own 110V battery charger.

3.2.2 MUNICIPAL INCOMER T03

- 3.2.2.1 *Frame leakage protection.*
- 3.2.2.2 *Earth fault protection (IDMT).*
- 3.2.2.3 *Over current protection (IDMT) with high-set element for define time operation.*
- 3.2.2.4 *Sensitive earth fault.*

3.2.3 LOCO T05

- 3.2.3.1 *Buchholz protection if required.*
- 3.2.3.2 *Earth fault protection (IDMT) with high-set element for define time operation.*
- 3.2.3.3 *Over current protection (IDMT) with high-set element for define time operation.*
- 3.2.3.4 *Oil over-temperature protection if required.*
- 3.2.3.5 *Winding temperature protection if required.*

3.2.4 LOCAL T04

- 3.2.4.1 *Buchholz protection if required.*
- 3.2.4.2 *Earth fault protection (IDMT) with high-set element for define time operation.*
- 3.2.4.3 *Over current protection (IDMT) with high-set element for define time operation.*
- 3.2.4.4 *Oil over-temperature protection if required.*
- 3.2.4.5 *Winding temperature protection if required.*

3.2.5 STATION T01

- 3.2.5.1 *Buchholz protection if required.*
- 3.2.5.2 *Earth fault protection (IDMT) with high-set element for define time operation.*
- 3.2.5.3 *Over current protection (IDMT) with high-set element for define time operation.*
- 3.2.5.4 *Oil over-temperature protection if required.*
- 3.2.5.5 *Winding temperature protection if required.*

3.2.6 Current and Voltage Transformers

- 3.2.6.1 *The current and Voltage transformers shall be in compliance with Clauses 14.0 and 15.0 of the Specification no. BBB 4182 Version 2 and their rating / ratios shall be discussed at the site meeting and recorded on the minutes of that meeting.*
- 3.2.6.2 *These CT ratio's shall be recorded from existing old equipment at the distribution substations. The Contractor shall be responsible to verify that CT ratio's and other ratings are suitable for the protection requirements at the substation.*
- 3.2.6.3 *The Contractor shall supply its own security for the duration of the contract.*

4.0 STEELWORK

- 4.1 The design, supply and installation of all steel structures for the support of equipment shall be the responsibility of the Contractor. This shall be in accordance with Transnet Freight Rail specification CEE.0183.2002.
- 4.2 The manufacture of any steelwork shall not take place prior to the approval of the design drawings by the Supervisor/ Electrical Officer.
- 4.3 Transnet Freight Rail shall inspect the steelwork at the manufacturers works prior to dispatch.
- 4.4 All fasteners (nuts & bolts) shall be secured using flat and spring washers where necessary.
- 4.5 All steelwork shall be galvanized in accordance with SANS 121 and, where required painted in accordance with specification CEE 045 of 2002/1.

5.0 INSTALLATION

- 5.1 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.
- 5.2 All fasteners on steelwork, components and electrical connections (nuts and bolts) shall be secured using flat as well as lock washers.
- 5.3 Contractor shall re-use multi core cable and re-connect the tele-control that is currently available in the substation. The substation shall not be switched on unless the tele-control is fully operational.

6.0 INTERCONNECTION OF EQUIPMENT

- 6.1 High conductive silicon grease shall be liberally applied to all the connections.
- 6.2 All dissimilar metal connections (Cu to Al) shall be made using bi-metallic clamps that are specifically designed and manufactured to make that particular connection (ad hoc fabricated clamps are not acceptable).

7.0 DISPOSAL AND TREATMENT OF OIL AND OIL FILLED EQUIPMENT

- 7.1 The collection, handling and disposal of oil from the OCBs and VTs from the substation shall be done in a safe and environmentally sound manner.
- 7.2 Unless any equipment to be replaced containing oil is clearly certified PC free, the Contractor shall test or make arrangements for the testing of the equipment oil for Polychlorinated Biphenyls (PCBs) before replacing the equipment and submit the results to Transnet Freight Rail.
- 7.3 This will be done by first conducting preliminary screening chlorine tests and where the levels of chlorine presence are above 50ppm, further detailed PCB tests and analyses shall be conducted.
- 7.4 The units with levels of contamination less than 20ppm Chlorine shall be disposed of following the normal disposal procedure.

- 7.5 Any units with residual PCB pollution, or oils contaminated to a level greater than 50ppm shall be treated as PCB ITEMS.
- 7.6 Equipment and oil with a PCB content of between 20 and 49 PPM is classified as 'mildly contaminated' and shall be properly identified, i.e. marked with yellow stickers, and disposed of as contaminated.
- 7.7 In case of PCB items being identified, handling and disposal of the equipment shall be done in accordance to "A Manual and Guidelines for Management of Polychlorinated Biphenyls in Transnet Freight Rail".
- 7.8 Approved degreasing agents on concrete surfaces shall be used, if required.
- 7.9 The costs for the screening chlorine test and provisional analyses of oils and soil for PCB's, the tests and analysis of soil to determine the levels where spillages has occurred, must be furnished by the tenderers.
- 7.10 The Tenderer shall provide a provisional method statement and cost for the legal disposal of PCB items, such methodology and costing becoming applicable only in the event of PCB items requiring disposal, as specified, being required.
- 7.11 The old equipment that is not contaminated shall be transported by the Contractor to Transnet Freight Rail's Witbank Electrical Depot and scrapped by Transnet Freight Rail following normal Procedures.
- 7.12 The disposal of any PCB items shall be by thermal destruction method; encapsulation method is not permitted.

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:
- *Test for the functionality of all electrical circuitry.*
 - *Trip tests on relays.*
 - *Test on equipment as per manufacturer's instructions.*

- *Insulation tests.*

- 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 14 working days after commissioning.
- 10.3 The guarantee period for these standby plants shall expire after a period of 12 months commencing on the date of completion of the contract or the date the standby plant was handed over to Transnet Freight Rail.
- 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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Works Information

12. SPECIFICATIONS

Unless otherwise specified all material and equipment supplied shall comply with the current edition of the relevant SANS, BS, IEC or Transnet Freight Rail publication where applicable.

The following standard specifications will be applicable to this contract.

12.1 South African National Standards:

- 12.1.1 SANS 1091 National colour standard.
- 12.1.2 SANS 763 Hot dip galvanised zinc coating.
- 12.1.3 SANS 121 Hot Dip Galvanised Coating for Fabricated Iron or Steel Article.
- 12.1.4 SANS 10142 Wiring Code.

12.2 British Standards

- 12.2.1 BS 37: Electricity meters
- 12.2.2 BS 3938: Specification for current transformers.

12.3 IEC Standards

- 12.3.1 IEC 60051: Direct acting analogue electrical measuring instruments.
- 12.3.2 IEC 60243: Electrical strength of insulating material.

12.4 South African National Standards

- 12.4.1 SANS 109: National colour standards for paint.
- 12.4.2 SANS 1019: Standard voltages, currents and insulating levels for electrical supply.
- 12.4.3 SANS 62271-100: High voltage switchgear and control gear.
- 12.4.4 SANS 60044-1: Instrument transformer - current transformers.
- 12.4.5 SANS 60060: High voltage test techniques.
- 12.4.6 SANS 60298: A.C. metal enclosed switchgear and control gear for rated voltages above 1 kV and up to 52 kV.
- 12.4.7 SANS 60947: Low voltage switchgear and control gear control circuit devices and switch elements.

12.5 Transnet Freight Rail

- 12.5.1 BBB 4182 Ver-1 Indoor, high voltage, alternating current switchgear and control gear.
- 12.5.2 BBC 0198 Ver-1: Specifications for requirements for the supply of electrical cables.
- 12.5.3 BBC 0198 Ver-1: Specifications for the supply of cables
- 12.5.4 CEE.0023.90: Specifications for the installation of cables.
- 12.5.5 CEE.045: Painting of steel Components of Electrical Equipments.
- 12.5.6 CEE.0183.2002: Hot dip galvanising and painting of electrification steelwork.
- 12.5.7 CEE.0224.2002: Drawings, catalogues, instruction manuals and spares list for electrical equipment supplied under contract.
- 12.5.8 CEE-PA-13: Drawing for test block.
- 12.5.9 CEE-PA-56: Connection diagram for protection relays to CTs.

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

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

13.0 CONSTRAINTS ON HOW THE CONTRACTOR PROVIDES THE WORKS

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

14.0 IT IS REQUIRED OF THE TENDERER TO SUBMIT THE FOLLOWING INFORMATION FOR EVALUATION PURPOSES. TRANSNET FREIGHT RAIL RESERVES THE RIGHT TO DISQUALIFY TENDERS WITH INCOMPLETE INFORMATION.

- CIDB registration
- VAT registration certificate
- BBBEE status
- Delivery period for service or product.
- Rate of exchange to be specified if applicable.

15.0 REQUIREMENTS FOR THE PROGRAMME

| | |
|-------------------|--|
| Programme of work | : To be submitted by successful Contractor |
| CIDB rating | : 3EEPE and above |
| Format | : Bar chart |
| Information | : How work is going to be executed and commissioned |
| Submission | : Not Applicable |
| Site diary | : Successful Contractor to supply in triplicates carbon copies |

16.0 SERVICES AND OTHER THINGS PROVIDED BY THE EMPLOYER

16.1 Transnet Freight Rail shall have an electrician available for isolation and the erection of barriers to live electrical equipment and issuing of work permits.

16.2 Upon successful completion of the works to the satisfaction of Transnet Freight Rail, Transnet Freight Rail shall perform necessary protection tests and commission the equipment.



TRANSNET
freight rail

A Division of Transnet Limited

**ENGINEERING & TECHNOLOGY
TECHNOLOGY MANAGEMENT**

SPECIFICATION

**INDOOR, MEDIUM VOLTAGE METAL ENCLOSED
SWITCHGEAR AND CONTROL GEAR IN ACCORDANCE
WITH IEC 62271-200**

| | | |
|-------------|---|---------------|
| Author: | Chief Engineering Technician Technology Management | S.P. Rikhotso |
| Approved: | Senior Engineer Technology Management | L.O. Borchard |
| Authorised: | Principal Engineer Technology Management | W.A. Coetzee |
| Date: | | |

[Signature]

[Signature]

[Signature]

31 March 2011

Circulation Restricted To:

- Transnet Freight Rail
- Transnet and Relevant Third Parties
- Unrestricted

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1.0. SCOPE

- 1.1. This specification covers TFR's requirements for the supply of indoor three phase medium voltage metal enclosed switchgear and controlgear.

2.0. STANDARDS AND PUBLICATIONS

The latest version of the following publications and standards are referred herein.

2.1. INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

| | |
|----------------|--|
| IEC 60044-1* | Instrument transformer Part 1: Current Transformer |
| IEC 60044-2* | Instrument transformer Part 2: Inductive voltage transformer |
| IEC 60051 | Direct acting indicating analogue electrical measuring instruments and their accessories. |
| IEC 60243-1 | Electrical strength of insulating materials – Test methods – Part 1 Tests at power frequencies. |
| IEC 60255-5 | Electrical Relays: Part 5: Insulation coordination for measuring relays and protection equipment – Requirements and tests |
| IEC 60282-1* | High-voltage – Current limiting fuses |
| IEC 60529* | Degrees of Protection provided by enclosures (IP code) |
| IEC 60947-5-1* | Low-voltage switchgear and control gear Part 5-1. Control circuit devices and switching elements. Electromechanical control circuit devices. |
| IEC 61000-4 | Electromagnetic compatibility Part 4: Testing and measuring techniques |
| IEC 62053-21 | Electricity metering. Part 21 |
| IEC 62271-100* | High Voltage alternating current (AC) circuit breaker. |
| IEC 62271-102* | Alternating current disconnectors and earthing switches. |
| IEC 62271-105* | Alternating current (AC) switch-fuse combinations. |
| IEC 62271-200* | AC metal enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV. |

2.2. SOUTH AFRICAN STANDARDS (SANS)

| | |
|-----------|--|
| SANS 156 | Moulded-case circuit breaker |
| SANS 1091 | National colour standards for paint. |
| SANS 1274 | Coatings applied by powder for paint. |
| SANS 1507 | Electrical cables with extruded solid dielectric insulation for fixed installations. (300V/550V-1,900V/3,300V) Part 1: General |

2.3. TRANSNET FREIGHT RAIL (TFR)

| | |
|-------------------|--|
| BBD 7524 Version1 | Switching & Lightning Surges protection system for a low voltage equipment installed in substation. |
| BBD 8946 | Testing, setting and operation of a rogowski coil. |
| CEE.0224 | Drawings, catalogues, instruction manuals and spares list for electrical equipment supplied under contracts. |

3.0. APPENDICES

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

- 3.1. Appendix 1: "Schedule of requirements" - to be filled in by Transnet Freight Rail (Client).
 3.2. Appendix 2: "Technical Data Sheet" – to be furnished by tenders.
 3.3. Appendix 3: "Tests conducted on the switchgear"

4.0. TENDERING PROCEDURE

- 4.1. Tenderers shall indicate clause by clause compliance with this specification. This shall take the form of a separate document listings all the specification clause numbers the individual statement of compliance or non-compliance.
- 4.2. The tenderer shall motivate a statement of non-compliance.
- 4.3. Tenderers shall complete Appendix 2. "Technical Data Sheet".
- 4.4. Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 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**5.1. ATMOSPHERIC CONDITIONS**

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

| | |
|----------------------|---|
| Altitude | : 0 to 1,8m 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

The nominal operational conditions are specified in clauses 1.3, 4.1 and 6.0 of Appendix 1.

5.3. MECHANICAL CONDITIONS

The switchgear is installed in close proximity to railway tracks and be subjected to vibration.

6.0. GENERAL REQUIREMENTS OF SWITCHGEAR AND CONTROLGEAR

- 6.1. The switchgear and controlgear shall be designed, manufactured and tested in accordance with IEC 622171-200.
- 6.2. The design of the equipment shall be make provision for the safety of the persons concerned in the normal operation and maintenance of the equipment.
- 6.3. The equipment shall be capable to operate under full load and fault conditions.
- 6.4. It shall not be possible to manually operate the circuit breaker unless it is in the "service" or "earthed" position.
- 6.5. The switchgear and controlgear shall be of the following:
- Withdrawable vacuum interrupted switchgear and controlgear.
 - Non-withdrawable SF6 gas insulated vacuum interrupted switchgear and controlgear.

7.0. WITHDRAWABLE VACUUM INTERRUPTED SWITCHGEAR AND CONTROLGEAR

- 7.1. It shall not be possible to rack in the circuit breaker unless the truck is properly located in the correct position.
- 7.2. Position indication shall be provided to mechanically/manually indicate the position of the withdrawable circuit breakers, disconnectors and earthing devices, and fuse combinations, i.e. racked-in, racked-out (isolated), earthed, on/off. The indication shall be readily visible from the front of each panel.

- 7.3. Shutters from free fall design shall be provided to cover the "Busbar" and "Circuit" high-voltage sockets into which the contacts of the circuit breaker engages. These shutters shall automatically cover the sockets with a positive action when the switchgear is withdrawn.
- 7.4. Facilities of independently padlocking each shutter in the closed position shall be provided.
- 7.5. Busbar shutters shall be red (colour A11 in SANS 1091) and shall be clearly marked "Busbars".
The "Circuit"
- 7.6. The withdrawable circuit breaker shall be mounted on a transporting truck device, and fitted with wheels.
- 7.7. Flexible test rigs/cables shall be provided for testing the operation of the circuit breaker when fully withdrawn from the panels.

8.0. NON-WITHDRAWABLE SF6 GAS INSULATED VACUUM INTERRUPTED SWITCHGEAR AND CONTROLGEAR.

- 8.1. Live parts, switching functions and vacuum interrupters shall be housed in a completely sealed stainless steel tank.
- 8.2. The steel tanks shall be fitted with gas pressure densimeters provided with alarm contacts for low gas conditions. Low SF6 gas pressure for gas insulated vacuum interrupted switchgear shall trip the switchgear.
- 8.3. Position indication shall be provided to mechanically/manually indicate the position of the non-withdrawable circuit breakers, disconnectors and earthing switches and fuse combinations, i.e. on/off and earthed (isolated). The indication shall be readily visible from the front of each panel.
- 8.4. The sealed stainless tank, housing the live high voltage switching equipment shall be safe to touch.
- 8.5. All components doors giving direct access to high voltage equipment shall be mechanically and electrically interlocked so that the doors cannot be opened whilst the equipment is live.
- 8.6. A visible voltage detection system shall be supplied to verify safe isolation from supply during switching and maintenance operations.

9.0. SWITCHING DEVICES -: WITHDRAWABLE AND NON-WITHDRAWABLE

9.1. GENERAL

Switching device shall be ganged triple-pole construction.

- 9.1.1. Motors used for spring charging or other applications shall be protected by thermal overload and low voltage circuit protection.
- 9.1.2. Where motor driven operation is supplied, interlocking shall be provided to prevent three position switch-disconnectors from being switched from the closed position directly to the earthed position.
- 9.1.3. It shall be possible to manually charge the spring-operated mechanism.
- 9.1.4. A mechanical operated device shall indicate whether the spring is charged or free and this shall be visible without opening the operating cubicle doors.
- 9.1.5. The spring release coil shall be suitable for operation from the substation battery supply, which can vary between 80% to 120% of the stated nominal voltage.
- 9.1.6. It shall be possible to control the spring close/open mechanism from local/remote source depending on the position of the "local/remote" selector switch.
- 9.1.7. Tripping shall be by means of shunt trip coils.
- 9.1.8. A minimum of two normally open normally closed auxiliary contacts shall be provided on each switching device. The spare contacts shall be wired to a terminal strip in the panel. For withdrawable switchgear and controlgear auxiliary plugs and sockets shall be used.
- 9.1.9. Each individual switching device panel shall be fitted with "close" and "open" controls.
- 9.1.10. Where "close" and "open" pushbuttons protrude to the outside of the panel they shall be shrouded.

9.2. CIRCUIT BREAKER

- 9.2.1. The circuit breaker shall be designed, manufactured and tested in accordance with IEC 62271-100.
- 9.2.2. Only Vacuum interrupters shall be used.
- 9.2.3. Circuit breakers shall be equipped with trip-free closing mechanisms. An electrical manual closing mechanism shall be provided for maintenance purposes.
- 9.2.4. Prestriking and chopping current shall be kept to a minimum. The tenderer shall give full details regarding these characteristics at the time of tendering.
- 9.2.5. The first pole clear factor shall be 1.5.
- 9.2.6. The making time shall not be greater than 100 milliseconds.
- 9.2.7. The breaking time shall not be greater than 40 milliseconds.
- 9.2.8. If a direct means of indicating contact wear and the necessity for replacement is not provided in withdrawable switchgear, a concise description of how this can be determined shall be provided on a label permanently fixed to the switchgear or switch panel.
- 9.2.9. Where remote pendant control system for the opening and closing of the circuit breaker is required, the design of the system shall be in conjunction with TFR staff.

9.3. FUSE-SWITCH COMBINATIONS

- 9.3.1. Fuse-switch combinations shall be designed, manufactured and tested in accordance with IEC 602271-105.
- 9.3.2. The switches shall be of the load break-fault make type.
- 9.3.3. Undervoltage releases shall not be fitted.
- 9.3.4. Fuse-switch combinations shall be fitted with striker pins for automatic tripping purposes.
- 9.3.5. High Rupturing Capacity (HRC) fuses used shall be in accordance with IEC 60282-1.

9.4. DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES

- 9.4.1. Disconnectors and earthing switches shall be designed, manufactured and tested in accordance with IEC 602271-102.
- 9.4.2. Earthing switches shall be of the fault make type.
- 9.4.3. The operation mechanism shall be positioned on the front of the panel and lockable in all switching positions.
- 9.4.4. The operation of the disconnectors shall be manually operated.
- 9.4.5. Reliable mechanical indication of these positions shall be visible from the front of the panel.
- 9.4.6. A notice with the following inscription shall be provided adjacent to the operating mechanism:-
"DO NOT OPERATE UNDER LOAD CONDITION"

10.0. PROTECTION SYSTEM

- 10.1. The protection relays shall be designed, manufactured and tested in accordance with IEC 60255-5.
- 10.2. The contractor shall be responsible for the design, supply and installation of the protection system. In the event of any discrepancies or disputes concerning the protection, Transnet freight Rail (TFR) reserves the right to final decision. TRF will provide the settings for the protection system.
- 10.3. The protection system shall be submitted to Transnet Freight Rail for approval.
- 10.4. Protection relays shall be supplied as specified in Appendix 1. (Protection schedule).
- 10.5. The protection relays shall be flush mounted and shall be contained in a dust-proof metal case. The degree of protection of the relay enclosure shall be IP 34 in accordance with IEC 60529.
- 10.6. The protection relays shall be capable of being reset without the necessity for opening the case.
- 10.7. It shall not be possible to operate any relay by hand to trip without opening the case.

- 10.8. The protection relays shall unless otherwise approved be provided with double contacts independent of each other, for controlling duplicate tripping circuits if necessary.
- 10.9. High speed tripping relays shall be self-latching and unless otherwise specified, the coil circuit shall be broken by self-contained contacts.
- 10.10. Relays used for master tripping shall be of the electromechanical type which can only be reset manually.
- 10.11. Protection relays used shall be continuously rated for the rated current setting.
- 10.12. The protection relays shall have reset flag indication on each element, save for fuse switch combination protective systems.
- 10.13. The relays shall have an additional set of normally open contacts for remote indication of the relay operation. These contacts shall be capable of handling 50W in the range of 24 to 110V DC, and shall be wired to a terminal strip at the back of the panel.
- 10.14. The protection settings of the relays shall be menu driven and it shall be possible to manually program the protection relays from the front of the panel and by means of computer equipment if required.
- 10.15. Suitable surge protection shall be provided across the relay supply voltage to protect the electronic relays from incoming voltage transients. The surge protection shall be in accordance with BDD 7524.
- 10.16. Where multi-function, micro-processor protection relays are supplied they shall provide protection, measuring, supervisory and basic control functions.
- 10.17. It shall be possible to configure the relays for applications specific for TRF protection systems.
- 10.18. The relays shall comply with IEC 61000-4 for electrostatic discharge tests.

USER INTERFACE

- 10.19. The user interface and menu shall be in English.
- 10.20. A display shall be provided for input data maintenance information and reporting functions.
- 10.21. Alarm indication shall be provided on the front cover of the relay.

DATA COMMUNICATION

- 10.22. Where specified, data communication shall be possible between the protection relay(s) and remote transmission or supervisory equipment. SCADA (Supervisory and Data Acquisition) equipment.
- 10.23. Transnet Freight Rail shall be consulted for a decision on the compatibility of the protocol offered with the existing telecontrol system in the substations.

PROTECTION RELAYS FUNCTIONALITY

The clauses below cover the requirements for multifunction or individual relays.

- 10.24. The protection relays shall function with one-Ampere or five-Ampere secondary (1:5) windings of current transformer or with Rogowski coil sensor in accordance with BDD 8946.
- 10.25. The relays shall be provided with self monitoring "watchdog" facilities. Automatic tests shall be performed on start up and on a cyclic self monitoring process. Both software and hardware shall be monitored for errors.
- 10.26. Access to the relay settings shall be password protected to prevent casual access to the relay control

11.0. PROTECTION RELAYS

11.1. OVERCURRENT AND EARTH FAULT RELAYS

- 11.1.1. Inverse Definite Minimum Time (I.D.M.T) overcurrent and earth fault relays shall be of the microprocessor protection type having adjustable operating settings for standard, very or extreme inverse current/time characteristics. The relays shall incorporate an adjustable high-set element for definite time operation.
- 11.1.2. Sensitive earth fault relays shall be of the microprocessor protection type and have a current setting of 0.5 percent – 8 percent and an operating time adjustable from 1-99 seconds.

11.2. DIFFERENTIAL PILOT WIRE FEEDER PROTECTION

- 11.2.1. Only those systems, which do not require the use of, screened pilot wires and which utilise current transformers with earthed secondary windings will be considered.
- 11.2.2. The relays incorporate for this system shall:-

- 11.2.2.1. have minimum settings not exceeding 90 percent for phase faults and 40 percent for earth faults where 100 percent corresponds to rated secondary current.
- 11.2.2.2. provide "instantaneous" tripping.
- 11.2.2.3. be compensated for any inherent out-of-balance in the current transformer supplied and shall be automatically biased against tripping on through faults.
- 11.2.3. it shall be the responsibility of the tenderer to ensure that the transformer and relays supplied will match exactly the equipment installed at the other end of the cable to be protected and that the whole protection system will be stable on through-faults but will operate satisfactory on feeder faults.

11.2.4.

11.3. AUTO_RECLOSE RELAY

- 11.3.1. This system shall consist of instantaneous and time lag over-current and earth fault relays and auto-reclosing relay.
- 11.3.2. After a preselected number of times if the fault remains the auto-reclosing relay will lock-out.
- 11.3.3. If the fault clears during the reclosing cycle the auto-reclosing relay shall reset to initial condition.
- 11.3.4. The relay shall be provided with the following functions:-
 - 11.3.4.1. the facility to select the number and sequence of the instantaneous and of the delayed trips which form the reclosing cycle, up to at least 4;
 - 11.3.4.2. adjustable setting to set the duration of the time interval between the tripping and reclosing in the range 0-30 seconds,
 - 11.3.4.3. adjustable setting to set the definite minimum time of the delayed tripping between 0-10 seconds.
- 11.3.5. The auto-reclosing system shall be provided with a non resettable cumulative operation counter.
- 11.3.6. The auto-reclosing system shall be inhibited in the event of a sensitive earth fault operation.

11.4. BUSBAR FRAME LEAKAGE PROTECTION

- 11.4.1. Instantaneous earth fault protection for the complete busbar panel.
- 11.4.2. The system shall consist of an instantaneous relay with adjustable current setting from 0 to 100 percent where 100 percent corresponds to the secondary rating of the current transformer associated with the relay.
- 11.4.3. A master trip relay shall be incorporated in circuitry so that when energised by the operation of the frame leakage relay it shall trip all the switching devices and inhibit them from been closed form remote until the manual resetting of the master trip relay.
- 11.4.4. The master trip relay shall be a mechanical latched relay with flags and manual reset.

BUSBAR ZONED FRAME LEAKAGE PROTECTION

- 11.4.5. Instantaneous earth fault protection to isolate only the faulty section of a sectionalised busbar panel.
- 11.4.6. This system shall consist of individual zone relays, which shall trip all switching devices in their respective zones to isolate the fault from all sources of supply.
- 11.4.7. Busbar zoned frame leakage protection master trip shall be in terms of clauses 11.4.3 and 11.4.4 above.
- 11.4.8. The bus-section switching device shall be a separate zone.
- 11.4.9. Insulating material between zones and earth shall be high grade non-deteriorating and non-hygroscopic, at least 2mm thick cut to size and ready for installation.
- 11.4.10. The insulating material shall have an electric strength of not less than 4 kV when tested in accordance with IEC 60243-1 for 1 minute.
- 11.4.11. The insulating material required for the installation of the switchgear, shall be supplied with the switchgear panels.

11.5. TRANSFORMER PROTECTION

(3 phase, 2 winding power transformer)

11.5.1. OVER-CURRENT AD EARTH-FAULT PROTECTION

- 11.5.1.1. The relay shall consist of the following elements:-

- two extremely inverse definite minimum time lag over-current elements,
- two high set instantaneous over-current elements with low transient over each characteristic,
- one extremely inverse definite minimum time lag earth fault element.

11.5.2. RESTRICTED EARTH FAULT PROTECTION

11.5.2.1. The relay shall:-

- be of the high impedance instantaneous type,
- be fitted with low pass filter or be tuned to 50 Hz,
- stability on through fault shall be maintained up to the fault rating of the switchgear,
- sensitivity shall be equal to the rated current of the current transformer.

11.5.2.2. The successful tenderer shall supply the current transformer for installation in the neutral connection of the power transformer.

11.5.2.3. The insulation rating of the neutral current transformer shall be of withstanding the power frequency withstand test specified in IEC 60044-1 for electrical equipment with a rated insulation level for the highest voltage of 12kV.

11.5.2.4. The tenderer shall advise the maximum lead burden.

11.5.2.5. Should the current transformer be installed by others the Contractor shall be responsible for the correct operation of the restricted earth fault protection system.

11.5.3. BIASED DIFFERENTIAL PROTECTION

11.5.3.1. The relay shall:-

- have a high speed characteristic,
- be biased to provide stability during through faults,
- not be operated by normal magnetising inrush current.

11.5.3.2. Current transformer for the higher voltage winding of the power transformer will be installed by others but the tenderer shall advise the maximum lead burden.

11.5.4. OVER TEMPERATURE, GAS DETECTION AND OVERPRESSURE PROTECTION

11.5.4.1. Circuit breakers controlling transformers shall be provided with the instantaneous trip auxiliary relays with mechanical flags for indication purposes.

11.5.4.2. The relays for oil /winding temperature shall trip and inhibit the reclosing of the circuit breaker until the oil or winding temperature of the transformer has cooled down sufficiently for the relay to reset by itself.

11.5.4.3. The relays for the transformer Bucholz shall trip and inhibits the reclosing of the circuit breaker until Bucholz relay has been reset manually.

11.5.5. TANK - EARTH PROTECTION

11.5.5.1. The circuit breaker panel shall be provided with an instantaneous type relay.

11.5.5.2. The current transformer associated with the above relay for installation between the transformer tank and earth shall be supplied loose to Transnet Freight Rail when called for in APPENDIX 1.

12.0. INDICATING INSTRUMENTS

12.1. AI, indicating instruments shall be of the analogue type and shall comply with the requirements of IEC 60051.

12.2. All indicating instruments shall:-

- be flush-mounted and dustproof. The degree of protection shall be IP 34 in accordance with IEC 60529,
- have a minimum a scale length of not less than 85mm,

- have a minimum accuracy class of 2.5,
 - be marked with the ratios of the associated current and/or voltage transformers.
- 12.3. The ammeter full-scale deflection shall be the first standard value above the normal primary current rating of the associated current transformers.
- 12.4. Voltmeter full-scale deflection shall indicate nominal voltage at approximately 75 percent of the scale length and shall be marked with a red line.
- 12.5. Maximum demand ammeters shall be of the 15-minute thermal type and shall be integrated with the marking ammeters.

13.0. ENERGY METERS

- 13.1. Energy meters shall comply with the requirements specified in IEC62053-21.
- 13.2. Suitable surge protection shall be provided across the low voltage supplies for the energy meters in accordance with BBD7524 version 1.

14.0. CURRENT TRANSFORMERS

- 14.1. Current transformers shall be designed, manufactured in accordance with IEC 60044-1.
- 14.2. The current transformers shall have the following accuracies:-
- Indicating instruments : Class 3
 - Metering : Class 0.5
 - Protective systems : Class 10P
- 14.3. Ring type current transformers shall have separate insulation between live conductors of the main circuit and inner surface of the current transformers.

15.0. VOLTAGE TRANSFORMER

- 15.1. All voltage transformers shall be designed, manufactured and tested in accordance with IEC 60044-2.
- 15.2. Voltage transformer secondaries shall have the following minimum accuracy:
- Metering : Class 0.5
 - Indicating Instrument : Class 3
 - Protective systems : Class 6P
- 15.3. The secondary winding of the voltage transformer shall be provided with fuses.
- 15.4. Phase or neutral earthing of the secondary winding through a removable link shall be provided. No fuses or miniature circuit breaker shall be fitted in this connection to earth.
- 15.5. The burden shall be suitable for the connected load but shall not be less than 50VA per phase.

16.0. REMOTE CONTROL OF ELECTRICAL SWITCHGEAR

- 16.1. Remote control of electrical switchgear shall be equipped with circuits and wired up for the remote open and close operation and indication from the "Centralised Electrical Control Office".
- 16.2. The circuits shall include the following:-
- A minimum of one set of normally open (N/O) and normally closed (N/C) auxiliary contacts to indicate the "open" or "closed" condition of the switching device and for the closing and tripping operations.
 - All remote circuits shall be wired to a terminal strip at the back of the panel.
 - A selector switch on the front of the panel to select between "local" and "remote" operation.

17.0. CLOSING AND TRIPPING SUPPLIES

- 17.1. Battery voltage closing and tripping shall be utilised unless otherwise specified.
- 17.2. The battery and battery charging unit shall comply with requirements of Transnet Freight Rail's (TFR) specification No.CEE.0085.
- 17.3. The preferred battery supply voltage for the switchboard is 110V DC unless otherwise specified.
- 17.4. A battery undervoltage relay shall be provided. The relay shall be adjustable between 80% and 100% of the nominal battery supply voltage. Hysteresis adjustment shall be incorporated.
- 17.5. In the event of low voltage or no battery voltage, the battery undervoltage relay shall trip and inhibit the reclosing of all the circuit breakers.

18.0. TEST TERMINAL BLOCKS

- 18.1. Readily accessible, suitably enclosed test terminal blocks as shown on drawing CEE-PA-13 shall be provided on the front panel of each switch unit for the purposes of testing all protective systems.
- 18.2. Test terminal blocks need not be provided for the frame protection systems if the associated current transformers are mounted externally.
- 18.3. The test block shall be wired to the protective relays and associated current transformer as indicated in the typical connection drawing CEE-PA-56.

19.0. CONTROL SWITCHES

- 19.1. All control switches shall be designed, manufactured and tested in accordance with IEC 60947-5-1.
- 19.2. Rotary pistol grip switches or push buttons shall be used on electrically operated switching devices.
- 19.3. The electrical and mechanical endurance of the control switches shall be not less than 100 000 operations.

20.0. MOULDED-CASE CIRCUIT BREAKERS

- 20.1. The moulded-case circuit breaker shall be designed, manufactured and tested in accordance with SANS 156.

21.0. LOW VOLTAGE WIRING

- 21.1. Low voltage wiring shall be a stranded copper conductor type and shall comply with SANS 1507.
- 21.2. Wiring shall be:
- numbered at the terminals using white non-split, PVC ferrule type markers with black lettering,
 - terminated by means of compression lugs or soldering on terminal blocks or strips,
 - of minimum size of 1.5mm² for instrument or control circuits and 2.5mm² for current transformer circuits,
 - heat-resistant from heaters to terminals,
 - suitably strapped and enclosed in flexible conduit when looping from panels to doors,
 - continuous without joints.
- 21.3. Current transformer star point on secondary windings shall be earthed in the immediate vicinity of the transformer as well as onto the main circuit earth.

22.0. NAMEPLATES AND LABELS

- 22.1. All nameplates and labels shall be in English and the lettering, shall be minimum height of 6mm.
- 22.2. Each switchgear and controlgear panel shall be fitted with a nameplate in conspicuous position indicating the following:-
- Maker's name

Maker's type number
Maker's serial number
Service voltage
Number of phases
Continuous rating
Rating kA seconds

- 22.3. Identical nameplate as that on all current and voltage transformers shall be mounted in a conspicuous position inside the protection relay compartment. The phase colour with which each current/voltage transformer is associated shall appear beneath each nameplate.
- 22.4. Engraved labels, showing panel designation shall be fitted to the front and rear of the fixed part of each cubicle and associated withdrawable equipment.
- 22.5. All control equipment, relays, terminal strips etc shall clearly marked in accordance with the wiring and schematic drawings.
- 22.6. Voltmeter labels shall state whether busbar or cable voltage is indicated.

23.0. PAINTING AND OTHER PROTECTIVE COATINGS

- 23.1. All equipment shall be power coated in accordance with specification SANS 1274.
- 23.2. The switchboard panels shall be painted light orange colour of B26 in accordance with SANS 1091.

24.0. TESTS

- 24.1. All equipments shall be tested as detailed in Appendix 3.

25.0. INSPECTION

- 25.1. Transnet Freight Rail (TFR) reserves the right to inspect the equipment at any stage during manufacture.

26.0. DRAWINGS AND INSTRUCTIONS

- 26.1. Drawings, instruction manuals and spares lists shall be supplied in accordance with TFR's specification CEE.0224.

27.0. TOOLS AND APPLIANCES

- 27.1. One set of special tools and appliances required for normal operation and maintenance of each installation shall be supplied.

28.0. SPARES

- 28.1. The tenderer shall state whether a complete range of spares is held in stock by their local representatives for subsequent purchase by Transnet Freight Rail, as and when required.
- 28.2. A detailed description of each item including manufacturer's catalogue for maintenance purposes.
- 28.3. The spares list shall be divided into two parts, one covering items likely to be used in a 12-month period and those likely to be used in a 10-year period.

29.0. PACKING

- 29.1. The equipment shall be packed in such a manner that it will be protected during handling and transport. The movement of instruments, meters and relays shall be protected against vibration damage during transit.

30.0. TRAINING

- 30.1. In the event of training or training courses being required the contractor shall submit a training plan for approval by Transnet Freight Rail (TFR).
- 30.2. The cost of training shall be included in the tenderer.

END

“PREVIEW COPY ONLY”

APPENDIX 1

SCHEDULE OF REQUIREMENTS

(To be completed by the Client)

A. SWITCHGEAR AND CONTROLGEAR

- Number of switching devices required
- System voltage nominal voltage
- Number of Phases
- Frequency (Hz)

1.0. NEUTRAL EARTHING

- 1.1. Unearthed
- 1.2. Solidly earthed
- 1.3. Reactance earthed
- 1.4. Resistance earthed

2.0. BATTERY SUPPLY

- 2.1. CLOSING SUPPLY
 - Rated voltage
- 2.2. TRIPPING SUPPLY
 - Rated voltage

3.0. BUSBARS

- 3.1. Rated nominal current
- 3.2. Dimensions:
 - Width
 - Thickness

4.0. BUSBAR EARTHING

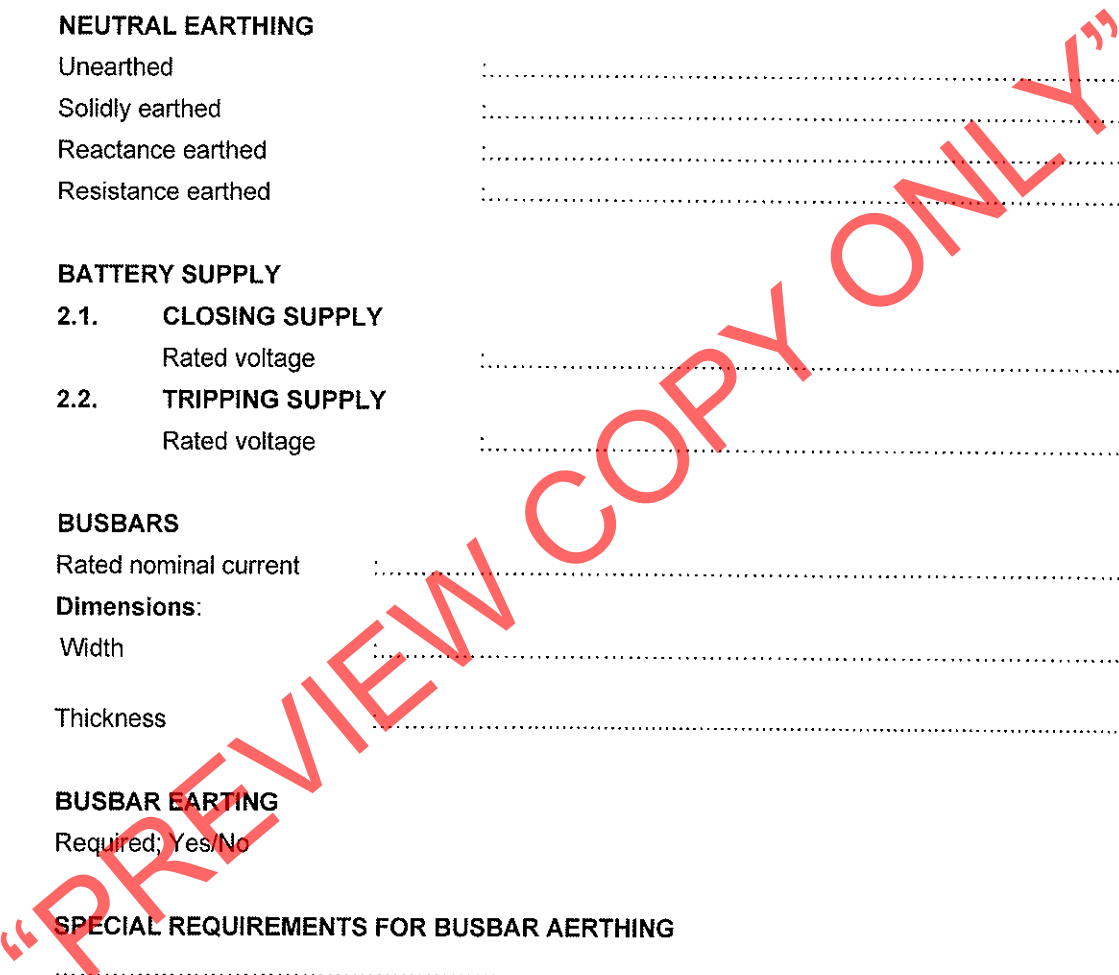
Required; Yes/No

5.0. SPECIAL REQUIREMENTS FOR BUSBAR EARTHING

-
-
-

6.0. REMOTE PENDANT CONTROL SYSTEM

Required: Yes/No



APPENDIX 1

SCHEDULE OF REQUIREMENTS

(To be completed by the Client)

B. SWITCHING DEVICES

- 1.0. **UNIT NUMBER. (Panel No.)** :.....
- Designation/ Drawing Number :.....
- Circuit Breaker :.....
- Fuse Switch combination :.....
- Disconnecter :.....
- Incoming or outgoing :.....
- With-or-non-withdrawable :.....
- Rated Nominal Current :.....
- Rated Nominal circuit breaking current :.....
- Rated short time withstand current for disconnecter :.....
- Type and size of cable :.....
- Voltage Transformer ratio :.....

C. PROTECTION SCHEDULE

- UNIT NUMBER. (Panel No.)** :.....
- 1.0. **OVERCURRENT**
- Number of elements :.....
- IDMT Curve :.....
- IDMT Extremely Inverse :.....
- High Set Instantaneous :.....
- Definite Time :.....
- 2.0. **EARTH FAULT**
- Number of elements :.....
- IDMT Inverse :.....
- IDMT Extremely Inverse :.....
- High Set Instantaneous :.....
- Instantaneous :.....
- Definite Time :.....
- Sensitive Earth Fault :.....
- 3.0. **AUTO RECLOSING** :.....
- 4.0. **DIFFERENTIAL PILOT WIRE** :.....
- 5.0. **FRAME LEAKAGE** :.....
- Zone Number :.....
- 6.0. **TRANSFORMER**
- Restricted Earth Fault :.....
- Differential :.....
- Tank Earth :.....
- Gas Detection :.....
- Over Pressure :.....

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APPENDIX 1

SCHEDULE OF REQUIREMENTS

(To be completed by the Client)

TRANSFORMER (continues)

- Winding Over Temperature :
- Top Oil Temperature :
- 7.0. INTERTRIPPING** :
- 8.0. OTHER** :
- 9.0. SPECIAL REQUIREMENTS**
-
-
-

D. CURRENT TRANSFORMER

- 1.0. UNIT NUMBER (Panel No.)** :
- 1.1. Overcurrent and Earth Fault**

 - Ratio :

- 1.2. Accuracy**

 - Limit Factor :
 - Class :

- 1.3. Differential**

 - Pilot wire :
 - Feeder Ratio :
 - Class X :

- 1.4. FRAME LEAKAGE**

 - Ratio :
 - Class of Accuracy :
 - Accuracy Limit Factor :

- 1.5. Transformer Restricted Earth Fault**

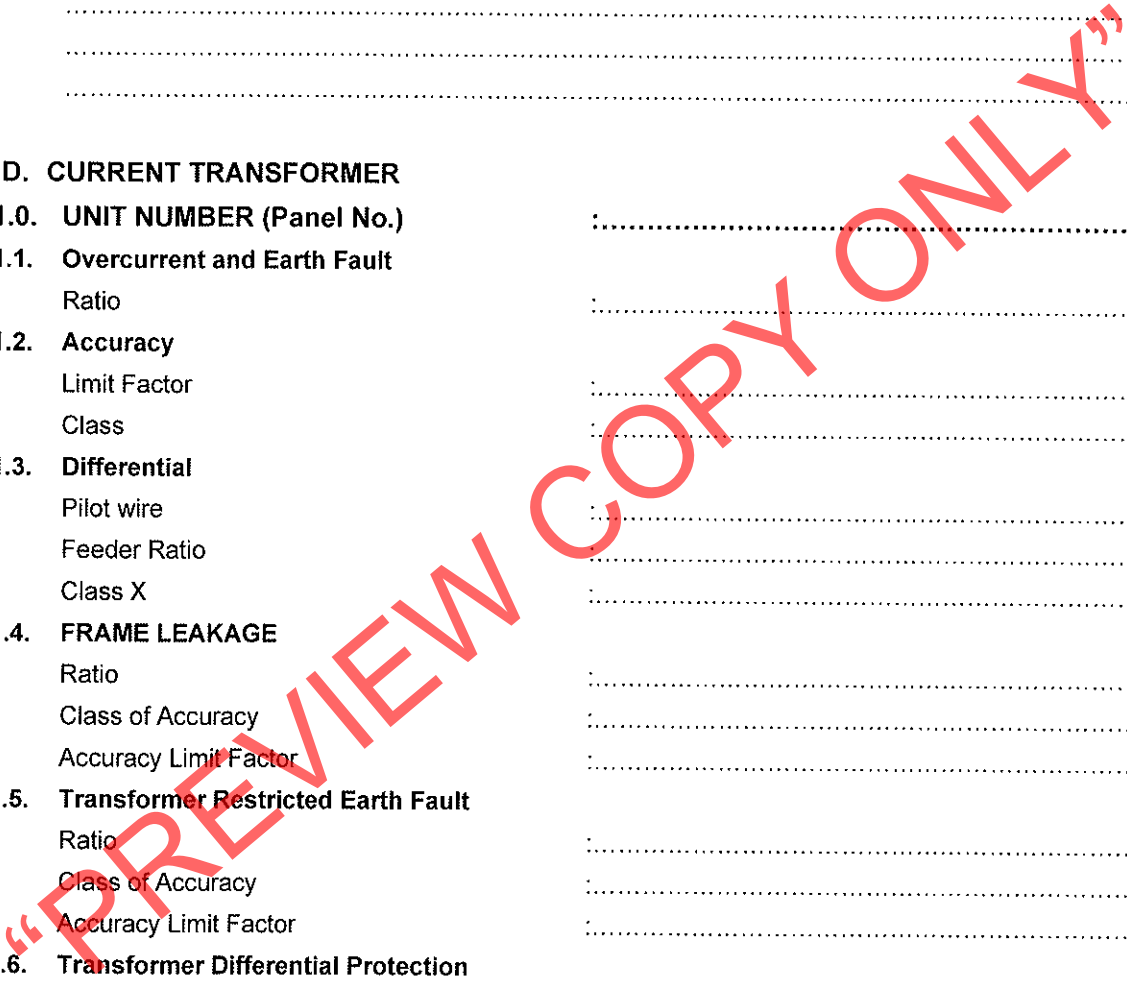
 - Ratio :
 - Class of Accuracy :
 - Accuracy Limit Factor :

- 1.6. Transformer Differential Protection**

 - Higher Voltage Winding Ratio :
 - Lower Voltage Winding Ratio :
 - Class of Accuracy :
 - Accuracy Limit Factor :

- Tank Earth Protection**

 - Ratio :
 - Class of Accuracy :
 - Accuracy limit Factor :



APPENDIX 1

SCHEDULE OF REQUIREMENTS

(To be completed by the Client)

E. INSTRUMENT

- 1.0. **UNIT NUMBER (Panel No.)** :.....
- Voltmeter :.....
- Frequency Meter :.....
- Ammeter :.....
- Ammeter Maximum Demand :.....
- Power Factor Meter :.....
- kWH Meter (if required) :.....
- Current Transformer Ratio :.....

2.0. SPECILA REQUIREMENTS:

.....

.....

.....

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APPENDIX 2

TECHNICAL DATAD SHEET

(To be completed by Tenderers)

1.0. SWITCHGEAR AND CONTROLGEAR

GENERAL

- 1.1. Makers' Name :
- 1.2. Designation Type :
- 1.3. Rated Voltage :
- 1.4. Rated Peak Withstand Current :
- 1.5. Rated Frequency :
- 1.6. Type of Insulating Medium :
- 1.7. Rated Insulation Level :
- 1.7.1. Impulse Withstand Voltage:**
 - a) To Earth and Between Phases :
 - b) Across the isolating distance :
- 1.7.2. One Minute Power Frequency Withstand Voltage:**
 - a) To Earth and Between Phases :
 - b) Across the isolating distance :
- 1.8. Degree of Protection**
 - a) For Covers :
 - b) For Partitions :
- 1.9. Method of pressure relief :
- 1.10. Type Test Certificate No, and Name of Testing Authority:
 :

2.0. SWITCHING DEVICES

CIRCUIT BREAKER

- 2.1. Interrupting Medium :
- 2.2. Rated Frequency :
- 2.3. Rated Normal Current :
- 2.4. Rated Short Circuit Breaking Current**
 - a) Root Mean Value (RMS) :
 - b) Percent DC Component :
- 2.5. Rated Making Current :
- 2.6. Rated Duration of Short Circuit :
- 2.7. Rated Operating Sequence :
- 2.8. Operating Mechanism**
 - a) Type of Closing Mechanism :
 - b) Rated Supply of Closing Mechanism :
 - c) Current required :
 - d) Rated Supply Voltage of Shunt Opening release :
- 2.9. Number and Type of spare auxiliary contacts :

APPENDIX 2

TECHNICAL DATAD SHEET (continues)

(To be completed by Tenderers)

2.10. Type Test Certificate Number and name of Testing Authority:

FUSE SWITCH COMBINATIONS

- 2.11. Rated Voltage :
- 2.12. Rated Insulation Level :
- 2.13. Rated Frequency :
- 2.14. Rated Normal Current :
- 2.15. Rated Short Circuit Breaking Current :
- 2.16. Rated Short Circuit Making Current :
- 2.17. Type Test Certificate Number and Name of Testing Authority:

DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES

- 2.18. Rated Voltage :
 - 2.19. Rated Insulation Level :
 - 2.20. Rated Frequency :
 - 2.21. Rated Normal Current (disconnectors only) :
 - 2.22. Rated Short Time Withstand Current :
 - 2.23. Rated Duration of Short Circuit :
 - 2.24. Rated Peak Withstand Current :
 - 2.25. Rated Short Circuit making Current (earthing switches only):
- 2.26. Type Test Certificate Number and name of Testing Authority:

3.0. BUSBARS

- 3.1. Size of Busbar :
- 3.2. Type of Principal Insulation :
- 3.3. Rated Normal Current :
- 3.4. Rated Short Time Withstand Current :
- 3.5. Rated Short Circuit Duration :

4.0. BUSHINGS

- 4.1. Type Test Certificate Number and name of Testing Authority:

5.0. HIGH VOLTAGE FUSES

- 5.1. Make of Fuse :
- 5.2. Design type Number :
- 5.3. Nominal Current Rating :
- 5.4. Type Test Certificate Number and name of Testing Authority:

APPENDIX 2

TECHNICAL DATAD SHEET (continues)

(To be completed by Tenderers)

6.0. CURRENT TRANSFORMER

- 6.1. Make :
- 6.2. CT Ratio :
- 6.3. VA Rating :
- 6.4. Class of Accuracy :
- 6.5. Short Time Current and Duration :
- 6.6. Connection Type :
- 6.7. Method of Limiting Partial Discharge :
- 6.8. Maximum Partial Discharge :
- 6.9. Type Test Certificate Number and name of Testing Authority:
.....

7.0. VOLTAGE TRANSFORMER

- 7.1. Make :
- 7.2. Class of Accuracy :
- 7.3. Output :
- 7.4. Method of Limiting Partial Discharge :
- 7.5. Maximum Partial Discharge :
- 7.6. Type Test Certificate Number and name of Testing Authority:
.....

8.0. INDICATING INSTRUMENTS

| | Accuracy | Scale length (mm) |
|---|----------|-------------------|
| 8.1. Voltmeter | | |
| 8.2. Ammeter | | |
| 8.3. Ammeter/Maximum Demand 15min | | |
| 8.4. Power Factor Meter | | |
| 8.5. Wattmeter | | |
| 8.6. Frequency Meter | | |
| 8.7. Ammeter Overload Rating and Duration | | |
| 8.8. Type Test Certificate Number and name of Testing Authority: | | |

9.0. ENERGY METERS

- 9.1. Make and Type :
- 9.2. kW Rating :
- 9.3. kWh percent error :

10.0. SPARES

- 10.1. Range of Spares held in local stock:.....
- 10.2. Full description of items not held locally:.....
.....

TEST REQUIREMENTS**1.0. TYPE TESTS**

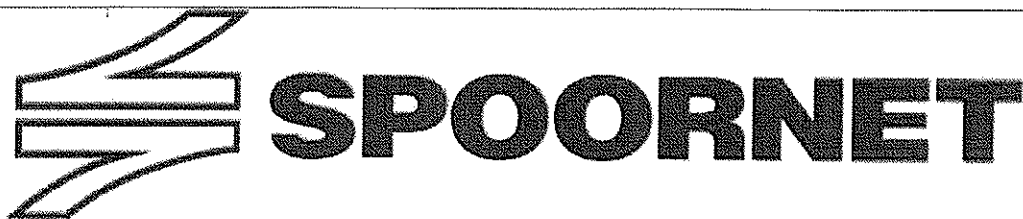
- 1.1. Where type tests are specified they shall be carried out in accordance with the recommended standards or specification referred to this specification.
- 1.2. Type tests certificates shall be submitted with tender documents.

2.0. ROUTINE TESTS

- 2.1. The following additional routine tests shall be carried out on the completed switchgear or control gear at the manufacturers works prior to delivery. Test certificate for these tests shall be supplied.
- 2.2. The ratio, polarity and magnetisation curve of each current transformer after their installation in the board.
- 2.3. The characteristic curves of each protection relay where applicable.
- 2.4. The ratio of each voltage transformer.
- 2.5. The errors of all indicating instruments.

3.0. FUNCTIONAL TESTS

- 3.1. A functional test of the complete board including all protective relays by primary injection. Test certificate for these shall be supplied.
- 3.2. Breakers' opening times.
- 3.3. Four copies of all approved routine test certificates shall be supplied, at the date nor later than the delivery date of the switchgear or control gear.
- 3.4. All routine testing shall be witnessed and inspection carried out by the Quality Assurance Section of Transnet Freight Rail's Technology Management.



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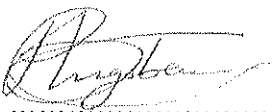
**ENGINEERING AND TECHNOLOGY
TECHNOLOGY MANAGEMENT**

SPECIFICATION

**REQUIREMENTS FOR THE SUPPLY OF ELECTRIC
CABLES**

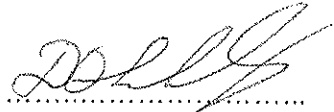
(Appendix to be filled in by client)

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



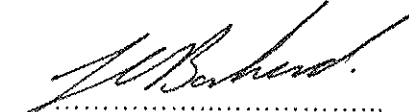
.....

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



.....

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



.....

Date: 5 September 2005

Circulation restricted to:

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1.0 SCOPE

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

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

2.0 STANDARDS

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

2.1 SOUTH AFRICAN NATIONAL STANDARDS

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

3.0 APPENDIX

The following appendix forms an integral part of this specification.

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

4.0 TENDERING PROCEDURE

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

5.0 MEDIUM VOLTAGE CABLES

5.1 IMPREGNATED PAPER INSULATED.

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

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

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

7.0 QUALITY ASSURANCE

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

8.0 INSPECTION AND TESTING

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

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SCHEDULE OF REQUIREMENTS

(To be completed by the client)

1.0 MEDIUM VOLTAGE CABLES

1.1 PAPER IMPREGNATED LEAD SHEATHED (PILC)

1.1.1 Rated Voltage (V):

1.1.2 Number of cores:

1.1.3 Length of cables (m):

1.1.4 Size of conductors (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

**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.

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**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

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**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

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

**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

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

**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

4.0 DRAWINGS AND INSTRUCTIONS

4.1 All drawings submitted by the tenderer shall be in accordance with Spornets 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 Spornet.

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 Spornet.

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

**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

- 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

**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

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

**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

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- 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.

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- 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

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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.

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- 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

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- 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

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- 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

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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

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- 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

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- 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

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- 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. EG 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

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- 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

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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

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- 14.3 Spornet 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 Spornet.

Complies/Does not comply

- 14.6.1 A suitably qualified staff member of the Contractor shall assist Spornet 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:

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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.

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- 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 Spornet.
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 Spornet.
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 Spornet of such defects.
Complies/Does not comply
- 15.6 Should the Contractor fail to comply with the requirements stipulated above, Spornet shall be entitled to undertake the necessary repair work or effect replacement of defective apparatus or materials, and the Contractor shall reimburse Spornet 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)

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APPENDIX 1

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SCOPE OF WORK

1.0 Site inspection required/not required.

Date :

Time :

“PREVIEW COPY ONLY”

**CHIEF ENGINEER (POWER SUPPLIES)
(INFRASTRUCTURE)**

REFERENCE :

**SPOORNET
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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 :

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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 | | |

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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 | | | | |

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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 | | | | |

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**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

APPENDIX 3

PAGE 4 OF 7

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 | | | | |

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**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

APPENDIX 3

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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 | | | | |

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**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

APPENDIX 3

PAGE 6 OF 7

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 | | | | |

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**SPOORNET
(INFRASTRUCTURE) (POWER SUPPLIES)**

SPECIFICATION No. CEE.0023.90

APPENDIX 3

PAGE 7 OF 7

SCHEDULE OF ESTIMATED QUANTITIES AND UNIT RATES

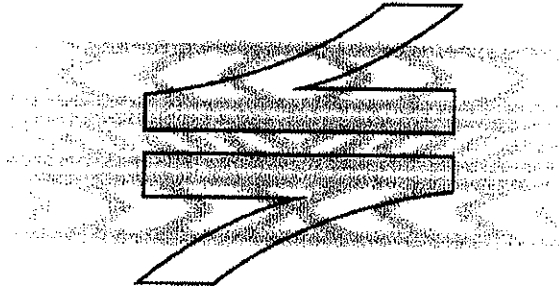
| ITEM NO. | DESCRIPTION | ESTIMATED QUANTITY | UNIT | UNIT RATE | TOTAL |
|----------|--|--------------------|------|-----------|-------|
| 19.2 | XLPE to XLPE 240 mm sq 185 mm sq 120 mm sq 95 mm sq 16 mm sq Other sizes | | each | | |
| 19.3 | PILC to PILC 240 mm sq 185 mm sq 120 mm sq 95 mm sq 16 mm sq Other sizes | | each | | |
| 19.4 | XLPE to PILC 240 mm sq 185 mm sq 120 mm sq 95 mm sq 16 mm sq Other sizes | | each | | |

TENDERER'S SIGNATURE

DATE

CHIEF ENGINEER (ELECTRICAL)
(INFRASTRUCTURE)

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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

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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) |
|---|--|
| <ul style="list-style-type: none"> > Sandblast to a standard of Sa2 to remove mill scale and/or flash rust > Remove dust with <u>clean</u> compressed air (Check air for oil contamination) | <ul style="list-style-type: none"> > 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/m² |

4.1.2 Previously Coated Steelwork

4.1.2.1 COATING START FAILING TO A LEVEL OF RE 2

| | |
|---|--|
| <ul style="list-style-type: none"> ➤ 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 | <ul style="list-style-type: none"> ➤ 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

| | |
|---|---|
| <ul style="list-style-type: none"> ➤ 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. | <ul style="list-style-type: none"> ➤ 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/m² to the entire substrate using a contrasting color. |
|---|---|

4.1.2.3 BITUMEN COATED

| | |
|---|---|
| <ul style="list-style-type: none"> ➤ 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. | <ul style="list-style-type: none"> ➤ 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/m² per coat to the complete substrate using contrasting colors |
|---|---|

4.1.2.4 BADLY RUSTED STEEL WITH PITTING & CRUST FORMATION TO RE 5

| | |
|---|--|
| <ul style="list-style-type: none"> ➤ 1.Degrease thoroughly with OptiDegreaser ➤ 2.Hydro Blast complete substrate using a spinner tip and minimum 250 bar at the nozzle ➤ 3.Shotblast/sandblast complete substrate giving particular attention to bolts nuts rivets and crevices. Sa2 ➤ 4.Dedust | <ul style="list-style-type: none"> ➤ 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/m² |
|---|--|

4.2 GALVANISED STEELWORK

4.2.1 NEW AND WEATHERED GALVANISING WITH A SMOOTH GLOSSY FINISH

| | |
|---|---|
| <ul style="list-style-type: none"> ➤ Degrease thoroughly with OptiDegreaser ➤ Rinse down with copious quantities of potable water | <ul style="list-style-type: none"> ➤ Apply one thin coat of OptiPrime^{AQ28} (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/m² per coat to the complete substrate using contrasting colors |
|---|---|

4.2.2 WEATHERED GALVANISING

4.2.2.1 White rust (zinc oxide)

| | |
|---|---|
| <ul style="list-style-type: none"> ➤ Degrease thoroughly using OptiDegreaser - ensure that all traces of "white rust" are removed ➤ Rinse down with copious quantities of potable water | <ul style="list-style-type: none"> ➤ 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/m² 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)

| | |
|--|---|
| <ul style="list-style-type: none"> ➤ 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 | <ul style="list-style-type: none"> ➤ 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/m² per coat to the complete substrate using a contrasting color |
|--|---|

| NOTES and SPECIAL INSTRUCTIONS: | | |
|--|---|--|
| <p>1 Sand or Grit-blasting</p> <ul style="list-style-type: none"> 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 | <p>2 Degreasing:</p> <ul style="list-style-type: none"> a) Use only OptiDegreaser b) Dilute according to instructions - see data sheet c) Always follow up with hydro-blasting to remove all chemical residues | <p>3 Hydro-blasting:</p> <ul style="list-style-type: none"> 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 ^{AG19} | Noxyde |
|--|--|
| <p>Temperature-Min 5 °C Relative humidity-Max 80% R.H.</p> <ul style="list-style-type: none"> ➤ 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 | <p>Temperature-Min. 8 °C, Max. 55 °C Relative Humidity-Max 80% R.H.</p> <ul style="list-style-type: none"> ➤ Apply by brush, roller or airless spray ➤ For airless spray applications refer to "Tips for airless spraying of Noxyde" |

5.2 DRYING TIME AND OVERCOAT PERIODS

| | |
|--|---|
| <ul style="list-style-type: none"> ➤ 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 | <ul style="list-style-type: none"> ➤ 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 | <ul style="list-style-type: none"> > 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 vicinities 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 <p>NOTE: DFT readings can only be taken after 72 hours</p> |
|-----------|--|

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/m².

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/m² in low to mild corrosive areas, and 500g/m² 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

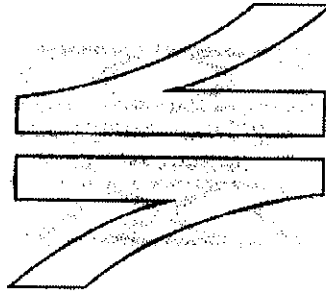
7.1 All specified coatings shall be applied according to the relevant specification and the manufacturer's instructions shall be followed.

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.....



SPOORNET

A division of Transnet limited

**TECHNICAL
RAILWAY ENGINEERING**

SPECIFICATION

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

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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

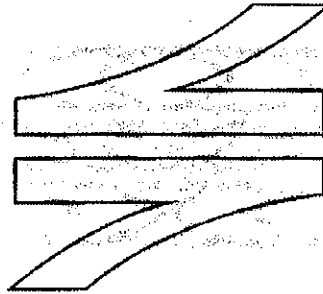
1.0

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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

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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 Spornet'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 subcontractor 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 12.0 and 13.0 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 Spornet 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 12.0.

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

“PREVIEW COPY ONLY”

SCHEDULE OF REQUIREMENTS

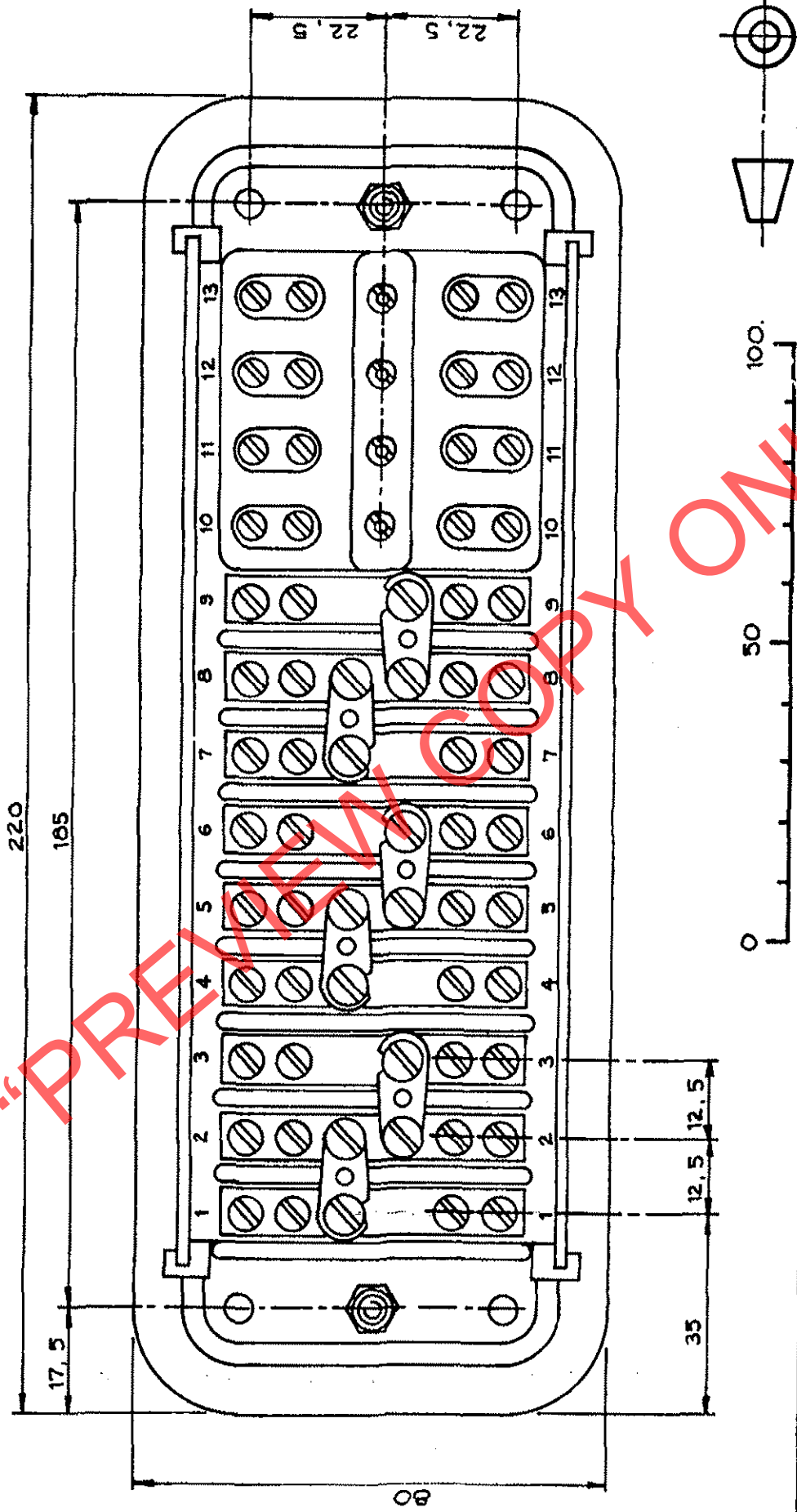
PREVIEW COPY ONLY

FOR SPOORNET: _____

GRADE: _____

END

ORIGINAL FRAME SIZE
OORSPRONKLIKE RAAMGROOTTE 267x180.



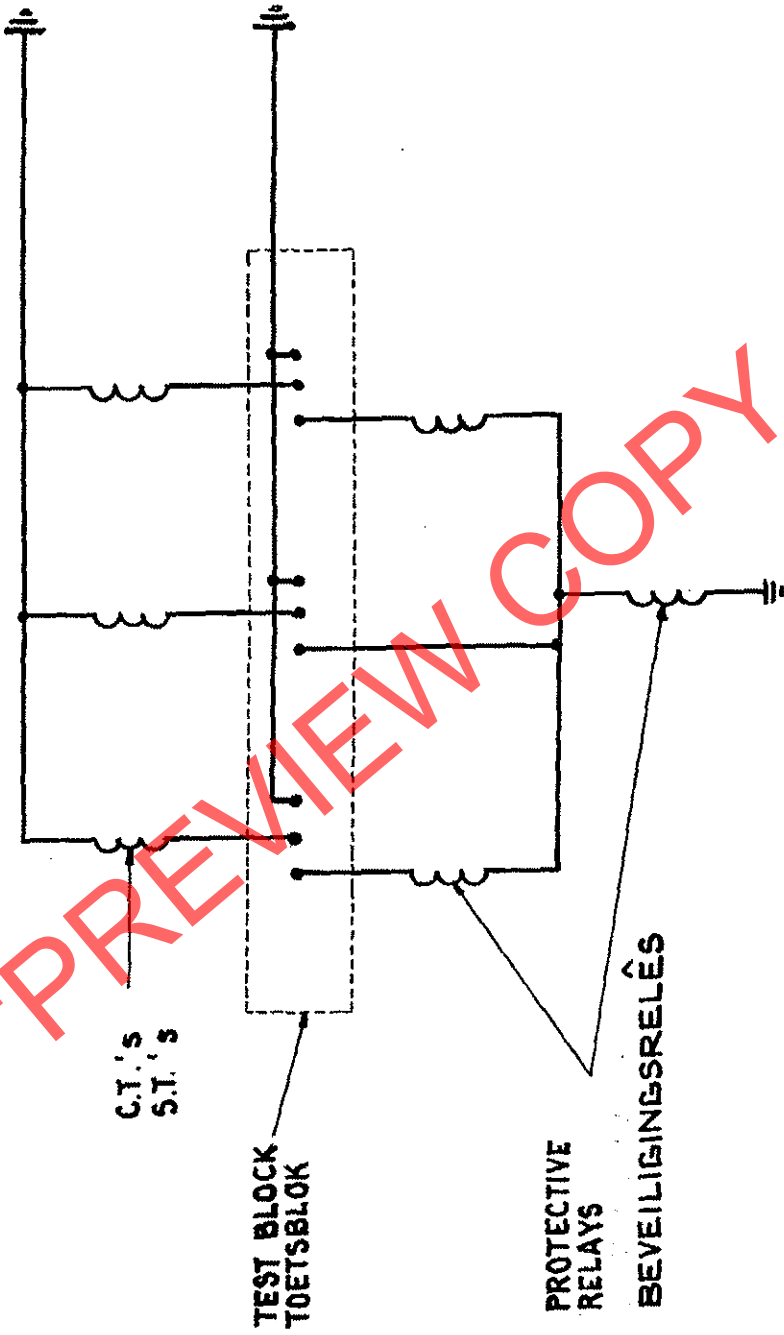
| | |
|--|----------------------------------|
| DRN. J.VANTONDER | GEN. TOLERANCES: LIN ±0,5. |
| TRCO. J.VANTONDER | ALG. TOLERANSIES: ANG/HOEK ±0°30 |
| NGT. K. G. VERW. | DO. REF. Z78/160 |
| CKD. K. G. VERW. | TK. VERW. IR. |
| NGS. K. G. VERW. | DATE. 26/9/68 |
| CHIEF ELECTRICAL ENGINEER | DATUM. 26/9/68 |
| ELEKTROTEGNIESE HOOFINGENIEUR S.A.S. JOHANNESBURG. | <i>R. G. Verwey</i> FOR NS. |

TEST BLOCK FOR HV.
SWITCHGEAR.
TOETS BLOK VIR HS.
SKAKELTOERUSTING.

CLASS. ASSY. DRG.
KLAS. SAMEST. TEK
DRAWING NO. CEE
TEKENING NO. CEE
PA-13.

ORIGINAL FRAME SIZE 390 X 267
 OORSPRONKLIKE RAAMGROOTTE

| AMENDMENTS WYSIGINGS. | | |
|--------------------------|--------------|---------------|
| NO. | NAME NAAM | DATE DATUM |
| | | |



TYPICAL CONNECTION DIAGRAM.
 PROTECTIVE RELAYS TO
 CURRENT TRANSFORMERS.
 TIPIESE VERBINDINGSDIAGRAM.
 BEVEILIGINGSRELÊS NA
 STROOMTRANSFORMATORS.

DRAWING NO. CEE -
 TEKENING
 PA-56.

DIMENSIONS : MILLIMETRES DRG. N.T.S.
 AFMETINGS : MILLIMETER TEK. N.V.S.

DRN. L. BADENHORST GEN. TOLERANCES : LIN. ±0.5.
 GET. L. BADENHORST ALG. TOLERANSIES : ANG. / HOEK -

TRCD. L. BADENHORST D.O. REF. P79/157 ENG. [Signature]
 NGT. TK-VERB. IR

CKD. I. Thompson. DATE 81-09-14 For ns.

CHIEF ELECTRICAL ENGINEER S R JOHANNESBURG
 ELEKTRIESE HOOFINGENIEUR S A S

PREVIEW COPY ONLY

A4
 A4



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.

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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 _____ am personally assuming the
Act I, _____ 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 : _____

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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 _____ I,
Contractor/Builder :- _____

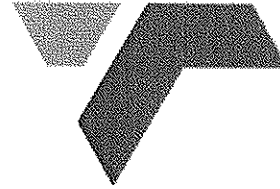
do hereby acknowledge and accept
the duties

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



Transnet SOC Limited Registration Number 1990/00900/06

TRANSNET SPECIFICATION

E7/1 - SPECIFICATION FOR GENERAL WORK AND WORKS ON, OVER, UNDER OR ADJACENT TO RAILWAY LINES AND NEAR HIGH VOLTAGE EQUIPMENT

(This specification shall be used in network operator contracts)

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1.0 SCOPE

- 1.1 This specification covers the network operator's requirements for general work and works on, over, under or adjacent to railway lines and near high voltage equipment.

2.0 DEFINITIONS

The following definitions shall apply:

"Authorised Person" - A person whether an employee of the network operator or not, who has been specially authorised to undertake specific duties in terms of Transnet' publication Electrical Safety Instructions, 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 the network operator to carry out work on its behalf.

"Contract Supervisor" - The person or juristic person appointed by the network operator from time to time as the Contract Supervisor, to administer the Contractor's performance and execution of the Works according to the powers and rights held by and obligations placed upon the Contract Supervisor in terms of the Contract.

"Dead" - Isolated and earthed.

"Electrical Officer (Contracts)" - The person appointed in writing by the Project Manager in terms of this specification 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 the network operator 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 1000 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 the network operator 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.

"Optical Fibre Cable" - Buried or suspended composite cable containing optical fibres used in:

- telecommunication networks for transmission of digital information and
- safety sensitive train operations systems.

"Project Manager" - As defined in the special conditions of the contract. The person or juristic person appointed by the network operator 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 (general or direct) staff under his control who perform general work or to work on, over, under or adjacent to railway lines and in the vicinity of high-voltage electrical equipment.

"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.

"Works" - The contractual intent for the work to be done as defined in the contract at a defined work site.

PART A - GENERAL SPECIFICATION**3.0 AUTHORITY OF OFFICERS OF TRANSNET**

- 3.1 The Contractor shall co-operate with the officers of the network operator and shall comply with all instructions issued and restrictions imposed with respect to the Works which bear on the existence and operation of the network operator's railway lines and high-voltage equipment.
- 3.2 Without limiting the generality of the provisions of clause 3.1, any duly authorised representative of the network operator, having identified himself, may stop the work if, in his opinion, the safe passage of trains or the safety of the network operator's assets or any person is affected. **CONSIDERATIONS OF SAFETY SHALL TAKE PRECEDENCE OVER ALL OTHER CONSIDERATIONS.**

4.0 CONTRACTOR'S REPRESENTATIVES AND STAFF

- 4.1 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 Contract Supervisor with the names, addresses and telephone numbers of the representatives.
- 4.2 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.
- 4.3 The Contractor shall ensure that all contractor staff receives relevant awareness, educational and competence training regarding safety as prescribed.

5.0 OCCUPATIONS AND WORK PERMITS

- 5.1 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 Contract Supervisor and at times to suit the network operator requirements.
- 5.2 The Contractor shall organise the Works in a manner which will minimise the number and duration of occupations and work permits required.
- 5.3 The network operator 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.
- 5.4 The Contractor shall submit to the Contract Supervisor, in writing, requests for occupations or work permits together with details of the work to be undertaken, at least 21 days before they are required. The network operator does not undertake to grant an occupation or work permit for any particular date, time or duration.
- 5.5 The network operator 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 5.6 to 5.8.
- 5.6 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.
- 5.7 When the Contractor is notified less than 2 hours before the scheduled 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.
- 5.8 Reimbursement of the Contractor for any loss of working time in terms of clause 5.6 and 5.7, 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 Contract Supervisor certifies that no other work on which the labour and plant could be employed was immediately available.
- 5.9 Before starting any work for which an occupation has been arranged, the Contractor shall obtain from the Contract Supervisor written confirmation of the date, time and duration of the occupation.
- 5.10 Before starting any work for which a work permit has been arranged, the Responsible Representative shall read and sign portion C of the Work Permit, signifying that he is aware of the work boundaries 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 Work Permit, thereby acknowledging that he is aware that the electrical equipment is to be made "live". The Contractor shall advise all his workmen accordingly.

6.0 SPEED RESTRICTIONS AND PROTECTION

- 6.1 When speed restrictions are imposed by the network operator 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.
- 6.2 When the Contract Supervisor 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 the network operator's and the Contractor's personnel and assets, the public and including trains.
- 6.2.1 The network operator will provide training free of charge of the Contractor's flagmen and other personnel performing protection duties. The Contractor shall consult with the Contract Supervisor, whenever he considers that protection will be necessary, taking into account the minimum permissible clearances set out in the Manual for Track Maintenance (Document no. BBB0481):
- Drawing no. BE-97 Sheet 1: Horizontal Clearances: 1065mm gauge (Annexure 1 sheet 1)
 - Drawing no. BE-97 Sheet 2: Vertical Clearances: 1065mm gauge (Annexure 1 sheet 2)
 - Drawing no. BE-97 Sheet 3: Clearances: Platform (Annexure 1 sheet 3)
 - Drawing no. BE-97 Sheet 5: Clearances: 610mm Gauge (Annexure 1 sheet 5)
- 6.3 The Contractor shall appoint a Responsible Representative to receive and transmit any instruction which may be given by the network operator personnel providing protection.

7.0 ROADS AND ROADS ON THE NETWORK OPERATOR'S PROPERTY

- 7.1 The Contractor shall take every reasonable precaution to prevent damage to any roads or bridges used to obtain access to the site, and shall select routes, use vehicles, and restrict loads so that any extraordinary traffic as may arise from the moving of plant or material to or from the site shall be limited as far as is reasonably possible.
- 7.2 The Contractor shall not occupy or interfere in any way with the free use of any public or private road, right-of-way, path or street unless the Contract Supervisor has obtained the approval of the road authority concerned.

8.0 CLEARANCES

- 8.1 No temporary works shall encroach on the appropriate minimum clearances set out in the Manual for Track Maintenance (Document no. BBB0481):
- Drawing no. BE-97 Sheet 1: Horizontal Clearances: 1065mm gauge (Annexure 1 sheet 1)
 - Drawing no. BE-97 Sheet 2: Vertical Clearances: 1065mm gauge (Annexure 1 sheet 2)
 - Drawing no. BE-97 Sheet 3: Clearances: Platform (Annexure 1 sheet 3)
 - Drawing no. BE-97 Sheet 5: Clearances: 610mm Gauge (Annexure 1 sheet 5)

9.0 STACKING OF MATERIAL

- 9.1 The Contractor shall not stack any material closer than 3m from the centre line of any railway line without prior approval of the Contract Supervisor.

10.0 EXCAVATION, SHORING, DEWATERING AND DRAINAGE

- 10.1 Unless otherwise approved by the Contract Supervisor any excavation adjacent to a railway line shall not encroach on the hatched area shown in Figure 1.

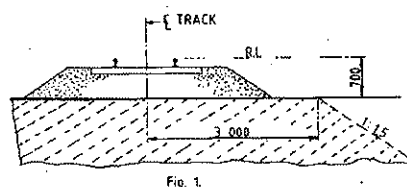


Fig. 1.

- 10.2 The Contractor shall provide, at his own cost any shoring, dewatering or drainage of any excavation unless otherwise stipulated elsewhere in the Contract.
- 10.3 Where required by the Contract Supervisor, 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.
- 10.4 The Contractor shall prevent ingress of water to the excavation but where water does enter, he shall dispose of it as directed by the Contract Supervisor.
- 10.5 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.
- 11.0 FALSEWORK FOR STRUCTURES**
- 11.1 Drawings of falsework for the construction of any structure over, under or adjacent to any railway line shall be submitted to the Contract Supervisor 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.
- 11.2 After the falsework has been erected and before any load is applied, the Contractor shall submit to the Contract Supervisor 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 Contract Supervisor to proceed, the Contractor shall be entirely responsible for the safety and adequacy of the falsework.
- 12.0 PILING**
- 12.1 The Contract Supervisor will specify the conditions under which piles may be installed on the network operator's property.
- 13.0 UNDERGROUND SERVICES**
- 13.1 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.
- 13.2 Any damage shall be reported immediately to the Contract Supervisor, or to the official in charge at the nearest station, or to the traffic controller in the case of centralised traffic control.
- 14.0 BLASTING AND USE OF EXPLOSIVES**
- 14.1 When blasting within 500m of a railway line, the Contractor shall observe the requirements stipulated in this specification.
- 14.2 No blasting shall be carried out except with the prior written permission of the Contract Supervisor and under such conditions as he may impose.
- 14.3 On electrified lines the Contractor shall also obtain the permission of the Electrical Officer (Contracts) before blasting, and shall give at least 21 days notice of his intention to blast. No blasting shall be done in the vicinity of electrified lines unless a member of the network operator's electrical personnel is present.
- 14.4 The Contractor shall arrange for the supply, transport storage and use of explosives.
- 14.5 The Contractor shall have labour, tools and plant, to the satisfaction of the Contract Supervisor, available on the site to clear immediately any stones or debris deposited on the track or formation by blasting, and to repair any damage to the track or formation immediately after blasting. Repairs to the track shall be carried out only under the supervision of a duly authorised representative of the network operator.
- 14.6 The Contractor shall notify the Contract Supervisor of his intention to blast at least 21 days before the commencement of any blasting operations.
- 14.7 Before any blasting is undertaken, the Contractor and the Contract Supervisor shall jointly examine and measure up any buildings, houses or structures in the vicinity of the proposed blasting to establish the extent of any existing cracking or damage to such structures, etc. The Contractor, shall, subject to the provisions stipulated in the Contract Insurance Policy, make good any deterioration of such buildings, houses, or structures, which, in the opinion of the Contract Supervisor, was directly caused by the blasting.
- 14.8 After completion of the blasting the Contractor shall obtain a written clearance from each landowner in

the vicinity of the blasting operations to the effect that all claims for compensation in respect of damage caused by the blasting operations to their respective properties, have been settled.

14.9 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).

14.10 Blasting within 500m of a railway line will only be permitted during intervals between trains. A person appointed by the Contract Supervisor, 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.

14.11 The flagmen described in clause 14.10, where provided by the network operator, are for the protection of trains and the network operator's 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.

14.12 The person described in clause 14.10 will record in a book provided and retained by the network operator, 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.

14.13 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 Contract Supervisor and the person who will do the blasting shall both sign the book whenever an entry described in clause 14.12 is made.

15.0 RAIL TROLLEYS

15.1 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 Contract Supervisor and under the conditions stipulated by him.

15.2 All costs in connection with trolley working and any train protection services requested by the Contractor shall, be borne by the Contractor, unless otherwise agreed.

16.0 SIGNAL TRACK CIRCUITS

16.1 Where signal track circuits are installed, the Contractor shall ensure that no material capable of conducting an electrical current makes contact between rails of railway line/lines.

16.2 No signal connections on track-circuited tracks shall be severed without the Contract Supervisor's knowledge and consent.

17.0 PENALTY FOR DELAYS TO TRAINS

17.1 If any trains are delayed by the Contractor and the Contract Supervisor is satisfied that the delay was avoidable, a penalty will be imposed on the Contractor as stipulated in the contract, for the period and number of trains delayed.

18.0 SURVEY BEACONS AND PEGS

18.1 The Contractor shall not on any account move or damage any beacon, bench mark, reference mark, signal or trigonometrical station in the execution of the Works without the written approval of the Contract Supervisor.

Should the Contractor be responsible for any such occurrence, he shall report the circumstances to the Contract Supervisor who will arrange with the Director-General of Surveys for replacement of the beacon or mark at the cost of the Contractor.

18.2 The Contractor shall not move or damage any cadastral or mining beacon without the written approval of the Contract Supervisor and before it has been referenced by a registered land surveyor. Any old boundary beacon, which becomes an internal beacon on creation of new boundaries, shall not be moved without the written approval of the Contract Supervisor.

Should the Contractor move or damage any cadastral or mining beacon without authority, he shall be responsible for having it replaced, at his cost, by a land surveyor.

- 18.3 The Contractor shall preserve all pegs and bench marks. Such survey points shall not be removed without the written approval of the Contract Supervisor. Should any peg or benchmark be removed without authority, the Contract Supervisor will arrange for its replacement and the cost will be recovered from the Contractor. No claim will be considered for delay in replacing any such peg or bench mark. Each peg replaced shall be checked by the Contractor.
- 18.4 Where a new boundary has been established, beacons on the fence line shall not be disturbed, and fence posts or anchors may not be placed or excavations made within 0,6 m of any beacon without the prior written approval of the Contract Supervisor.

19.0 TEMPORARY LEVEL CROSSINGS

- 19.1 The Contract Supervisor may, on request of the Contractor, and if necessary for the purpose of execution of the Works, permit the construction of a temporary level crossing over a railway a line at a position approved by the Contract Supervisor and at the Contractor's cost. The period for which the temporary level crossing is permitted will be at the discretion of the Contract Supervisor.
- 19.2 The Contractor will provide protection and supervise the construction of the road over the track(s) and within the railway servitude at the level crossing, as well as the erection of all road signs and height gauges. All cost to be borne by the applicant.

The Contractor shall exercise extreme caution in carrying out this work, especially in respect of damage to tracks, services, overhead power and communications routes and prevent contact with "live" overhead electrical equipment.

Unless otherwise agreed, the Contractor will provide the service deviations or alterations to the network operator's track-, structure-, drainage-, electrical-, telecommunications- and train authorisation systems to accommodate the level crossing.

- 19.3 The Contractor shall take all necessary steps including the provision of gates, locks and, where necessary, watchmen to restrict the use of the temporary level crossing to himself and his employees, his subcontractors and their employees, the staff of the network operator and to such other persons as the Contract Supervisor may permit and of whose identity the Contractor will be advised. If so ordered by the Contract Supervisor, the Contractor shall provide persons to control road traffic using the temporary level crossing. Such persons shall stop all road traffic when any approaching train is within seven hundred and fifty (750) metres of the temporary level crossing, and shall not allow road traffic to proceed over it until the lines are clear.
- 19.4 The Contractor shall maintain the temporary level crossing within the railway servitude in good condition for the period it is in use. A temporary agreement with the road authority to be concluded for the maintenance of the level crossing outside the railway servitude.
- 19.5 When the temporary level crossing is no longer required by the Contractor, or permitted by the network operator, the Contractor shall at his own cost remove it and restore the site and the network operator's track-, structure-, drainage-, electrical-, telecommunications- and train authorisation systems to its original condition. Work over the tracks and within the railway servitude will be supervised by the network operator.

20.0 COMPLETION OF THE WORKS

- 20.1 On completion of the works, the Contractor shall remove all the remaining construction plant and material from the site, other than material which is the property of the network operator, and leave the site in a clean, neat and tidy condition. If material and plant is required for the liability and maintenance period the Contract supervisor must authorise it's retention on site.

21.0 PROTECTION OF PERSONS AND PROPERTY

- 21.1 The Contractor shall provide and maintain all lights, guards, barriers, fencing and watchmen when and where necessary or as required by the Contract Supervisor or by any statutory authority, for the protection of the Works and for the safety and convenience of the public.

Red, yellow, green or blue lights may not be used by the Contractor as they can be mistaken for signals. Red, yellow, green or white flags shall only be used for protection by the Contractor. Within the precincts of a port the Contractor shall obtain the permission of the Port Captain before installing any light.

- 21.2 The Contractor shall take all the requisite measures and precautions during the course of the Works to:
- (i) protect the public and property of the public,
 - (ii) protect the property and workmen of both the network operator and the Contractor,
 - (iii) avoid damage to and prevent trespass on adjoining properties, and
 - (iv) ensure compliance with any instruction issued by the Contract Supervisor or other authorised person, and with any stipulation embodied in the contract documents which affects the safety of any person or thing.
- 21.3 The network operator will provide, at its own cost, protection for the safe working of trains during such operations as the Contract Supervisor may consider necessary. Protection by the network operator for any purpose whatsoever, does not absolve the Contractor of his responsibilities in terms of the Contract.
- 21.4 The Contractor shall take all precautions and appoint guards, watchmen and compound managers for prevention of disorder among and misconduct by the persons employed on the Works and by any other persons, whether employees or not, on the work site and for the preservation of the peace and protection of persons and property in the direct neighbourhood. Any relocation of camps because of disorder shall be at the Contractor's expense.
- 21.5 All operations necessary for the execution of the Works, including the provision of any temporary work and camping sites, shall be carried out so as not to cause veldt fires, ground and environmental pollution, soil erosion or restriction of or interference with streams, furrows, drains and water supplies.
- If the original surface of the ground is disturbed in connection with the Works, it shall be made good by the Contractor to the satisfaction of the land owner, occupier or responsible authority.
- 21.6 The Contractor shall take all reasonable steps to minimise noise and disturbance when carrying out the Works, including work permitted outside normal working hours.
- 21.7 Dumping of waste or excess materials by the Contractor shall, in urban areas, be done under the direction and control of, and at sites made available by the local authority. Dumping outside local authority boundaries shall be done only with the express permission and under the direction and control of the Contract Supervisor.
- 21.8 The Contractor shall comply with environmental protection measures and specifications stipulated by the Contract Supervisor and/or local and environmental authorities.
- 22.0 INTERFERENCE WITH THE NETWORK OPERATOR'S ASSETS AND WORK ON OPEN LINES**
- 22.1 The Contractor shall not interfere in any manner whatsoever with an open line, nor shall he carry out any work or perform any act which affects the security, use or safety of an open line except with the authority of the Contract Supervisor and in the presence of a duly authorised representative of the network operator.
- 22.2 The Contractor shall not carry out any work or operate any plant, or place any material whatsoever nearer than three metres from the centre line of any open line except with the written permission of the Contract Supervisor and subject to such conditions as he may impose.
- 22.3 Care must be taken not to interfere with or damage any services such as overhead wire routes, cables or pipes and optical fibre cable, except as provided for the work specified. The Contractor will be held responsible for any damage to or interruption of such services arising from any act or omission on his part or of any of his employees, or persons engaged by him on the Works. The cost of repairing, replacing or restoring the services, as well as all other costs arising from any damage to services, shall be borne by, and will be recovered from the Contractor.
- 22.4 Authority granted by the Contract Supervisor and the presence of an authorised representative of the network operator in terms hereof, shall not relieve the Contractor of his duty to comply with this specification.
- 23.0 ACCESS, RIGHTS-OF-WAY AND CAMPSITES**
- 23.1 Where entry onto the network operator's property is restricted, permission to enter will be given only for the purpose of carrying out the Works and will be subject to the terms and conditions laid down by the network operator.
- 23.2 The Contractor shall arrange for campsites, workplaces and access thereto as well as for any right-of-

way over private property to the site of the Works, and for access within the boundaries of the network operator's property. The owners of private property to be traversed shall be approached and treated with fact and courtesy by the Contractor, who shall, if necessary, obtain a letter of introduction to such property owners from the Contract Supervisor.

The Contractor shall be responsible for the closing of all gates on roads and tracks used by him or his employees. Except with the prior approval of the Contract Supervisor and the owner or occupier of any private land to be traversed, the Contractor shall not cut, lower, damage, remove or otherwise interfere with any fence or gate which is either on the network operator's property or on private property and which restricts access to the Works. Where such approval has been given, the Contractor shall prevent entry of animals or unauthorised persons onto the network operator's or private property, and shall make the fences safe against trespass at the close of each day's work.

23.3 The Contractor shall take all reasonable steps to confine the movement of vehicles and plant to the approved right-of-way to minimise damage to property, crops and natural vegetation.

23.4 When access is no longer required, and before completion of the Works, the Contractor shall repair, restore or replace any fence or gate damaged during execution of the Works to the satisfaction of the Contract Supervisor and shall furnish the Contract Supervisor with a certificate signed by the owner and occupier of land over which he has gained access to a campsite, workplace and the Works, certifying that the owner and occupier have no claim against the Contractor or the network operator arising from the Contractor's use of the land. Should the Contractor be unable to obtain the required certificate, he shall report the circumstances to the Contract Supervisor.

24.0 SUPERVISION

24.1 The Contract Supervisor will provide overall technical superintendence of the Works, and may direct the Contractor in terms of the provisions of the Contract or in respect of any measures which the Contract Supervisor may require for the operations of the network operator, the safety of trains, property and workmen of the network operator, and for the safety of other property and persons. The Contractor shall carry out the directions of the Contract Supervisor. The superintendence exercised by the Contract Supervisor, including any agreement, approval, refusal or withdrawal of any approval given, shall not relieve the Contractor of any of his duties and liabilities under the Contract, and shall not imply any assumption by the network operator or by the Contract Supervisor of the legal and other responsibilities of the Contractor in carrying out the Works.

24.2 The Contract Supervisor may delegate to any deputy or other person, any of his duties or functions under the Contract. On receiving notice in writing of such delegation, the Contractor shall recognise and obey the deputy or person to whom any such duties or functions have been delegated as if he were the Contract Supervisor.

24.3 The Contractor shall exercise supervision over the Works at all times when work is performed or shall be represented by an agent having full power and authority to act on behalf of the Contractor. Such agent shall be competent and responsible, and have adequate experience in carrying out work of a similar nature to the Works, and shall exercise personal supervision on behalf of the Contractor. The Contract Supervisor shall be notified in writing of such appointment which will be subject to his approval.

24.4 The Contractor or his duly authorised agent shall be available on the site at all times while the Works are in progress to receive the orders and directions of the Contract Supervisor.

25.0 HOUSING OF EMPLOYEES

25.1 The Contractor shall, where necessary, make his own arrangements for suitable housing of his employees. Where temporary housing is permitted by the Contract Supervisor on any part of the site, the Contractor shall provide suitable sanitation, lighting and potable water supplies in terms of the requirements of the local authority or the current network operator's specification; Minimum Communal Health Requirements in Areas outside the Jurisdiction of a Local Authority - E.4B, as applicable.

25.2 Fouling the area inside or outside the network operator's boundaries shall be prevented. The Contractor will be called upon by the Contract Supervisor to dispose of any foul or waste matter generated by the Contractor.

26.0 OPTICAL FIBRE CABLE ROUTES

26.1 The Contractor shall not handle, impact, move or deviate any optical fibre cable without prior approval.

26.2 Works that in any way affect the optical fibre cable requires prior approval from the Contract Supervisor

who will determine the work method and procedures to be followed.

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PART B - SPECIFICATION FOR WORK NEAR HIGH-VOLTAGE ELECTRICAL EQUIPMENT

27.0 GENERAL

27.1 This specification is based on the contents of Transnet's publication ELECTRICAL SAFETY INSTRUCTIONS, 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 the network operator, and the onus rests on the Contractor to ensure that he obtains a copy.

27.2 This specification must be read in conjunction with and not in lieu of the Electrical Safety Instructions.

27.3 The Contractor's attention is drawn in particular to the contents of Part I, Sections 1 and 2 of the Electrical Safety Instructions.

27.4 The Electrical Safety Instructions 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).

27.5 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.

27.6 The Contractor shall regard all high-voltage equipment as "live" unless a work permit is in force.

27.7 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 the network operator's staff where this is necessary.

27.8 No barrier shall be removed unless authorised by the Electrical Officer (Contracts).

28.0 WORK ON BUILDINGS OR FIXED STRUCTURES

28.1 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.

28.2 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.

28.3 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.

29.0 WORK DONE ON OR OUTSIDE OF ROLLING STOCK, INCLUDING LOADING OR UNLOADING

29.1 No person may stand, climb or work, whilst on any platform, surface or foothold:

29.1.1 higher than the normal unrestricted access way, namely -

29.1.1.1 external walkways on diesel, steam and electric locomotives, steam heat vans, etc. and

29.1.1.2 walkways between coaches and locomotives.

29.1.2 of restricted access ways in terms of the Electrical Safety Instructions namely -

29.1.2.1 the floor level of open wagons

29.1.2.2 external walkways or decks of road-rail vehicles, on-track maintenance machines and material trains.

29.1.3 Unauthorised staff working on these platforms must be directly supervised by duly authorised persons in terms of clause 607.1.3 of the Electrical Safety Instructions. These persons must attend the relevant electrical safety module training. A letter of training must then be issued by an accredited training authority. A Category C Certificate of Authority must be obtained from the

local depot examining officer.

- 29.2 When in the above positions no person may raise his hands or any equipment he is handling above his head.
- 29.3 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.
- 29.4 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.
- 29.5 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.
- 29.6 Where the conditions in clauses 30.1 to 30.4 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 the network operator and at the Contractor's cost, 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 of the network operator.

30.0 USE OF EQUIPMENT

30.1 Measuring Tapes and Devices

- 30.1.1 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.
- 30.1.2 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.
- 30.1.3 Special measuring devices longer than 2 metres such as survey sticks and rods may be used if these are of non-conducting material and approved by the responsible Electrical Engineer of the network operator, but these devices must not be used within 3 metres of "live" high-voltage equipment in rainy or wet conditions.
- 30.1.4 The assistance of the Electrical Officer (Contracts) shall be requested when measurements within the limits defined in clauses 31.1.1 to 31.1.3 are required.
- 30.1.5 The restrictions described in 31.1.1 to 31.1.3 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.

30.2 Portable Ladders

- 30.2.1 Any type of portable ladder longer than 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.

31.0 CARRYING AND HANDLING MATERIAL AND EQUIPMENT

- 31.1 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 such material should be carried by two or more persons so as to maintain it as nearly as possible in a horizontal position. The utmost care must be taken to ensure that no part of the material comes within 3 metres of any "live" high-voltage equipment.
- 31.2 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.
- 31.3 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.

32.0 PRECAUTIONS TO BE TAKEN WHEN ERECTING OR REMOVING POLES, ANTENNAE, TREES ETC.

- 32.1 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.

32.2 The cost of supervision by an Authorised Person and the provision of earthing shall, unless otherwise agreed, be borne by the Contractor.

32.3 The provisions of clauses 33.1 and 33.2 shall also apply to the erection or removal of columns, antennae, trees, posts, etc.

33.0 USE OF WATER

33.1 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.

34.0 USE OF CONSTRUCTION PLANT

34.1 "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.

34.2 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.

34.3 The cost of any supervision by an Authorised Person and the provision of earthing shall, unless otherwise agreed, be borne by the Contractor.

34.4 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.

34.5 Clauses 35.1 to 35.4 shall apply *mutatis mutandis* to the use of maintenance machines of any nature.

35.0 WORK PERFORMED UNDER DEAD CONDITIONS UNDER COVER OF A WORK PERMIT

35.1 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.

35.2 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.

36.0 TRACTION RETURN CIRCUITS IN RAILS

36.1 DANGEROUS CONDITIONS CAN BE CREATED BY REMOVING OR SEVERING ANY BOND.

36.2 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 the network operator personnel.

36.3 The Contractor shall not break any permanent bonds between rails or between rails and any structure. He shall give the Contract Supervisor at least 7 days written notice when removal of such bonds is necessary.

36.4 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.

37.0 HIGH-VOLTAGE ELECTRICAL EQUIPMENT NOT MAINTAINED AND/OR OPERATED BY THE NETWORK OPERATOR

Where the work is undertaken on or near high-voltage electrical equipment which is not maintained and/or operated by the network operator, 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.

END

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Contract Data

Site Information

17 **SITE INFORMATION**

17.1 The works shall be performed at the **WITBANK DISTRIBUTION SUBSTATION**.

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