

APPENDIX 1

SCHEDULE OF REQUIREMENTS
(To be completed by client)

SYSTEM DETAIL

- 1.0 Transformer required for: Brits and Thabazimbi substation/location
- 2.0 Nominal system voltage: 25 000 kV
- 3.0 Number of phases: 1
- 4.0 Frequency: 50 Hz
- 5.0 Neutral point effectively earthed: _____ Yes/No

TRANSFORMER DETAIL

- 1.0 Type of transformer: Outdoor: Indoor: _____
- 2.0 Number of phases: Single phase: 1-ph Three phase: _____
- 3.0 Rated power: 16 kVA
- 4.0 Impedance percentage %: Supplier to Specify
- 5.0 Primary voltage rating: 25 000 kV
- 6.0 Secondary voltage rating: 230 kV
- 7.0 Vector group: Supplier to Specify

TANK TYPE (Supplier to Specify)

- 1.0 Free-breathing _____ Yes/No
- 2.0 Sealed (Transformer main tank cover joint shall be welded) _____ Yes/No

FITTINGS REQUIRED (Supplier to Specify)

- 1.0 Conservator with oil level indication. _____ Yes/No
- 2.0 Silica gel breather _____ Yes/No
- 3.0 Gas and oil actuating relay with test and sample valves _____ Yes/No
- 4.0 Main tank drain valve _____ Yes/No
- 5.0 Indicating thermometer _____
- 5.1 Oil temperature _____ Yes/No
- 5.2 Winding temperature indication _____ Yes/No
- 6.0 Radiators. _____ Yes/No
- 7.0 Auxilliary wiring terminal box _____ Yes/No
- 8.0 Neutral current transformer required _____ Yes/No
- 8.1 Ratio: _____

8.2 Class: _____

8.3 VA Rating: _____

9.0 Off circuit tap switch required Yes/No

9.1 Number of tap positions: _____

10.0 Bushings required: Outdoor: Yes Indoor: _____

High voltage side Yes No

Low voltage side Yes No

11.0 Cable box required LV side Yes No

Number and types of cables per phase

High voltage side: 1

Low voltage side: 1

12.0 Neutral required

High voltage side Yes No

Low voltage side Yes No

Number and types of cables per neutral: U/A

13.0 Mountings

13.1 Pole mounting Yes No

13.2 Platform mounting Yes No

13.3 Flat underbase Yes No

13.4 Skid underbase Yes No

13.5 Wheels and axles Yes No

13.6 Lifting lugs Yes No

13.7 Jacking pads Yes No

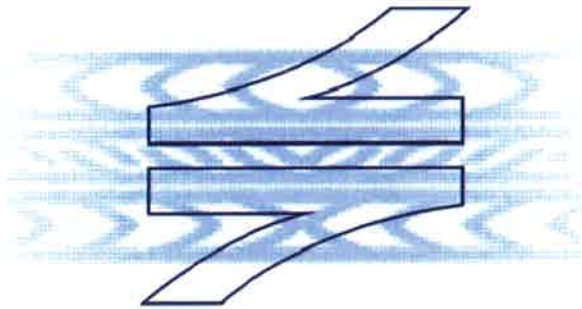
14.0 Dimensions (if critical)

Length: _____ mm. Breadth: _____ mm. Height: _____ mm

15.0 Special requirements: 52 KV Insulation level,
95 KV Power frequency withstand, and 250 KV
lightning impulse withstand.

15/03/2013

END



SPOORNET

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**ENGINEERING & TECHNOLOGY
INFRASTRUCTURE ENGINEERING
SPECIFICATION CONTROL PAGE**

SPECIFICATION

**SUPPLY, INSTALLATION AND COMMISSIONING OF
ELECTRICAL POWER SUPPLY POINTS FOR HOT BEARING
DETECTOR EQUIPMENT AT VARIOUS LOCATIONS - PHASE 2**

Statement of authorisation:

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

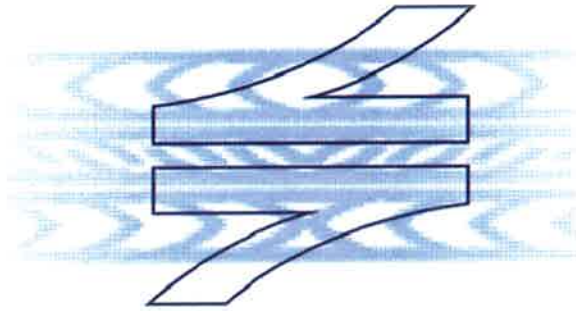
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Date: July 2004

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



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INFRASTRUCTURE ENGINEERING**

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1.0 SCOPE

1.1 This specification covers the requirements for the supply, installation and commissioning of new hot bearing detector electrical power supply points, as well as the upgrading of existing power points, at various locations.

2.0 SPECIFICATIONS AND STANDARD

The following publications (latest edition) are referred to herein and shall apply:

2.1 SPOORNET SPECIFICATIONS.

BBB0845	Appendix to SANS Specification for Metal Oxide Surge Arresters.
BBB1616	450 Volt Gas Arrester Spark Gap for Traction Supplies.
CEE.0005.87	Specification for 11 kV 50 Hz AC Outdoor Fuse Cut - Outs of Continuous Current Rating 100 Amps and Fitted with Fast - Acting Fuses.
CEE.0017.83	Provision of Foundations for Electrification Masts.
CEE.0023.90	Specification for the Installation of Cables.
CEE.0042.83	Provision of Core Type Foundations and Anchor Foundations for Electrification Masts and Anchors.
CEE.0174.86	Specification for 25 kV (Phase-To-Earth) 50 Hz AC Outdoor Fuse Cut - Outs of Continuous Current Rating 100 Amps and Fitted with Fast - Acting Fuses.
CEE.0177.86	Code of Practice: Earth Systems for Electric Light and Power and Traction Installations.

2.2 SOUTH AFRICAN BUREAU OF STANDARDS.

SANS 0142	Code of Practice for the Wiring of Premises.
SANS 0150	PVC Insulated Electrical Cables and Flexible Cords.
SANS 0156	Moulded Case Circuit Breakers.
SANS 0763	Hot Dip Galvanised Zinc Coatings.
SANS 0780	Distribution Transformers.
SANS 1019	Standard Voltages, Currents and Insulation Levels for Electricity Supply.
NRS 005(Appendix A)	Schedule of Requirements & Technical Data Sheet for Distribution Transformers.

3.0 DRAWINGS

3.1 The following drawings form part of this specification.

BBB0949	Step-Down Transformer Arrangement 25 kV AC Electrification.
BBB1587	Surge Arrester Earthing Arrangement 25 kV AC.
CEE - PA - 41	Earthing - Transmission Line on DC OHTE Structure.
CEE - PFB - 27	Transformer Structure.
CEE - PFC - 6	Cleat. Cable and Earth Wire.
CEE - PFC - 9	Cleat. Earth Wire.
CEE - PFC - 10	Cable Cleat Assembly. I-Beam Mast.
CEE - PFC - 22	Cable Cleat Assembly. Rail Mast.
CEE - PFC - 105	Cable Cleat Assembly. UC Mast.
CEE - PFC - 141	Anti-Climbing Device.
CEE - TMB - 67	Mast Base Assembly (4 Bolt Group).
CEE - TQ - 17	Foundation (Small Top Box - UC Mast).
CEE - TQ - 25	4 x M36 Foundation Bolt Group (UC Mast).
CEE - TQ - 57	Core Type Foundation.

4.0 DESCRIPTION OF WORK

4.1 The Works shall include the supply and installation of foundations, masts, steelwork, transformers, protection equipment, distribution boxes, cabling, earthing and bonding.

4.2 The electrical power supply point locations and site details are specified in Appendix 5 of this document.

4.3 On the 3 kV DC overhead track equipment (OHTE) traction sections.

4.3.1 On the 3 kV DC traction sections where the transmission lines are mounted on the OHTE mast structures a single-phase step-down transformer shall be mounted on a steel platform, which will be attached to an existing steel (OHTE) mast structure.

4.3.2 On the 3 kV DC traction section where the transmission lines are mounted on a separate wooden pole route, the wooden pole nearest to the mast location specified in Appendix 5 shall be removed and replaced with a steel mast structure. A single-phase step-down transformer shall be mounted on a steel platform, which will be attached to this new steel mast structure.

4.3.3 On the 3 kV DC traction section where no transmission lines are available the power point shall be supplied by a LV cable fed from a LV source inside the nearest traction substation. See clause 12.0.

4.4 On the 25 kV AC OHTE traction sections.

4.4.1 A single-phase step-down transformer shall be mounted on a steel platform, which will be attached to a newly installed steel mast structure.

4.5 General

4.5.1 The primary side of the step-down transformers shall be connected to the existing transmission line phase wires on the 3 kV DC traction sections and the OHTE catenary wire and earth on 25 kV AC sections.

4.5.2 Protection shall include fuse cut-outs and surge arresters.

4.5.3 A supply cable shall be installed between the step-down transformer secondary side and a double pole combination MCB/isolator, mounted in a box, which will be secured to the mast.

4.5.4 The Contractor shall be responsible for all terminations, connections, earthing and bonding.

4.5.5 The hot bearing detector equipment as well as the supply cable from the lockable box on the mast to the hot bearing detector equipment cubicle will be supplied, installed and connected by others.

5.0 STRUCTURE ARRANGEMENT

5.1 On the 3 kV DC OHTE traction sections.

- 5.1.1 Drawing No. CEE-PFB-27 shall be used as a concept drawing for the electrical power supply arrangements on the 3 kV DC traction sections.
- 5.1.2 The supply and installation of masts on the 3 kV DC sections with the transmission lines mounted on the OHTE mast structures will not form part of the requirements, as existing OHTE masts will be utilised.
- 5.1.3 On the 3 kV DC traction section with a separate wooden pole transmission line route the Contractor shall install a 206 x 204 mm Universal Column (UC) steel mast nearest to the mast location specified in Appendix 5.
 - 5.1.3.1 A 4 bolt group small top box type foundation in accordance with Drawings No. CEE -TQ -25 and CEE -TQ -17 shall be used.
 - 5.1.3.2 The foundation shall be done in accordance with Specification No. CEE.0017.83.
- 5.1.4 The length of the steel mast shall be determined by the height of the existing transmission lines at that location.
- 5.1.5 The mast base assembly for the UC mast shall be to Drawing CEE - TMB - 67.

5.2 On the 25 kV AC OHTE traction sections.

- 5.2.1 Drawing No. BBB0949 shall be used for the electrical power supply arrangements on the 25 kV AC traction sections.
- 5.2.2 The Contractor shall install the steel mast at a distance of 7 metres from the specified site mast location.
- 5.2.3 The foundation shall be done in accordance with Specification No. CEE.0023.90.
- 5.2.4 The rail to mast centre of the new mast shall be the same as the existing mast structures on that section of the line.

5.3 General

- 5.3.1 Anti-climbing devices in accordance with Drawing No. CEE-PFC-141 shall be installed where rail type OHTE mast structures are utilised.
- 5.3.2 The mast types and sizes, to which the steelwork and equipment will be attached, are specified in Appendix 5.
- 5.3.3 The manufacturing of any steelwork not in accordance with Drawings No. CEE-PFB-27 and BBB0949 shall not take place prior to the submission of the design drawings by the Contractor and approval of the design by Spoornet.
- 5.3.4 All steelwork shall be adequately protected against corrosion as per Specification SANS 763.

6.0 TRANSFORMERS

- 6.1 All transformers shall be manufactured in accordance with Specification SANS 780, NRS 005, Appendix A.
- 6.2 On the 3 kV DC OHTE traction sections.
 - 6.2.1 The 6,6 kV/230 V AC and 11 kV/230 V AC step-down transformers shall be rated at 16 kVA.

- 6.2.1.1 Step-down transformers with the primary winding supplied from the 6,6 kV or 11 kV AC transmission lines shall be connected between two of the three phase wires.
- 6.2.1.2 The rated secondary voltage of the step-down transformers shall be 230 V, 50 Hz AC.

6.3 On the 25 kV AC OHTE traction sections.

- 6.3.1 The 25 kV/230 V AC transformers shall be rated at 16 kVA.
- 6.3.2 Transformers with the primary winding supplied from the 25 kV AC OHTE system shall be connected between the OHTE catenary wire and earth.
- 6.3.3 The 25 kV/230 V AC transformers shall conform to the following requirements to ensure that they will be suitable for higher insulation levels and fluctuations in voltage.
 - 6.3.3.1 Insulation levels for high voltage equipment shall be in accordance with the recommendation of SANS 1019.
 - 6.3.3.2 The transformer shall have a rated insulation level based on an equivalent 3 phase system with a highest voltage for equipment of 52 kV AC r.m.s. i.e., a rated lightning impulse withstand voltage of 250 kV AC peak and a rated power frequency withstand voltage of 95 kV AC r.m.s.
 - 6.3.3.3 The transformer shall be capable of operating satisfactorily with a supply voltage varying between 22 kV AC and 27,5 kV AC. No-load conditions will normally be 27,5 kV AC and the transformer shall be capable of operating continuously at this voltage.

6.4 General

- 6.4.1 The rated primary voltage of the various transformers shall either be 6,6 kV, 11 kV or 25 kV AC, as indicated in Appendix 5.
- 6.4.2 Bushings shall be provided on the HV side of the transformers.
- 6.4.3 The HV bushings of the transformer shall face away from the mast structure when mounted.
- 6.4.4 The secondary phase and neutral of the step-down transformers shall be provided with terminals housed in a terminal box. Provision shall be made for blanked off entries for a 4 mm² 2 core cable with cable gland as well as an insulation type compression gland to accommodate a 50mm² single core earth cable.
- 6.4.5 The transformers shall be oil cooled.
- 6.4.6 The transformers shall be of the outdoor type.
- 6.4.7 Lashing lugs shall be provided.
- 6.4.8 The transformers shall be mounted on a platform, which shall be perpendicular to the rail (90° in relationship to the rail) and attached to the masts as per Drawings No.CEE-PFB-27and BBB0949.

7.0 FUSE CUT-OUTS

- 7.1 The fuse cut-outs shall be in accordance with Specification No. CEE.0005.87 for 6,6 kV AC and 11 kV AC and Specification No. CEE.0174.86 for 25 kV AC.
- 7.2 2,5 Ampere fuse elements shall be installed in the fuse holders at the 6,6 kV and 11 kV AC sites.
- 7.3 1 Ampere fuse elements shall be installed in the fuse holders at the 25 kV AC sites.
- 7.4 The fuse cut-out assembly shall be mounted as per Drawing No.CEE-PFB-27 for 6,6 kV and 11kV AC and Drawing No.BBB0949 for 25 kV AC.
- 7.5 The fuse cut-out height must be such that the fuses can be readily closed using a standard Spoonnet telescopic earthing/link stick.

8.0 SURGE ARRESTERS

- 8.1 The 6,6/11/25 kV AC surge arresters (class 2 station type) shall be in accordance with Appendix to SANS Specification No. BBB0845.
- 8.2 The surge arresters shall be mounted as per Drawings No.CEE-PFB-27 for 6,6 kV and 11 kV AC and BBB0949 for the 25 kV AC.

9.0 CABLING AND JUMPERS

- 9.1 A 4mm², 2 core, SWA, PVC insulated cable shall be installed, secured and connected between the secondary side of the step-down transformer and a 30 ampere removable combination MCB/isolator, mounted in a lockable galvanised steel box, supplied as part of this contract and secured 1 500mm above the base of the mast.
- 9.2 The feeder jumpers between the cut-out fuses (6,6 kV and 11kV AC systems) and the step-down transformer primary shall be insulated.
- 9.3 All cabling shall be secured to the mast structures by means of wooden cleats. Drawings No. CEE - PFC - 6, 9, 10, 22 and 105 shall be applicable.
- 9.4 Sufficient slack that will not allow the jumpers to be placed under tension when the OHTE wires migrate to their extreme positions shall be allowed for where these feeder jumpers are connected to a weight tensioned OHTE design.
- 9.5 None-tension aluminium-aluminium connections shall be made with approved "C" type compression clamps; alternatively approved bolted type clamps may be used. The clamps shall be of the correct size for the wire to which they are applied.
- 9.6 None-tension aluminium-copper connections shall be made with approved "C" type compression clamps; alternatively approved bolted type clamps may be used. The bi-metallic clamps shall be of the correct size for the wire to which they are applied.

10.0 EARTHING AND BONDING

10.1 On the 3 kV DC OHTE traction sections.

- 10.1.1 The earthing of the equipment mounted on masts in the 3 kV DC sections shall be done in accordance with Drawing No. CEE-PA-41.
- 10.1.2 The earth downlead from the secondary side of the 6,6 and 11 KV/230 V AC transformers shall be connected to its own earth spike or trench earth.
- 10.1.3 The earth downlead from the surge arresters shall be connected to a dedicated earth spike or trench earth.
- 10.1.4 The earth downlead from the surge arresters shall be continuous and it shall not be possible to open circuit this conductor when the spark gap, installed and connected to this circuit, needs replacing.
- 10.1.5 The earth downleads on the secondary side of the 6,6 and 11 kV/230 V AC transformers shall be secured at the terminal box by means of an insulation type compression cable gland.
- 10.1.6 The power and lighting earth downleads (i.e. transformers, surge arresters and outgoing supply cables) shall be kept insulated from the steel structures of the OHTE at all times, see clause 9.3.

10.2 On the 25 kV AC OHTE traction sections.

- 10.2.1 The earthing of the equipment on the 25 kV AC traction sections shall be done as indicated on Drawing No. BBBO949.
- 10.2.2 The earthing of the surge arresters on these sections shall be in accordance with Drawing No. BBB1587.

10.3 General

- 10.3.1 The mast structures where the power supply points are installed shall be double bonded to the rail.
- 10.3.2 All cabling shall be secured to the mast structures by means of wooden cleats. Drawings No. CEE - PFC - 6, 9, 10, 22 and 105 shall be applicable.
- 10.3.3 The earth resistance readings of the earth spikes or trench earths shall be less than 5 ohms.
- 10.3.4 The earthing system shall be in accordance with Specification No. CEE.0177.86.

11.0 UPGRADING OF EXISTING SITES

- 11.1 The following upgrades are to be implemented at the existing sites as indicated with "EX" or "Existing Point" in Appendix 5.
- 11.2 **On the 3 kV DC OHTE traction sections.**
 - 11.2.1 The surge arresters shall be replaced with ones complying with the requirements of clause 8.1.
 - 11.2.2 The cabling, jumpers, connection box, removable MCB/Isolator and the mounting cleats shall be in accordance with the applicable sub-clauses of clause 9.0.

- 11.2.3 The earthing and bonding shall comply with the applicable sub-clauses of clause 10.0 of this specification.
- 11.2.4 The existing step-down transformers and fuse cut-outs shall be retained.
- 11.3 **On the 25 kV AC OHTE traction sections.**
- 11.3.1 The existing step-down transformers, surge arresters and fuse cut-outs shall remain.
- 11.3.2 The cabling, jumpers, connection box, and removable MCB/Isolator shall be upgraded to comply with the applicable sub-clauses of clause 9.0.
- 11.3.3 The earthing and bonding shall comply with the applicable sub-clauses of clause 10.0 of this specification.

12.0 SUPPLY POINTS WHERE NO TRANSMISSION LINES ARE AVAILABLE

- 12.1 The sites without transmission lines are at Buckingham (mast location 25/1) and Gatiep (mast location 81/2).
- 12.2 A 35mm², 4 core, SWA, PVC insulated cable shall be installed, secured and connected between the 230 V AC source (LV panel) inside the traction substation and a 30 ampere removable combination MCB/isolator, mounted in a lockable galvanised steel box, supplied as part of this contract and secured to the mast structure 1 500mm above the base of the mast.
- 12.2.1 The 4 cores of the cable shall be paralleled (black/blue and red/white) for the single-phase supply.
- 12.2.2 The cable shall be installed in accordance with Specification No. CEE.0023.90.
- 12.2.3 The supply cable from the substation shall be "block jointed" where entering the connection box at the mast structure.
- 12.3 The protective cable guard for the supply cable shall be mounted and secured in such a manner as to be insulated from the steel of the mast structure.
- 12.4 A 60 ampere combination MCB/isolator to be installed at the substation LV panel shall protect the supply cable.

13.0 MATERIAL SUPPLIED BY OTHERS

- 13.1 The Spoornet depot at Port Elizabeth shall supply the 25 kV/230 V AC transformers for the sites at Cradock, Glenheath and Wildfontein. The Contractor will however be responsible for the transportation of the transformers from the depot to the various sites.

END

BREAKDOWN OF COSTS (BILL OF QUANTITIES)

Appendices 1, 2, 3 and 4 must be filled in by the tenderer.

The prices set out against each item in the schedule hereunder shall be the total cost (labour and material) per item for the, supply, installation, commissioning and guarantee. Prices must exclude VAT.

APPENDIX 1 - POWER SUPPLY POINTS ON 3 kV DC OHTE TRACTION SECTION
TRANSMISSION LINE ON OHTE STRUCTURES

No.	Item	Unit Price	Quantity	Total
1.0	Supply and install 16 kVA 6,6/11 kV/230 V AC transformer		14 each	
2.0	Supply and install transformer mounting platform		14 each	
3.0	Supply and install 6,6/11 kV AC fuse cut-outs (2 per point)		14 sets	
4.0	Supply and install 6,6/11 kV AC surge arresters (2 per point)		17 sets	
5.0	Supply and install cabling and jumpers		17 each	
6.0	Supply and install transformer earthing		17 each	
7.0	Supply and install surge arrester earthing		17 each	
8.0	Supply and install mast to rail bonding (Double bonds)		17 each	
9.0	Supply and install lockable connection box		17 each	
10.0	Supply and install removable MCB/isolator		17 each	
11.0	Other (Specify)			
12.0	Preliminary & General Stage Two (Specify)			
13.0	Preliminary & General Stage Seven (Specify)			
	TOTAL			

APPENDIX 2 - POWER SUPPLY POINTS ON 3 kV DC OHTE TRACTION SECTION
TRANSMISSION LINE ON WOODEN POLE STRUCTURES

No.	Item	Unit Price	Quantity	Total
1.0	Excavate and cast foundation		6 each	
2.0	Supply and install OHTE mast structure		6 each	
3.0	Supply, install and secure cross arm/transmission line to mast structure		6 each	
4.0	Supply and install 16 kVA 11 kV/230 V AC transformer		6 each	
5.0	Supply and install transformer mounting platform		6 each	
6.0	Supply and install 11 kV AC fuse cut-outs (2 per point)		6 sets	
7.0	Supply and install 11 kV AC surge arresters (2 per point)		7 sets	
8.0	Supply and install cabling and jumpers		7 each	
9.0	Supply and install transformer earthing		7 each	
10.0	Supply and install surge arrester earthing		7 each	
11.0	Supply and install lockable connection box		7 each	
12.0	Supply and install removable MCB/isolator		7 each	
13.0	Other (Specify)			
14.0	Preliminary & General Stage One (Specify)			
	TOTAL			

APPENDIX 3 - POWER SUPPLY POINTS ON 25 kV AC OHTE TRACTION SECTION

No.	Item	Unit Price	Quantity	Total
1.0	Excavate and cast foundation		13 each	
2.0	Supply and install OHTE mast structure		13 each	
3.0	Supply and install 16 kVA 25 kV/230 V AC transformer		10 each	
4.0	Supply and install transformer mounting platform		13 each	
5.0	Supply and install 25 kV AC fuse cut-out (1per point)		13 each	
6.0	Supply and install 25 kV AC surge arrester (1 per point)		13 each	
7.0	Supply and install cabling and jumpers		16each	
8.0	Supply and install transformer earthing		16 each	
9.0	Supply and install surge arrester earthing		16 each	
10.0	Supply and install mast to rail bonding (Double bonds)		13 each	
11.0	Supply and install lockable connection box		16 each	
12.0	Supply and install removable MCB/isolator		16 each	
13.0	Other (Specify)			
14.0	Preliminary & General Stage 3 (Specify)			
15.0	Preliminary & General Stage 4 (Specify)			
16.0	Preliminary & General Stage 6 (Specify)			
	TOTAL			

APPENDIX 4 - POWER SUPPLY POINTS ON 3 kV DC OHTE TRACTION SECTION
NO TRANSMISSION LINES AVAILABLE

No.	Item	Unit Price	Quantity	Total
1.0	Excavation of trench at Buckingham		385 m	
2.0	Supply and install LV cable at Buckingham		385 m	
3.0	Excavation of trench at Gatiep		415 m	
4.0	Supply and install LV cable at Gatiep		415 m	
5.0	Supply and install lockable connection box		2 each	
6.0	Supply and install removable MCB/isolator		2 each	
7.0	Supply and install fused switch isolator		2 each	
8.0	Supply and install cable protection		2 each	
9.0	Other (Specify)			
10.0	Preliminary & General Stage Five (Specify)			
	TOTAL			

ELECTRICAL POWER SUPPLY POINTS FOR HOT BEARING DETECTORS – SITE INFORMATION APPENDIX 5

NO	STATION/S IN VICINITY OF SITE	MAST LOCATION OF SITE	HV RATING	HV CONSTRUCTION	OHTE RATING	DEPOT	MAST SIZE AND TYPE
STAGE ONE							
1	PHOMENI-LEGOGOTE	38/14	11 kV AC	Wooden Pole Transmission Line	3 kV DC	Nelspruit	Mast To Be Erected
2	HAZYVIEW	66/11	11 kV AC	Wooden Pole Transmission Line	3 kV DC	Nelspruit	Mast To Be Erected
3	MIR-B	78/8	11 kV AC	Wooden Pole Transmission Line	3 kV DC	Nelspruit	Mast To Be Erected
4	MATSHAYE A	95/12	11 kV AC	Wooden Pole Transmission Line	3 kV DC	Nelspruit	Mast To Be Erected
5	COTTONDALE-MBUMBA	119/14	11 kV AC	Wooden Pole Transmission Line	3 kV DC	Nelspruit	Mast To Be Erected
EX	HOEDSPRUIT-BRAKSPRUITBRUG	9/10E	11 kV AC	Wooden Pole Transmission Line	3 kV DC	Nelspruit	Existing Point
6	PALMLOOP	26/10	11 kV AC	Wooden Pole Transmission Line	3 kV DC	Nelspruit	152 X 203 I-Beam
STAGE TWO							
7	TWEEDRAG-KLEINSONDERHOUT 1	74/1	11 kV AC	Transmission Line On OHTE	3 kV DC	Isando East	204 X 206 UC
8	ELOFF-WELGEDAG B 1	10/8	6,6 kV AC	Transmission Line On OHTE	3 kV DC	Isando East	120 X 430 Rail Mast
9	RAYTON-FORFAR	42/2	11 kV AC	Transmission Line On OHTE	3 kV DC	Koedoespoort	120 X 430 Rail Mast
10	CLEWER-WAKEFIELD	101/3	11 kV AC	Transmission Line On OHTE	3 kV DC	Koedoespoort	120 X 430 Rail Mast
11	CASSHOME-ARNOT	64/1	11 kV AC	Transmission Line On OHTE	3 kV DC	Koedoespoort	152 X 203 I-Beam
12	SUNBURY-BELFAST	96	11 kV AC	Transmission Line On OHTE	3 kV DC	Koedoespoort	152 X 203 I-Beam
13	AIRLIE-HEMLOCK	44/7	11 kV AC	Transmission Line On OHTE	3 kV DC	Nelspruit	152 X 203 I-Beam
14	CITRIODORA-ELANDSHOEK	67/13	11 kV AC	Transmission Line On OHTE	3 kV DC	Nelspruit	152 X 203 I-Beam
15	BROHAM-ALKMAAR	94/8	11 kV AC	Transmission Line On OHTE	3 kV DC	Nelspruit	152 X 203 I-Beam
16	MALELANE-IMPALA	172/4	11 kV AC	Transmission Line On OHTE	3 kV DC	Nelspruit	152 X 203 I-Beam
17	DROOGLAND-DTHB	197/10	11 kV AC	Transmission Line On OHTE	3 kV DC	Nelspruit	152 X 203 I-Beam
STAGE THREE							
18	PENDORING-STEPHANUS	46/2	25 kV AC	25 kV AC OHTE	25 kV AC	Koedoespoort	152 X 203 I-Beam
19	ROOIHUWEL-MAROELASKOP	75/5	25 kV AC	25 kV AC OHTE	25 kV AC	Koedoespoort	204 X 206 UC
20	RUSTENBURG-KGALESTAD	122/11	25 kV AC	25 kV AC OHTE	25 kV AC	Koedoespoort	204 X 206 UC
21	STEILDRIF-SUN CITY HALT	154/2	25 kV AC	25 kV AC OHTE	25 kV AC	Koedoespoort	204 X 206 UC
22	NORTHAM	207/14	25 kV AC	25 kV AC OHTE	25 kV AC	Koedoespoort	204 X 206 UC

ELECTRICAL POWER SUPPLY POINTS FOR HOT BEARING DETECTORS – SITE INFORMATION								APPENDIX 5
NO	STATION/S IN VICINITY OF SITE	MAST LOCATION OF SITE	HV RATING	HV CONSTRUCTION	OHTE RATING	DEPOT	MAST SIZE AND TYPE	
STAGE FOUR								
23	SPYKERRAS	39*	25 kV AC	25 kV AC OHTE	25 kV AC	Pietersburg	204 X 206 UC	
24	WILLEM A	96/1*	25 kV AC	25 kV AC OHTE	25 kV AC	Pietersburg	204 X 206 UC	
25	NYLSTROOM-KEESPOORT	130/7	25 kV AC	25 kV AC OHTE	25 kV AC	Pietersburg	204 X 206 UC	
26	TOBIAS	173/10	25 kV AC	25 kV AC OHTE	25 kV AC	Pietersburg	204 X 206 UC	
27	GEYSER	259/8	25 kV AC	25 kV AC OHTE	25 kV AC	Pietersburg	204 X 206 UC	
STAGE FIVE								
28	BUCKINGHAM	25/1	None	See Clause 13.0	3kV DC	Krugersdorp	152 X 203 I-Beam	
29	GATIEP	81/2	None	See Clause 13.0	3kV DC	Krugersdorp	152 X 203 I-Beam	
STAGE SIX								
EX	RIPPON	43/2 43/3	25 kV AC	25 kV AC OHTE	25 kV AC	Port Elizabeth	Existing Point	
EX	KLIPFONTEIN	197/11	25 kV AC	25 kV AC OHTE	25 kV AC	Port Elizabeth	Existing Point	
30	CRADOCK	135/11	25 kV AC	25 kV AC OHTE	25 kV AC	Port Elizabeth	206 X 216 UC	
31	GLENHEATH	70/11	25 kV AC	25 kV AC OHTE	25 kV AC	Port Elizabeth	206 X 216 UC	
32	WILDFONTEIN	88/1	25 kV AC	25 kV AC OHTE	25 kV AC	Port Elizabeth	206 X 216 UC	
EX	RIET	21/13	25 kV AC	25 kV AC OHTE	25 kV AC	Port Elizabeth	Existing Point	
STAGE SEVEN								
EX	FOCHVILLE WEST	42/10	11 kV AC	Transmission Line On OHTE	3 kV DC	Krugersdorp	Existing Point	
33	SASOLBURG-VILJOENSDRIF	13/15	6,6 kV AC	Transmission Line On OHTE	3 kV DC	Krugersdorp	120 X 430 Rail Mast	
EX	DOVER-GREENLANDS	54/6	11 kV AC	Transmission Line On OHTE	3 kV DC	Bloemfontein	Existing Point	
EX	HENNEMAN	38/11	11 kV AC	Transmission Line On OHTE	3 kV DC	Bloemfontein	Existing Point	
34	THEUNISSEN-VETRIEVER	104/6	11 kV AC	Transmission Line On OHTE	3 kV DC	Bloemfontein	152 X 203 I-Beam	
35	BRANDFORT	150/3	11 kV AC	Transmission Line On OHTE	3 kV DC	Bloemfontein	152 X 203 I-Beam	

END

Notes: 35 NEW POWER SUPPLY POINTS

07 EXISTING POWER SUPPLY POINTS

* POSITION TO BE FINALISED



**TECHNOLOGY MANAGEMENT
SPECIFICATION**

**MEDIUM VOLTAGE DISTRIBUTION AND SUPPLY
TRANSFORMERS IN ACCORDANCE WITH SANS 780.
(For nominal system voltages up to 33 kV)**

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Date: 29th April 2008

Circulation Restricted To:

Transnet Freight Rail – Chief Engineer Infrastructure
- Technology Management

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1.0 SCOPE

- 1.1 This specification covers Transnet freight rail's requirements for single phase and three phase oil immersed type distribution and supply transformers for indoor or outdoor use in accordance with SANS 780.

2.0 BACKGROUND

- 2.1 Distribution and supply transformers are used on Transnet freight rail for the following applications:

- Supply transformers are used as step down transformers for power distribution of the 11kV and 6,6 kV Transnet freight rail reticulation systems and the 11 kV and 6,6 kV transmission line network.
- Distributions transformers are used as step down transformers for the provision of power at a required voltage.
- Distribution transformers are also used on the 11 kV and 6,6 kV transmission line system for step down supply points to signals relay rooms and for auxiliary supplies to traction substations etc.

3.0 STANDARDS AND PUBLICATIONS

The transformer shall comply with all relevant requirements of the latest edition of the specifications as listed in SANS 780.

3.1 SOUTH AFRICAN NATIONAL STANDARDS

SANS 121	Hot-dip Galvanized coatings for fabricated iron or steel articles.
SANS 780	Distribution Transformer.
SANS 1091	National colour standard.
SANS 9001	Quality Management systems – Requirements.

3.2 TRANSNET FREIGHT RAIL

CEE.0224.	Drawings, Catalogues, Instruction Manuals and Spares lists for Electrical Equipment supplied under contract.
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4.0 APPENDICES

The following appendices form an integral part of this specification:

Appendix 1:	Schedule of requirements.
Appendix 2:	Information provided by the tenderers.

5.0 TENDERING PROCEDURE

- 5.1 Tenderers shall indicate clause by clause compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.
- 5.2 A statement of non-compliance shall be motivated by the tenderer.
- 5.3 Tenderers shall complete Appendix B. " Information to be provided by tenderers."
- 5.4 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 5.5 Failure to comply with clauses 5.1, 5.2, 5.3 and 5.4 could preclude a tender from consideration.

6.0 SERVICE CONDITIONS.

The transformers shall be designed to operate under the following conditions.

6.1 ATMOSPHERIC CONDITIONS

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

6.2 ELECTRICAL CONDITIONS

Frequency:	The AC high voltage supply will normally be supplied by Eskom. The frequency will be 50 ± 2.5 Hz.
Harmonics:	For the supply transformers installed at the traction substations to supply power to the 11 kV and 6,6 kV transmission lines systems, it can be expected that the low voltage winding of such transformers shall be subjected to the total voltage harmonic distortion of up to 27%. Distribution transformers that are used for step down points on the 11 kV and 6,6 kV transmission line systems to step down voltages to 400 V/ 230 V for signal relay rooms, auxiliary supplies to traction substations or any other application shall be subjected to the total voltage harmonic distortion of up to 27%.
No of Phases:	Three phase systems.

7.0 TECHNICAL REQUIREMENTS**7.1 CONSTRUCTIONAL REQUIREMENTS**

7.1.1 The "schedule of requirements" Appendix 1 shall determine the constructional requirement of the transformers.

7.2 PAINTING AND CORROSIVE PROTECTION.

7.2.1 The corrosion protection and coatings both interior and external surfaces shall be in accordance with Clause 4.17 of SANS 780 and shall be suitable for coastal and heavily polluted conditions.

7.2.2 The transformer radiators shall be hot dipped galvanized in accordance with SANS 121 for coastal and heavily polluted conditions and be painted.

7.2.3 Internal surfaces of the conservator tank above oil level including the tank shall be protected from corrosion by varnishing, priming or painting as specified in clause 4.17.2 for coatings of interior services of SANS 780.

7.2.4 The conservator tank where required shall be painted white.

7.2.5 The finished external coats of paint of the transformer tank shall match the colour G12 for grey as specified in SANS 1091.

8.0 DRAWINGS AND MAINTENANCE MANUALS

8.1 Drawings, instruction manuals and spares lists shall be supplied in accordance with Transnet freight rail's specification CEE.0224.

8.2 Three copies of each of the following drawings shall be submitted to the responsible project manager for approval within 7 days of the order being placed.

8.2.1 Dimension drawings showing external arrangements of transformer.

8.2.2 External wiring diagrams for the transformer.

8.2.3 Vector diagram and rating plate.

9.0 INSPECTION AND TESTS

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

9.2 Arrangements must be made timeously with the Senior Engineer, Technology Management for inspections and tests prior to delivery.

9.3 All routine tests shall be carried out in accordance to SANS 780.

9.4 These tests shall be carried out at the manufacturers premises and shall be witnessed by Transnet freight rail's Quality Assurance staff.

9.5 Type test certificates for the same type of transformers with the validity of five years or less must be made available.

10.0 QUALITY ASSURANCE

10.1 The supplier must indicate what steps have been taken to implement a quality assurance system in terms of SANS 9001.

11.0 GUARANTEE AND DEFECTS

11.1 The contractor shall guarantee the transformer and accept liability for maker's defects, which may appear in design, materials and workmanship.

11.2 The guarantee period for the transformer shall expire after a period of 12 months commencing on the date of commissioning of the equipment.

END

APPENDIX 1

**SCHEDULE OF REQUIREMENTS
(To be completed by client)**

SYSTEM DETAIL

- 1.0 Transformer required for: _____ substation/location
- 2.0 Nominal system voltage: _____ kV
- 3.0 Number of phases: _____
- 4.0 Frequency: _____ Hz
- 5.0 Neutral point effectively earthed: _____ Yes/No

TRANSFORMER DETAIL

- 1.0 Type of transformer: Outdoor: _____ Indoor: _____
- 2.0 Number of phases: Single phase: _____ Three phase: _____
- 3.0 Rated power: _____ kVA
- 4.0 Impedance percentage %: _____
- 5.0 Primary voltage rating: _____ kV
- 6.0 Secondary voltage rating: _____ kV
- 7.0 Vector group: _____

TANK TYPE

- 1.0 Free-breathing _____ Yes/No
- 2.0 Sealed (Transformer main tank cover joint shall be welded) _____ Yes/No

FITTINGS REQUIRED

- 1.0 Conservator with oil level indication. _____ Yes/No
- 2.0 Silica gel breather _____ Yes/No
- 3.0 Gas and oil actuating relay with test and sample valves _____ Yes/No
- 4.0 Main tank drain valve _____ Yes/No
- 5.0 Indicating thermometer _____
- 5.1 Oil temperature _____ Yes/No
- 5.2 Winding temperature indication _____ Yes/No
- 6.0 Radiators. _____ Yes/No
- 7.0 Auxiliary wiring terminal box _____ Yes/No
- 8.0 Neutral current transformer required _____ Yes/No
- 8.1 Ratio: _____

- 8.2 Class: _____
- 8.3 VA Rating: _____
- 9.0 Off circuit tap switch required Yes/No
- 9.1 Number of tap positions: _____
- 10.0 Bushings required: Outdoor: _____ Indoor: _____
 - High voltage side Yes/No
 - Low voltage side Yes/No
- 11.0 Cable box required Yes/No
 - Number and types of cables per phase
 - High voltage side: _____
 - Low voltage side: _____
- 12.0 Neutral required
 - High voltage side Yes/No
 - Low voltage side Yes/No
 - Number and types of cables per neutral: _____
- 13.0 Mountings
 - 13.1 Pole mounting Yes/No
 - 13.2 Platform mounting Yes/No
 - 13.3 Flat underbase Yes/No
 - 13.4 Skid underbase Yes/No
 - 13.5 Wheels and axles Yes/No
 - 13.6 Lifting lugs Yes/No
 - 13.7 Jacking pads Yes/No
- 14.0 Dimensions (if critical)
 - Length: _____ mm. Breadth: _____ mm. Height: _____ mm
- 15.0 Special requirements: _____

END

APPENDIX 2

INFORMATION TO BE PROVIDED BY TENDERERS

1.0 GENERAL

1.1 Manufacturers name: _____

2.0 TRANSFORMER DETAIL

1.0 Type of transformer: Outdoor: _____ Indoor: _____

2.0 Number of phases: Single phase: _____ Three phase: _____

3.0 Rated power: _____ kVA

4.0 Impedance (percentage) %: _____

5.0 Primary voltage rating: _____ kV

6.0 Secondary voltage rating: _____ kV

7.0 Tapping Switch.

No of positions: _____ %Steps: _____

8.0 Vector group: _____

9.0 Free Breathing Yes/No

10.0 Sealed Yes/No

11.0 Welded cover Yes/No

12.0 Method of Cooling: _____

13.0 Overall dimensions: Length _____ mm. Breadth _____ mm. Height _____ mm

14.0 Winding material: HV _____ LV _____

15.0 Mass of core and windings: _____ kg

16.0 Oil capacity: _____ (Litres)

17.0 Mass of transformer complete with oil: _____ kg

18.0 HV end turns insulation reinforced Yes/No

19.0 Type of breather and dehydrating agent: _____

20.0 The following information refers to the transformer when connected on the principal tapping and appropriate reference temperature for the class of insulation used.

20.1 Iron loss (Watts): _____

20.2 Copper loss at full load: _____ at _____ °C

20.3 Total load losses (Watts): _____ at _____ °C

20.4 Impedance at full load (percentage) _____ Z _____ X

20.5 Regulation at full load at: 1.0 PF _____ Percent, 0.8 PF _____ Percent at _____ °C

20.6 Efficiency at full load at: 1.0 PF _____Percent, 0.8 PF _____Percent at
_____°C

20.7 Temperature rise at rated voltage and power of:

Windings: _____°C

Top oil: _____°C

END

"Preview Copy Only"