TRANSNET

(REGISTRATION NO.1990/000900/06)
TRADING AS
TRANSNET FREIGHT RAIL

ADDENDUM NO. 1 TO THE SECONDARY SPECIFICATIONS AND GENERAL SPECIFICATIONS TO THE CONTRACT

1) Where ever the word "Spoornet" appears in the secondary specifications, please replace it with "Transnet Freight Rail".

2) Wherever it is referred to the E5(M.W.)(1996) or the E5(Nov.1996) General Conditions of Contract, please refer to the conditions of contract of the NEC Short Contract.

SPOORNET

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TECHNICAL
RAILWAY ENGINEERING

SPECIFICATION CONTROL PAGE

450 VOLT GAS ARRESTER SPARKGAP FOR TRACTION POWER SUPPLIES

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: 18th Nov 2002

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

SPOORNET

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TECHNICAL
RAILWAY ENGINEERING

SPECIFICATION

450 VOLT GAS ARRESTER SPARKGAP FOR TRACTION POWER SUPPLIES

Circulation restricted to:

Technical: Maintenance (Infrastructure)
Technical: Maintenance
Technical: Resource Evaluation Acquisition & Review
Technical: Railway Engineering
Specialised Business: COALlink

1.0 SCOPE

1.1 This specification covers Spoornet's requirements for the manufacturing and supply of the 450 Volt gas arrestor spark gap for use in traction power supply systems.

2.0 DEFINITION

2.1 The spark gap assembly is a voltage limiting device which consists of a gas arrester and is contained in a housing according to Spoornet drawing BBB0906.

3.0 BACKGROUND

3.1 The spark gaps assemblies are used to limit voltages between the earthing system and the traction negative return system i.e. to limit contact voltages for the protection and safety of the staff and the public

3.2 Spark gaps are used at substations, bridges, station platforms sidings, Switching structures, H-masts, etc.

4.0 STANDARDS AND PUBLICATIONS

The following publication to be referred to.

4.1 Spoornet Drawing BBB 0906. - Spark Gap Assembly

5.0 METHOD OF TENDERING

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

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

5.3 The tenderer shall ensure that he has all the latest relevant documents.

6.0 SERVICE CONDITIONS

6.1 The equipment shall be designed and rated for operation under the following environmental conditions:

Altitude	:	0 to 1 800m above sea level
Ambient temperature range	:	Minus 5 °C to plus 50 °C
Relative humidity	:	10% to 90%
Lightning conditions	:	11 ground flashes per square kilometre per annum.

7.0 TECHNICAL REQUIREMENTS.

7.1 The spark gap shall be fitted with a gas arrester similar to the Surge Technology/DEHN + SÖHNE type, part No SDS 923116.

7.2 The gas arrester device shall be of the type that will return to its initial state after discharging the impulse current in case of over voltages due to lightning effects.

7.3 The gas arrester shall comply with the following parameters.

1. AC- spark over voltage – 50 Hz voltage ramp: 400V ≤ U_{ac} ≤ 550V
   (U_{ac} - Rating of the gas arrestor: 450V.)

2. Impulse spark over voltage – 1,2/50µs Impulse voltage:≤ 1000V
3. Impulse current without welding: 0,5 to 5 kA (10/350µs)
4. Impulse current without mechanical failure: 25 kA (10/350µs)
5. Short circuit current: 14kA to 28kA (peak) 50Hz: t > 30 ms

7.4 In the event of failure the gas arrestor shall fail to a short circuit mode.

7.5 The spark gap housing shall be manufactured in accordance to drawing No. BBB0906 and its associated drawings.

7.6 The spark gap shall be assembled with the gas arrester installed according to the drawing BBB0906.

7.7 The complete assembled spark gap shall be torqued to a value of 60 Nm to ensure sufficient surface contact between the gas arrester and spark gap housing.

8.0 QUALITY ASSURANCE AND INSPECTIONS.

8.1 Spoornet reserves the right to inspect the tenderers facilities for manufacturing the spark gap assemblies prior to awarding the contract.

8.2 Spoornet reserves the right to test a sample of the spark gaps in service for a period during the lightning season.

8.3 The issuing of acceptance certificates will be authorised by the quality assurance section of Spoornet.

8.4 The tenderer shall supply test certificates for the gas arresters.

8.5 Tests shall be carried out on the gas arresters to verify the spark over voltage rating.

8.6 Type test certificates shall be provided by the tenderer for the spark gap assembly to show compliance with clauses 7.2, 7.3 and 7.4 of this specification.

END

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ENGINEERING AND TECHNOLOGY
TECHNOLOGY MANAGEMENT

REPORT

INSTALLATION OF AERIAL FEEDER CONDUCTORS AT OAKMOOR

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Date: July 2005

Circulation restricted to:
Engineering and Technology: Infrastructure Maintenance
Engineering and Technology: Infrastructure Engineering
Engineering and Technology: Technology Management

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ENGINEERING AND TECHNOLOGY
TECHNOLOGY MANAGEMENT

REPORT

INSTALLATION OF AERIAL FEEDER CONDUCTORS AT OAKMOOR

Circulation restricted to:
Engineering and Technology: Infrastructure Maintenance
Engineering and Technology: Infrastructure Engineering
Engineering and Technology: Technology Management

EXECUTIVE SUMMARY

The track feeders at the Oakmoor substation consist of aerial feeder conductors that terminate on a structure and then connect to track switches No. 37 and No. 38 by means of underground cable. Due to continuous theft of the underground cables it is proposed that the aerial feeder conductors be installed from the substation to both track switches.

CONTENTS

1. SCOPE

The purpose of this document is to submit calculations proving that the newly proposed layout for the aerial feeder conductors will be suitable for installation at Oakmoor.

2: BACKGROUND

The underground cables and aerial feeder conductors feeding track switches No. 37 and No. 38 were stolen at Oakmoor substation.
The data for the stolen aerial feeder conductors is:
2.1 Material; Aluminium
2.2 Conductor size; 800 mm^2
2.3 Total length from the Substation

- To track switch No.37 = ± 710 meters
- To track switch No.38 = ± 830 meters

3. CALCULATIONS AND MEASUREMENTS

The plan is to shift track switch No. 37 to the top of the bridge at Oakmoor. The relocation of the track switch will enable the feeder conductor to terminate easily from a new 13m-mast pole to be installed. To ensure that the installation is successful the overturning moments (otm) for the existing 9.6m mast pole on the bridge must be known. Under normal condition a 206 X 204 UC mast pole is capable to withstand up to 64kN.m otm.

The 9.6m mast pole on the bridge has an average span length of 42.1m and 3.2m mast to track centres. It has feeder, catenary, and contact conductors suspended to it.
The otm calculations for the existing mast pole on the bridge are shown below:

a.) otm due to wind on wires:

otm_1 = wire diameter x wind pressure x k x wire height x spanlength
= WD X WP X k x WH X S

Where: S = (S1 + S2) / 2
= (42.2 + 42) / 2
= 42.1m

W.P. = 750 P.a., k = 0.6

∴ otm_1 = W.D X 750 X 0.6 X WH X 42.1
Let T = 750 X 0.6 X 42.1
= 18945N/m

∴

	Wire	T (N/m)	W.D. (m)	W.H. (m)
i.	161mm^2 contact	18945	0.015	5.15
ii.	100 mm^2 catenary	18945	0.0126	7.075
iii.	800 mm^2 feeder	18945	0.03825	7.15

⇒ otm_1 = i. + ii. + iii.
= 8.334kN.m

b.) otm due to mass of wires suspended

otm_2 = Mass of wire x wire to mast track centre

∴ i. Contact Wire = 14.024 x 42.1 x 3.2
= 1889.31 N.m

ii. Catenary Wire = 8.5 x 42.1 x 3.2
= 1145.12 N.m

iii. Feeder Wire = 23.52 x 42.1 x 3.2
= 3168.61 N.m

iv. Mass of droppers, clamps etc. = 455N.m

⇒ otm_2 = i. + ii. + iii. + iv.
= 6.658 kN.m

c.) otm due to wind on mast: 9.6 X 206 X 204 UC Mast

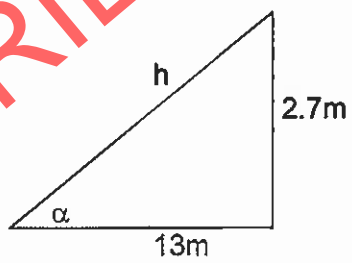
Area = 9.6 x 0.206
= 1.9776 m^2

otm_3 = force x distance
= (750N/ m^2 x 1.9776 m^2) x 9.6/2
= 7.117 kN.m

∴ otm_{total} = otm_1 + otm_2 + otm_3
= 8.333 + 6.658 + 7.117
= 22.108 kN.m

Length of aerial feeder between 13m-mast pole and 9.6m-mast pole on the bridge

The adjacent distance from the 13m-mast pole to the bridge is 13m. The height of the bridge plus parapet and a 9.6m mast pole is 16.3m.
∴ The aerial feeder will be 2.7m (i.e. 16.3 – 13) above the 13m-mast pole.



Where h is a distance from the top of the 13m-mast pole to the top of the 9.6m-mast pole on top of the bridge.

tanα = opposite/adjacent
tanα = (16.3 – 13)/ 13
tanα = 0.25
α = $\tan^{-1}$ 0.25
= 14.04^0

$\sin\alpha$ = opposite/hypotenuse
$\sin 14.04^0 = 3.3/h$
$h = 3.3/0.24$
$= \underline{13.75m}$

Maximum tension allowed

A 206 x 204 UC mast pole can withstand 64kN.m otm, but 22.108kN.m is already applied on it according to the calculations above:

$\therefore 64kN.m - 22.108kN.m = \underline{41.892kN.m}$
$\Rightarrow$ 41.892kN.m otm can still be exerted to the 9.6m-mast pole on the bridge.

Let K = the maximum allowable tension that can be applied to aerial feeder wire from the 13m-mast pole to the new 9m-mast pole on the bridge:

$\therefore$ otm = force x distance
41.892kN.m = K x 13.75m
K = 41.892kN.m / 13.75m
$= \underline{3.05\ kN}$

4. DISCUSSIONS

4.1 Reasons why the aerial feeder conductor has to run over a 13m-mast pole (for track switch No.37)
The aerial feeder conductor has to run over a 13m-mast pole to accommodate clearance to the bridge parapet.
Considering the visibility and for maintenance purposes, an aerial feeder is easier than an underground cable.

4.2 Insufficient Maintenance
The electrical personnel cannot get a full busbar permit at Hartebeest substation and Kaalfontein tie station, which means that the substations are not maintained to standard.

4.3 Delays
If power failure occurs at Hartebeest substation, it will result in trains standing in the section.

4.4 No back up feed
There will be no back up feed from Oakmor substation when urgent work has to be carried out at Hartebeest substation or Kaalfontein tie station.

5. METHOD OF INVESTIGATION

Oakmoor site visit, measurements and calculations were conducted for this project. Photos were taken and discussed with Mr. Felix Slier and Mr. Willem Mans. Various depot and head office personnel were consulted for more information regarding overturning moment calculations. Also the library was utilised for further information that was required.

6. CONCLUSION

According to the calculations, site inspection and measurements conducted, track switch No.37can be moved to the mast pole position on top of the bridge, provided that the new 9.6m-mast pole is installed on top of the bridge. The new 9.6m-mast pole shall replace the existing one, which is twisted. The mounting does not present any problems, since it is mounted on the bridge. The bolt group shows no corrosion or bending and the mast base insulation is still in a good condition. The 13m-mast pole can be installed, but the tension applied to the 13.75m aerial feeder conductor shall not exceed 3.05kN at -5^0C as this will result in the mast pole bending or twisting.

7. ACKNOWLEDGEMENTS

Many people have contributed valuable ideas and constructive criticism for this report to be successful. Their response has continued to be the source of inspiration for more information to be investigated even for the future projects and researches. Appreciation goes to Mr. Felix Slier, Mr. Willem Mans, Andrew Malatswane, Finnis Johnny, Isando depot personnel and Makhura Kgaugelo (librarian).

8. REFERENCES

a.) www.google.com; moments and forces
b.) Introduction to Multi-Disciplinary Concepts notes - OHTE
c.) Maintenance of 3kV DC Electrification - Manual

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ENGINEERING AND TECHNOLOGY

TECHNOLOGY MANAGEMENT

SPECIFICATION

REQUIREMENTS FOR THE SUPPLY OF ELECTRIC CABLES

(Appendix to be filled in by client)

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Date: 5 September 2005

Circulation restricted to:

Engineering &Technology: Infrastructure Maintenance

Engineering &Technology: Infrastructure Engineering

Engineering &Technology: Technology Management

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1.0 SCOPE

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

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

2.0 STANDARDS

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

2.1 SOUTH AFRICAN NATIONAL STANDARDS

SANS 97 : Electric cables - Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3 kV to 19/33 kV (excluding pressure assisted cables).

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

SANS 1507 : Electric cables with extruded solid dielectric insulation for fixed installations 300/500 V to 1900/3300 V,

Part 1-General,
Part 3-PVC Distribution cables,

Part 4-XLPEdistribution cables,
Part 5-Halogen free distribution cables.

3.0 APPENDIX

The following appendix forms an integral part of this specification.

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

4.0 TENDERING PROCEDURE

4.1 Tenderers shall indicate clause-by-clause compliance with the specification. They shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.

4.2 The tenderers shall motivate a statement of non-compliance.

4.3 The tenderer shall submit technical specifications of the cables offered.

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

5.0 MEDIUM VOLTAGE CABLES

5.1 IMPREGNATED PAPER INSULATED.

5.1.1 Paper impregnated lead sheathed (PILC) cables used for reticulation systems and traction power supplies and other applications shall be in accordance with SANS 97.

5.1.2 The voltage range for the cables shall be between 3,3kV and 33kV.

5.1.3 The cables shall be three core with stranded copper conductors.

5.1.4 The cables shall be paper insulated, screened type, lead sheathed provided with an extruded PVC bedding.

5.1.5 The armouring shall be galvanised steel wire with outer extruded PVC over sheath over the armouring.

5.1.6 The cable shall be so manufactured that it is fully protected against the effect of electrolysis.

5.1.7 Single core cables used for 3 kV DC application shall withstand a test voltage of 10,5 kV for one minute.

5.1.8 Cables shall be suitable for laying directly in soil and concrete trenches.

5.1.9 The cables shall withstand exposure to water, corrosive conditions as well as high ultra violet conditions caused by direct sunlight.

5.1.10 The cables shall be tested in accordance with SANS 97. Type test certificates shall be submitted with the cables offered.

5.1.11 The packing, marking and sealing of cables and cable drums shall be in accordance with SANS 97.

5.2 CROSS – LINKED POLYETHYLENE INSULATED (XLPE).

5.2.1 XLPE cables used for reticulation systems, 3kV DC traction feeders and traction power supplies and other applications shall be in accordance with SANS 1339.

5.2.2 The voltage range for the cables shall be between 3,8kV and 33kV.

5.2.3 Cables shall be single or three core with stranded copper conductors.

5.2.4 The cables shall be type A (armoured) for single and three core cables.

5.2.5 Single core type A cable shall be copper tape screened, aluminium wire armoured and provided with a PVC outer sheath.

5.2.6 Single core cables shall be rated for 3,8/6,6kV.

5.2.7 Single core cables used for 3 kV DC application shall withstand a test voltage of 10,5 kV for one minute.

5.2.8 Three core type A cable shall be copper tape screened, galvanised steel wire armoured and provided with a PVC outer sheath.

5.2.9 The manufacture of the single and three core cables shall be such that the cables are fully protected against the effect electrolysis.

5.2.10 The cables shall be suitable for laying directly in soil and concrete trenches.

5.2.11 The cables shall withstand exposure to water, corrosive conditions as well as high ultra violet conditions caused by direct sunlight.

5.1.12 The cables shall be tested in accordance with SANS 1339. Type test certificates shall be submitted with the cables offered.

5.2.12 Where specified flame-retardant and halogen free cables shall be in accordance with SANS 1339.

5.2.13 The packing, marking and sealing of cables and cable drums shall be in accordance with SANS 1339.

6.0 CABLES FOR FIXED INSTALLATIONS

6.1 Unless otherwise specified single and multi-core, wire armoured, extruded PVC insulated cables shall be used for fixed installations. The cables shall be in accordance with SANS 1507 part 1 and part 3.

6.2 The voltage range is between 300/500 V to 1900/3300 V.

6.3 Cables shall have stranded annealed copper conductors.

6.4 The cables shall be marked according to SANS 1507 part 3. Core identification shall be by means of colour code or numbering of the insulation.

6.5 The cable shall be so manufactured that it is fully protected against the effect of electrolysis.

6.6 Where XLPE or halogen free cables are specified the cables shall be in accordance with SANS 1507 parts 4 and 5.

6.7 The cables shall be tested in accordance with SANS 1507 parts 3, 4 and 5. Type test certificates shall be submitted with the cables offered.

6.8 The packing, marking and sealing of cables and cable drums shall be in accordance with SANS 1507.

7.0 QUALITY ASSURANCE

7.1 Spoornet reserves the right to carry out inspection and tests on the equipment at the works of the supplier/manufacturer.

7.2 Arrangements must be made timeously for such inspections and type/routine tests in accordance with the cable specifications are carried out before delivery of the cables to the site.

8.0 INSPECTION AND TESTING

8.1 Spoornet reserves the right to carry out inspections and any tests on cables at the factory of the supplier/ manufacture.

8.2 Arrangements must be made with The Senior Engineer, Technology Management Spoornet for inspections to be carried out before delivery of the equipment.

SCHEDULE OF REQUIREMENTS

(To be completed by the client)

1.0 MEDIUM VOLTAGE CABLES

1.1 PAPER IMPREGNATED LEAD SHEATHED (PILC)

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

1.1.2 Number of cores: .....

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

1.1.4 Size of conductors (mm^2): .....

1.2 CROSS LINKED POLYETHYLENE INSULATED (XLPE)

(XLPE is recommended for 3 kV DC Applications)

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

1.2.3 Number of cores: .....

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

1.2.5 Size of conductors (mm^2): .....

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

2.1 CABLES FOR FIXED INSTALLATIONS

2.1.1 Type of cable required:

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

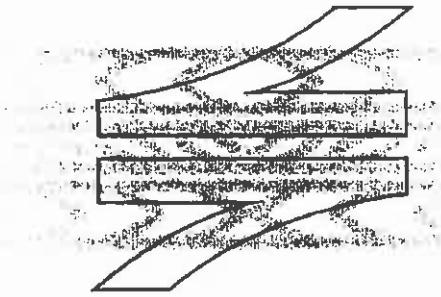
2.1.2 Rated Voltage (V): .....

2.1.3 Number of cores: .....

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

2.1.5 Size of conductors (mm^2): .....

END



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TECHNICAL
RAILWAY ENGINEERING
SPECIFICATION

PAINTING OF STEEL COMPONENTS OF ELECTRICAL EQUIPMENT

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Date: 27 February 2002

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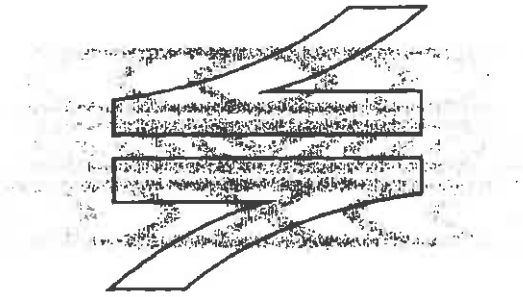

SPOORNET

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TECHNICAL
RAILWAY ENGINEERING
SPECIFICATION

PAINTING OF STEEL COMPONENTS OF ELECTRICAL EQUIPMENT

Circulation restricted to:
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INDEX

1.0 SCOPE

This specification covers the surface preparation, paint systems and painting of steel components of electrical equipment.

2.0 REFERENCES AND GLOSSARY

The following standards and specifications are referred to herein:

2.1 South African Bureau of Standards: -

SABS 064 : Code of Practice for the Preparation of Steel Surfaces for Coating.

SABS 1091 : National Colour Standards for Paint.

2.2 Trade names :

OptiDegreaser

OptiPrime^{Aqua}

Noxyde

2.3 Classification of level of surface degradation:

RE1 – 0.05% of surface rusted

RE2 – 0.5% of surface rusted

RE3 – 1.0% of surface rusted

RE4 – 3.0% of surface rusted

RE5 – 8.0% of surface rusted

3.0 METHOD OF TENDERING

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

4.0 SURFACE PREPARATION

4.1 NON-GALVANISED STEELWORK

4.1.1 New Steelwork

SURFACE PREPARATION (Read: NOTES and SPECIAL INSTRUCTIONS)	PRODUCT REQUIREMENTS & APPLICATION (See Variations for Specific Environmental Conditions)
➢ Sandblast to a standard of Sa2 to remove mill scale and/or flash rust ➢ Remove dust with clean compressed air (Check air for oil contamination)	➢ Apply a stripe coat to edges, bolts, crevices, nuts and rivets. ➢ Apply one thick coat of Noxyde to the entire structure with contrasting color. ➢ Apply a final thick coat of Noxyde at a consumption rate of minimum 400g/m^2

4.1.2 Previously Coated Steelwork

4.1.2.1 COATING START FAILING TO A LEVEL OF RE 2

➢ Test for adhesion (refer to supplier) ➢ **Degrease thoroughly with OptiDegreaser** ➢ **Hydro Blast complete substrate using a rotating nozzle and minimum 250 bar at the nozzle**	➢ **Apply a stripe coat to edges, bolts, nuts and rivets and fill crevices.** ➢ **Apply one coat of Noxyde to entire substrate in a contrasting color**

4.1.2.2 COATING FAILURE AND RUSTING TO A LEVEL OF RE 4

➢ Remove all visible traces of rust by **mechanical means ST2 (chip/grind/sand) OR shotblasting /spotblasting)** ➢ **Degrease thoroughly with OptiDegreaser** ➢ **Hydro Blast complete substrate using a rotating nozzle and minimum 250 bar at the nozzle.**	➢ **Apply a thick coat of Noxyde to the de-rusted areas, edges, bolts, nuts and rivets and fill crevices** ➢ **Apply one coat of Noxyde at a consumption rate of minimum 400g/m^2 to the entire substrate using a contrasting color.**

4.1.2.3 BITUMEN COATED

➢ Remove all visible rust and loosely adhering bitumen **coating by means of chipping and scraping (ST2)** ➢ **Degrease thoroughly with OptiDegreaser** ➢ **Hydro Blast complete substrate using a rotating nozzle and minimum 250 bar at the nozzle.**	➢ .Apply a thick coat of Noxyde to the de-rusted areas, edges, bolts, nuts and rivets and fill crevices ➢ **Apply two coats of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using contrasting colors**

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

➢ 1.Degrease thoroughly with OptiDegreaser ➢ **2.Hydro Blast complete substrate using a spinner tip and minimum 250 bar at the nozzle** ➢ **Shotblast/sandblast complete substrate giving particular attention to bolts nuts rivets and crevices. Sa2** ➢ **4 Dedust**	➢ Apply a first thick coat of Noxyde to the entire substrate ➢ **Apply a stripe coat to edges, bolts, nuts and rivets and fill crevices using a contrasting color** ➢ **Apply a final coat of Noxyde at a consumption rate of minimum 400g/m^2**

4.2 GALVANISED STEELWORK

4.2.1 NEW AND WEATHERED GALVANISING WITH A SMOOTH GLOSSY FINISH

➢ Degrease thoroughly with OptiDegreaser ➢ **Rinse down with copious quantities of potable water**	➢ Apply one thin coat of OptiPrime^{Aqua} (100 micron wet/35 micron dry) ➢ **Apply a stripe coat of Noxyde to edges, bolts, nuts and rivets and fill crevices** ➢ **Apply two coats of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using contrasting colors**

4.2.2 WEATHERED GALVANISING

4.2.2.1 White rust (zinc oxide)

➢ Degrease thoroughly using OptiDegreaser – ensure that all traces of "white rust" are removed ➢ Rinse down with copious quantities of potable water	➢ Apply one thin coat Noxyde ➢ Apply a stripe coat of Noxyde to edges, bolts, nuts and rivets and fill crevices ➢ Apply a final coat of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using a contrasting color

4.2.2.2 Combination of red rust (iron oxide) and white rust (zinc oxide)

➢ Remove all traces of red rust ➢ Degrease thoroughly using OptiDegreaser – ensure that all traces of "white rust" are removed ➢ Rinse down with copious quantities of potable water	➢ Apply a thick coat of Noxyde to the de-rusted areas, edges, bolts, nuts and rivets and fill crevices ➢ Apply a final coat of Noxyde at a consumption rate of minimum 400g/m^2 per coat to the complete substrate using a contrasting color

NOTES and SPECIAL INSTRUCTIONS:		
1 Sand or Grit-blasting	2 Degreasing:	3 Hydro-blasting:
a) Always use clean, non-recycled grit	a) Use only OptiDegreaser	a) Always use clean potable water
b) Always use fine or extra fine grit	b) Dilute according to instructions – see data sheet	b) Use a rotating nozzle and ensure a pressure of minimum 250 bar at the nozzle
c) Always use oil free air	c) Always follow up with hydro-blasting to remove all chemical residues	c) Remove ALL traces of dirt and any form of salt contamination and residues of the degreasing agent
d) Always use a moisture trap		d) Concentrate in crevices and other similar "collection" areas
e) Dedust		

5. PRODUCT APPLICATION

5.1 METHOD OF APPLICATION

OptiPrime^{Aqua}	Noxyde
Temperature-Min 5 °C Relative humidity-Max 80% R.H. ➢ Apply by brush, lacquer roller or airless spray using a no. 11 nozzle ➢ Apply one thin coat only - 100 micron wet = 35 micron dry (DFT) ➢ Small parts can be dipped - dilute with 10% water for dipping	Temperature-Min. 8 °C, Max. 55 °C Relative Humidity-Max 80% R.H. ➢ Apply by brush, roller or airless spray ➢ For airless spray applications refer to "Tips for airless spraying of Noxyde"

5.2DRYING TIME AND OVERCOAT PERIODS

➢ Do not overcoat within 12 hours ➢ Wash down with clean potable water (100 bar) before over coating to remove dust or any other form of intermediate contamination	➢ Drying time is dependant on ambient conditions and can vary from a few minutes (in dry windy conditions) to a few hours (in humid shaded conditions) ➢ Overcoat as soon as possible to avoid contamination of previous coat ➢ Wash down with clean potable water (100 - 150 bar) before over coating if danger of contamination exists or if left more than 4 hours before over coating

5.3 CURING TIME

n/a	➢ 7 - 14 days to "full cure". During this period the product is prone to mechanical damage - the longer time it is allowed to cure, the tougher it becomes

5.4 DRY FILM THICKNESS (DFT) READINGS

35 micron	➢ Severe coastal & marine environments (in the spray zone) – TWO stripe coats & overall minimum DFT of 400 micron ➢ Normal coastal environment (1 5 km from the coast line) - a single stripe coat & overall minimum DFT of 400 micron ➢ Non coastal high rainfall areas, in the immediate vaccinate of rivers, dams, lakes, etc., and in industrial areas with high levels of chemical pollution - a single stripe coat & overall minimum DFT of 400 micron ➢ Dry non aggressive environments - a single stripe coat & overall minimum DFT of 250 micron NOTE: DFT readings can only be taken after 72 hours

5.5 Notwithstanding the above requirements, all surfaces shall be cleaned according to the appropriate method described in SABS 064 for the particular surface to be cleaned, the contamination to be removed and the primer to be applied.

5.6 Blast cleaning of components shall be in accordance with clause 4.3 of SABS 064 to a degree of cleanliness of at least Sa 2 for inland exposure components and Sa 2 ½ for coastal exposure components. See Table 1 of SABS 064 for the appropriate profile.

5.7 Sheet metal that cannot be blast cleaned shall be cleaned by pickling according to clause 4.6 of SABS 064.

5.8 Components that will be powder coated shall be cleaned and prepared by the surface conversion process according to clause 5 of SABS 064 to a medium weight classification of table 2 of that specification.

5.9 Oil and accumulated dirt on steel components where no rusting is present shall be removed according to clause 3 of SABS 064.

6.0 PAINT SYSTEM

A choice of two systems is available to suit the contractors equipment.

6.1 Noxyde paint system

1st coat: OptiPrime^{Aqua}

Wet film thickness: 100 micrometers. Dry film thickness: 35 micrometers.

2nd coat: Noxyde Topcoat

Dry film thickness: 165 micrometers @ 400g/m^2.

6.1.1 Paint application:

6.1.1.1 The primer and paint is normally applied by brush at supply viscosity (no reducer required).

6.1.1.2 The practical spreading rate of the primer and paint is a function of the ambient temperature, wind velocity and the application technique, but will generally fall in the range of 400g/m^2 in low to mild corrosive areas, and 500g/m^2 in severely corrosive areas.

6.1.1.3 Once the applied coat of primer/paint is touch dry, the next coat of paint may be applied.

6.1.1.4 If painted steelwork is to be bolted onto structures, it is imperative that the paint has been allowed to hard dry before the steelwork is bolted onto structures. This is to prevent the soft paint being damaged when tightening the bolts securing the steelwork to the structures.

6.2 Powder Coating System.
The powder-coating process shall be in accordance with SABS 1274 type 4: Corrosion-resistant coatings for interior use and using the thermosetting type high gloss coatings.

7.0 COATINGS AND WORKMANSHIP

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

7.2 Coatings shall not be applied under conditions that may be detrimental to the effectiveness of the coating or the appearance of the painted surface.

7.3 When examined visually, the finished products shall have a uniform appearance and shall show no sign of damage. Damaged areas shall be repaired coat for coat to obtain the desired finish.

TENDERER'S SIGNATURE……

DATE……

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SOUTH AFRICAN TRANSPORT SERVICES
ELECTRICAL ENGINEERING

SPECIFICATION NO.
CEE.0017.83

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x This issue cancels Specification x
x No. ENW-F3A-3 August 1979 x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

PROVISION OF FOUNDATIONS FOR ELECTRIFICATION MASTS

This Specification covers bolt group type foundations for electrification masts for the South African Transport Services.

INDEX

1.0 SCOPE

This specification covers the S.A. Transport Services' requirements for the setting out of the location for the foundations, excavation for mast foundations, setting and positioning of foundation top boxes, casting of the concrete, removal of foundation top boxes and the excavation for and planting of stay rods and anchor foundations.

2.0 REFERENCES

2.1 The following are referred to herein :-

2.1.1 DRAWINGS : S.A. TRANSPORT SERVICES

CEE-TQ-1	Foundation for raking leg. (I-mast)
CEE-TQ-17	Foundation small type top box. (I-mast and universal column)
CEE-TQ-23	Mast Foundation (cross catenary construction)
CEE-TQ-24	Foundation bolt group (cross catenary construction)
CEE-TQ-25	4 x M36 Foundation bolt group (203 x 152 I-mast and 206 x 204 universal columns)
CEE-TQ-27	Foundation (Rail masts)
CEE-TQ-28	M36 foundation bolt group (Rail mast)
CEE-TQ-29	EXM36 Foundation Bolt Group (229 x 178 I-mast and 216 x 206 universal columns)
CEE-TQ-30	M36 Extention hook (Foundation bolt group)
CEE-TQ-34	4 x M36 foundation bolt group (Rail mast lattice bridge structures)
CEE-TQ-35	Foundations : Lattice bridge; rail and angle types (4 x M36 and 6 x M36 bolt groups)
CEE-TQ-36	Foundation bolt group 6 x M36 (Angle section.) Lattice bridge mast)
CEE-TQ-37	Foundation arrangement for A-frame tension bridges (I-beams and universal columns)
CEE-TQ-38	Foundation bolt groups : Tension bridge and heavy duty anchor masts. (I-beams and universal columns)
CEE-TQ-43	Stay wire, cast anchor, foundations.
CEE-TQ-45	Foundation bolt group (Terminating and switch structure at substations)
CEE-TQ-46	Foundations (Switch structure at substations)
CEE-TQ-55	Foundations for raking leg (Universal columns)
CEE-TMB-44	Erection of raking leg. (Rail mast. Clamp on construction)
CEE-TW-150	Top box racking leg foundation for railmast
CEE-TW-556	Top box, foundation, raking leg, I-section mast and universal column
CEE-TW-497	Top Box (Foundation for switch structure at substations)
CEE-PFD-24	Stay wire anchoring arrangement for transmission lines and E/W on 3 kV DC structures

2.1.2 SPECIFICATIONS : S.A. TRANSPORT SERVICES

CEE-M4A-41 : Tendering
S420 : Specification for concrete work.

3.0 METHOD OF TENDERING

3.1 Tendering shall be accordance with S.A. Transport Services specification CEE-M4A-41.

4.0 APPENDICES

4.1 Appendix 1 : Schedule of material supplied by the S.A. Transport Services. (See also clause 6.0).

4.2 Appendix 2 : Schedule of estimated quantities and prices.

4.2.1 The tenderer shall base his prices on the estimated quantities shown. His unit prices shall be inserted. Section and station layout drawings will be issued shortly before work is commenced unless otherwise specified in the schedule of requirement appendix No.4.

4.3 Appendix 3 : Drawings

This appendix lists all drawings accompanying the tender documents.

4.4 Appendix 4 : Schedule of requirements

This appendix details the schedule of requirements, special requirements and clarification of certain clauses.

5.0 MATERIAL TO BE SUPPLIED BY THE CONTRACTOR

5.1 The contractor shall supply all material required for excavations, mast foundations and stay anchors unless specifically mentioned in appendix 1 : Schedule of material supplied by the S.A. Transport Services.

6.0 EQUIPMENT AND MATERIAL TO BE SUPPLIED BY THE S.A. TRANSPORT SERVICES

6.1 The S.A. Transport Services will supply to the Contractor free of charge, and as indicated in the Schedule of Material Appendix No. 1 supplied by the S.A. Transport Services, a number of steel shuttering boxes for forming the exposed portion of the foundation bolts. These may not be sufficient for the contract, in which case the Contractor shall arrange at his own cost to obtain further boxes and templates of an identical pattern.

6.2 All such equipment supplied by the S.A. Transport Services shall be returned in the condition in which it was supplied, failing which, the Contractor shall be liable for the cost of replacement or repair.

6.3 Other material may be supplied by the S.A. Transport Services for foundations, in which case it will be detailed in the aforementioned Schedule. (Appendix No.1).

7.0 GENERAL INFORMATION

7.1 The Contractor shall commence work within the period specified in the Schedule of Requirement Appendix No.4. The completion period shall be as indicated in the E5 Elect contract agreement.

7.2 The standard foundation spacing on tangent track will be 67 metres ± 100 mm or 70 metres ± 100 mm where physical features permit unless otherwise specified in the schedule of requirement appendix No.4. Foundation to track Centres in the section are usually between 2,75 m and 3,7 m while in station precincts the centres are located to suit physical features. On banks, these centres will generally require the use of formwork outside the formation, the cost of which shall be included in the contractor's tender prices.

7.3 All foundations shall be cast on site. In normal ground conditions standard type foundations shall be provided unless otherwise approved.

7.4 "Groups of Foundations" shall mean foundations for single or multiple portal structures and tension bridges.

7.5 The term "approved" shall mean approved by the Engineer.

8.0 SURVEY

8.1 The Contractor shall set out the location of foundations from plans or survey marks on the rail or as directed by the Engineer.

8.2 Where foundations are in pairs or groups, levels and distance between centres are critical and a tolerance of 6 mm is required unless otherwise directed. Careful attention shall also be given to alignment and parallelism.

9.0 EXCAVATIONS

9.1 The Contractor shall excavate for electrification mast foundations to such depths and to the dimensions indicated on the plans or as directed by the Engineer. The walls of the excavated holes shall not deviate from the perpendicular by more than 100 mm.

9.2 The Contractor shall ensure that track ballast is not contaminated by excavated material. If necessary, he shall supply at his cost, sheets with which to cover the ballast to prevent contamination. Such sheets shall be of such a material and so laid as not to constitue a hazard to passing trains. Failure to observe these precautions may necessitate the cleaning of ballast by Transport Services staff, the cost of which shall be to the Contractor's account.

9.3 LOOSE GROUND

9.3.1 In loose ground and on banks suitable boxing or other means of supporting the walls of the excavation shall be provided by the Contractor.

9.3.2 In areas where high water table or non-cohesive material does not allow for vertical sides to be excavated due to walls collapsing, foundation bottom boxes of wood or corrugated iron will have to be provided.

9.4 HARD ROCK

9.4.1 At locations where hard rock is encountered, a reduction in the depth of foundations may be permitted. The Engineer, or his deputy, shall approve all locations necessitating a reduction in foundation depth.

9.5 PRECAUTIONS

9.5.1 Excavation shall be concreted as soon as possible and in no circumstances may excavations be left near running lines without adequate precautions.

9.5.2 Excavations shall be suitably covered whenever work is not actually in progress and side drains shall not be blocked.

9.5.3 Where excavations are undertaken in any area in which the S.A. Transport Services staff is employed, the aforementioned covering shall be capable of withstanding a mass of 100 kg .

9.6 FOUNDATION CONDITIONS : TERMINOLOGY

9.6.1 "Soil" shall mean material which can be excavated by means of pick and shovel only.

9.6.2 "Non-cohesive material" shall mean material in which it is not possible to excavate a hole with vertical sides by reason of the sides collapsing. This shall apply whether the material collapses in the dry state or as a result of water-logging.

9.6.3 "Soft rock" shall mean broken, friable or soft rock which can be excavated by means of a mechanical excavator, paving breaker or moil point.

9.6.4 "Hard rock" shall mean material which can only be excavated by blasting or drilling and splitting. This shall include non-reinforced concrete.

9.7 Should cuttings require to be widened to accommodate foundations or deviations of the table drains, the cutting shall be set back for its full depth and at the same slope as the original cutting. This will only apply to cuttings in soil or non-cohesive material. (See also clause 21.1.2).

9.8 Work shall be completed progressively and difficult foundations shall not be skipped without permission.

10.0 SETTING AND POSITIONING OF FOUNDATION TOP BOXES AND BOLT GROUPS

10.1 SETTING

10.1.1 The means of obtaining the correct position and level specified for all foundations shall be the Contractor's responsibility.

10.1.2 The difference in level across a finished foundation top shall not exceed 3 mm .

10.1.3 All bolt groups used shall be checked for any misalignment and adjusted if necessary so that the tops of the bolts are approximately at the same level. The permissible tolerance on the top rectangle between outer bolts is $\pm$ 1 mm . This tolerance is also applicable to the diagonals of the corner bolts. A tolerance of 5 mm between the highest and lowest bolt in the group is permitted.

The bolt group shall be positioned so that the bolts project 70 mm to 90 mm above the top of the foundation.

10.2 SHUTTERING

10.2.1 In certain cases it may be necessary for the Contractor to cast foundations in sections where the formation earthworks are partially complete or have not been started. In such sections the foundations may protrude above ground level more than 600 mm, and additional formwork will be required to raise the foundation shuttering box to the required level.

10.2.2 Such additional formwork shall be manufactured and supplied by the Contractor in interlocking units of 200 mm height capable of being attached to one another and the foundation box. The foundation box when used in conjunction with extension boxes, shall still be capable of being levelled by jack screws. In the case of firm ground or rock, the overall depth of the foundation block shall remain constant, with the provision that no foundation shall be less than 1 000 mm in firm ground or rock. In poor ground the overall depth of the foundation block shall be increased at the discretion of the Engineer, to prevent movement of the block during subsequent earthworks operations. In such cases the foundation bolts shall be lengthened by adding sufficient extensions. As per extension hook drawing No. CEE-TQ-30.

10.2.3 Cover over foundation bolts in the buried portion of the foundation shall be not less than 150 mm .

10.2.4 Removal of material from bank slopes for propping or supporting foundation boxes, filling sandbags, etc., is expressly forbidden.

10.3 All excavations, with the foundation top boxes set in position, will be inspected by the Engineer or his deputy before any concrete is poured.

10.4 All screw threads shall be thoroughly cleaned so that no difficulties are experienced when the mast is bolted to the completed foundation. A film of grease shall be applied to the threads when the foundation is completed.

11.0 CASTING OF FOUNDATIONS

11.1 All concrete work shall be undertaken in terms of Specification S420 Concrete used in mast foundations shall have a specified concrete strength of 21 MPa at 28 days.

11.2 The method of curing the concrete in foundations shall be as specified in Clause 3.3 of Specification S420.

11.3 Concrete shall be well vibrated and the foundation box shall be overfilled so that any shrinking of the concrete during setting will not lower its level below the top surface of the box. Over-vibration of the concrete shall be avoided and water shall be prevented from settling against the inside walls of the box. The method used for water removal shall be in agreement with the Engineer. The bolt group template shall be removed and the concrete shall be screeded to the level of the top of the foundation box after sufficient time has elapsed for the concrete partially to set. The Contractor shall ensure that the top surface is neither concave nor convex in the vicinity of the foundation bolts.

12.0 REMOVAL OF FOUNDATION BOXES AND COMPLETION OF WORK

12.1 The top box shall be carefully removed before the concrete is completely dried so as to avoid damage to the faces and edges of the foundation. The S.A. Transport Services reserves the right to reject any foundation showing an abnormal amount of stone in the sides of the foundation, or "honey combing", after the top box is removed.

12.1.1 The Contractor at his cost shall remove the rejected foundation, which shall thereafter be replaced by him in terms of this specification.

12.2 After removal of foundation boxes the Contractor shall consolidate material around all completed work. All open excavation work shall be back filled in 150 mm layers and rammed. All surplus material, soil, etc., shall be disposed of outside cuttings and all side drains and mounds fully restored.

13.0 MARKING OF FOUNDATIONS

13.1 An identification number, particulars of which will be provided by the Engineer, shall be stencilled on each foundation by the Contractor.

14.0 STANDARD UNIVERSAL COLUMN AND I-BEAM FOUNDATIONS

14.1 The standard foundation shall be cast as per Drawing No. CEE-TQ-17, with bolt groups in accordance with Drawing No. CEE-TQ-25 (4 bolt) or CEE-TQ-29 (6 bolt) as directed.

14.2 The normal height of these foundations shall not be less than 225 ± 25 mm above formation level nor more than 350 mm below rail level, except in station yards or where otherwise directed. In these cases the foundations shall be raised to rail level or as directed by the Engineer.

14.3 Foundations on high level platform shall be 1 000 mm above rail level and at a distance of not less than 4 700 mm from track centreline.

15.0 STANDARD RAIL MAST FOUNDATIONS

15.1 Standard rail mast foundations shall be cast as shown on Drawing No. CEE-TQ-27 with bolt groups in accordance with Drawing No. CEE-TQ-28.

15.2 The normal height of these foundations shall not be less than 225 ± 25 mm above formation level nor more than 500 mm below rail level, except in station yards or where otherwise directed. In these cases the foundation shall be at rail level or as directed by the Engineer.

15.3 Foundations in high level platforms shall be 1 000 mm above rail level and at a distance of not less than 4 800 mm from track centreline.

16.0 STAYS (BACK-GUYS)

16.1 Where stays for overhead track equipment are indicated the Contractor shall excavate for, and cast the anchor foundation, in accordance with drawing No. CEE-TQ-43. Stays for earth wires shall be in accordance with drawing No. CEE-PFD-24. The stay shall incorporate insulation. On completion of installation the excavation shal be closed and the fill consolidated to at least the density of undisturbed soil.

17.0 RAKING LEG FOUNDATION

17.1 These foundations shall be cast using the special top boxes supplied by the S.A. Transport Services in association with a standard cast foundation as shown in drawing CEE-TQ-1 and CEE-TW-556 for I-beam, CEE-TQ-55 and CEE-TW-556 for universal column and CEE-TMB-44 and CEE-TW-150 for railmasts respectively. Levels shall be taken from the associated mast foundations.

17.2 The horizontal dimensions of 2 900 mm, 3 110 mm and 2 665 mm for I-beam, universal column masts and rail masts respectively are critical and a tolerance of ± 6 mm shall be maintained. The centre line of the raking leg foundation shall be at right angles to the associated foundation. (a maximum deviation of 12 mm shall be permitted from the right angle line).

18.0 LATTICE BRIDGE FOUNDATION

18.1 These foundations shall be cast as shown in drawing No. CEE-TQ-35 with bolt groups in accordance with drawing No. CEE-TQ-36 and CEE-TQ-34.

19.0 A-MAST TENSION BRIDGE FOUNDATIONS

19.1 These foundations shall be set up in groups of four in accordance with Drawing No. CEE-TQ-37 in rectangular arrangement and bolt group to Drawing CEE-TQ-38. A maximum of 6 mm tolerance on foundation centres will be permitted. The tolerance will also apply to the two diagonals of the rectangle. The edges of foundations in the group shall be parallel and in a line.

19.2 The Contractor shall set up the boxes in such a manner that the foundations are 100 mm above rail level unless otherwise directed.

20.0 SWITCH STRUCTURE FOUNDATIONS (AT SUBSTATIONS)

20.1 The abovementioned foundations shall be cast as shown in drawing No. CEE-TQ-46 with bolt groups in accordance with drawing No. CEE-TQ-45.

21.0 CROSS CATENARY MAST FOUNDATIONS

21.1 The abovementioned foundations shall be cast as shown in Drawing No. CEE-TQ-23 with bolt groups in accordance with Drawing No. CEE-TQ-24.

21.2 The normal height of these foundations shall be level with the highest rail of the group of rail tracks to be spanned by the cross catenary wire, except where otherwise directed.

22.0 INSPECTION AND TESTS

22.1 INSPECTION

22.1.1 All excavations, with the foundation top boxes set in position, will be inspected by the Engineer or his deputy before any concrete is poured.

23.0 PAYMENT OF EXCAVATIONS AND MAST FOUNDATIONS

23.1 PAYMENT OF EXCAVATIONS

23.1.1 The schedule of estimated quantities and prices, appendix No. 2 provides for separate unit rates for various types of material excavated with respect to foundations (see also clause 9.6) and the contractor will be paid according to the rates applicable to, and volume of, each component material.

23.1.2 Excavation of material with respect to clause 9.7 will be measured separately from the foundation excavations.

23.1.3 Excavations for all types of foundations will be measured according to the dimensions shown on the relevant drawings, unless otherwise instructed by the Engineer. Overbreak will not be paid for.

23.2 PAYMENT OF MAST FOUNDTIONS

23.2.1 Payment for concrete work will be made per cubic metre at the rate quoted in the Schedule of estimated quantities and prices measured to exact dimensions specified or directed. This rate shall include curing foundations. Excessive concrete due to overlarge excavations will not be paid for, except as in 22.2.2 hereunder.

23.2.2 Where excavations have been blasted, the S.A. Transport Services will pay the Contractor for concrete in overbreak up to a maximum of 150 mm in excess of the nominal line. Where overbreak exceeds this limit the Contractor will be permitted to stonepack the overbreak in a neat and firm fashion before casting, save that this will not be permitted on the side of the excavation adjacent to track. No payment will be made for such stone packing, or for overbreak in excess of 150 mm .

23.2.3 Payment for stays will be made at the unit rates quoted in the Schedule of estimated quantities and prices.

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SOUTH AFRICAN TRANSPORT SERVICES

ELECTRICAL ENGINEERING

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 1

SPECIFICATION FOR THE PROVISION OF FOUNDATIONS FOR ELECTRIFICATION MASTS

SCHEDULE OF MATERIAL SUPPLIED BY THE SA TRANSPORT SERVICES

ITEM	DESCRIPTION OF MATERIAL	QUANTITY
1	Steel shuttering box for universal columns, I-masts	
2	Template jig for foundation bolts	
3	Raking leg shuttering box	
4	A-frame shuttering box	
5	Switch structure top box (at substations)	
6	Template jig for A-frame foundation bolts	
7	Foundation bolts complete with flat washers and nuts. (Note bolts supplied loose with separate transverse frames to be wired on site)	

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SOUTH AFRICAN TRANSPORT SERVICES

ELECTRICAL ENGINEERING

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 2

SPECIFICATION FOR THE PROVISION OF FOUNDATION FOR ELECTRIFICATION MASTS
SCHEDULE OF ESTIMATED QUANTITIES AND PRICES

ES

The Tenderer shall base his tender on the estimated quantities given in this schedule and the rates inserted therein by the Tenderer. Contract payments will be calculated on actual measured quantities and the tendered rates.

Columns are provided for both labour and material rates. When either of these is not applicable by reason of the labour/material being supplied by others, the appropriate space will be cancelled. The Tenderer shall insert prices for all items except where so cancelled.

Item 5 of the schedule shall apply to mast foundations the tops of which are between 150 mm and 600 mm above formation or ground level. Where the latter dimension is exceeded, item 6 shall apply and shall be additive to item 5.

Tendered prices shall be inclusive of General Sales Tax. Any rise or fall in the General Sales Tax shall be regarded as being allowed for in relevant indexes of the contract price adjustment formula.

Tenderers are free to subdivide composite items into component items and to quote separately for each component item.

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 2

ITEM	DESCRIPTION	DRAWING	UNIT	ESTIMATED QUANTITY	LABOUR UNIT	LABOUR TOTAL	MATERIAL UNIT	MATERIAL TOTAL	TOTAL LABOUR & MAT.
	Excavation for mast foundation, stay wire anchor, height gauge pole or cable trench, in soil.		m^3						
	Ditto, non-cohesive material.		m^3						
	Ditto, soft rock.		m^3						
	Ditto, hard rock.		m^3						
	Setting up foundation top box, setting up bolt group, inclusive of additional formwork on banks where necessary, for standard universal column, rail, lattice bridge or A-frame mast.	CEE-TM-69/1 ENW-E1S-2	Each Each						
	Setting up raking leg foundation box, inclusive of additional formwork on banks where necessary.	CEE-TW-25	Each						

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 2

1 DESCRIPTION	DRAWING	UNIT	ESTIMATED QUANTITY	LABOUR UNIT	LABOUR TOTAL	MATERIAL UNIT	MATERIAL TOTAL	TOTAL LABOUR & MAT.
Supply and setting up of additional formwork required for item where foundation top to ground level exceeds 600 mm .		Per unit 200 mm high						
Plant stay bolt complete, backfill and consolidate. (Clause 11 of Spec. ENW-F3A-3)	CEE-PFD-24	Each						
Supply bolt set up foundation hook. (CEE-TQ-53)	CEE-TQ-43 Case 1	Each						
Supply bolt groups. A-frame complete. (Tension and compression leg)	CEE-TQ-38	Each						
Supply bolt groups. Universal column mast 4 bolt group.	CEE-TQ-25	Each						
Supply bolt groups. Universal column mast 6 bolt group	CEE-TQ-29	Each						
Supply bolt groups. Switch structure (at substations).	CEE-TQ-45	Each						

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 2

1	DESCRIPTION	DRAWING	UNIT	ESTIMATED QUANTITY	LABOUR UNIT	LABOUR TOTAL	MATERIAL UNIT	MATERIAL TOTAL	TOTAL LABOUR & MAT.
	Supply bolt groups. Rail mast.	CEE-TQ-28	Each						
	Supply bolt groups. Lattice bridge mast	CEE-TQ-36	Each						
	Provide, transport to site and place, concrete for items		m^3						
	Screed level and trowel where applicable. Apply number to finished foundation.		Each						
	Shift camp at the Administration's request.		Item						
	Cast out of course foundations on engineer's instructions up to five in number and 20 km from current work site : extra per km on item 1.		km						
	Ditto, extra on item 2.		Km						

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 2

:M	DESCRIPTION	DRAWING	UNIT	ESTIMATED QUANTITY	LABOUR UNIT	LABOUR TOTAL	MATERIAL UNIT	MATERIAL TOTAL	TOTAL LABOUR & MAT.
	Ditto, extra on item 3.		Km						
	Ditto, extra on item 4.		Km						
	Ditto, extra on item 5.		Km						
	Ditto, extra on item 14.		Each						
	Plant pole for height gauge and consolidate.		Each						
	Plant stay wire anchor and consolidate (to Spec. ENW-T6M-1).		Each						
	Foundation in hard rock. Drill 1 m into rock, supply and fit 25 mm hooked tie-pin with expanding nut.		Each	1					

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 2

M	DESCRIPTION	DRAWING	UNIT	ESTIMATED QUANTITY	LABOUR UNIT	LABOUR TOTAL	MATERIAL UNIT	MATERIAL TOTAL	TOTAL LABOUR & MAT.
	36 mm stay bolt in hard rock. Drill 1 m into solid rock, fit 36 mm expanding bolt alternatively for wedge and cement with epoxy cement.		Each	1					
	16 mm stay bolt, ditto		Each	1					
	Supply and install permanent sheet steel shuttering box for non-cohesive soil.		Each	1					
	Where foundation obstructs table drain, deviate drain around foundation, with smooth bends, in soil.		per foundation	10					
	Ditto, in soft rock		ditto	3					

SPECIFICATION NO. CEE.0017.83

APPENDIX NO. 2

M	DESCRIPTION	DRAWING	UNIT	ESTIMATED QUANTITY	LABOUR UNIT	LABOUR TOTAL	MATERIAL UNIT	MATERIAL TOTAL	TOTAL LABOUR & MAT.
	Ditto, in hard rock		ditto	3					
	TOTAL :								

WITNESSES :

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WITNESSES :

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SIGNATURE OF TENDERER.

DATE : .....

.....
CHIEF ELECTRICAL ENGINEER

DATE : .....

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SOUTH AFRICAN TRANSPORT SERVICES

ELECTRICAL ENGINEERING

SPECIFICATION NO. CEE.0017.83

APPENDIX 3

TITLE	DRAWINGS	DRAWING NO.

CHIEF ELECTRICAN ENGINEER
JOHANNESBURG

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SOUTH AFRICAN TRANSPORT SERVICES
ELECTRICAL ENGINEERING

SPECIFICATION NO. CEE.0017.83

APPENDIX 4

SCHEDULE OF REQUIREMENTS