



VOLUME 3 – Bill of Quantities
Watershed 132kV Line diversions Project
ID: CTXQ0827

NED
NWOU-AC
Rev 0

INDEX :

DESCRIPTION		PAGE	Attached Y/N
1. 1.1	Primary Plant Design Bill of Quantities Design Bill of Quantities	2	Y

Comments:

The following document contains the Bill of Quantities information needed to divert the 132kV Kingbird lines from Watershed to Sephaku, Klerksdorp North, Makokskraal and Zeerust. e proposed Bophirima substation. 16kA OPGW shall be installed on the watershed Sephaku line and Wolf on the other lines.

Please Note: Contractor to ensure adherence to and not limited to all construction regulations, OSH Act, EMP contained in this document

C1 Revision Details:
Rev.0

Compiled By

Name: Ayanda Nzo **Tel:** 018- 464 7641



VOLUME 3
DETAIL SCOPE OF WORK
Watershed 132kV Line diversions
Project ID: CTXQ0827

NED
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Rev 0

INDEX

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.1 SCOPE OF WORK OVERVIEW

This document consists of all the information needed to divert the following 132kV lines at watershed:

- Watershed-Sephaku 132kV
- Watershed-Klerksdorp North 132kV
- Watershed-Makokskraal 132kV
- Watershed-Zeerust 132kV

The structures to be used are Mono Pole structures supporting a Kingbird conductor and the Chicadee earth wire.

This design will not include the shield wire. The shield wire design will be done by NED: Control Plant.


Please Note:

- All structures to be labelled.
- All tenders to include a health and safety plan.
- Critical information regarding this line design can be found in Volumes 1, 2, 3, 4, 5 of this design document.
- Line crossing labels must be installed as indicated in volume 2.
- The Project Manager must make sure that it is clearly indicated to and understood by the contractor in the tender documents which materials need to be supplied and which materials will be supplied by Eskom.
- All items in the Bill of Quantities which are not shaded-out should be quoted in. If an item does not contain a specific Rand value, it will be accepted that the price for that item is indeed included in the rest/total of the Tender pricing.
- All materials supplied by the contractor shall be in accordance with Eskom standards and specifications and the Eskom buyers' guide. All materials shall be approved by Eskom and be marked with the manufacturers' logo/trade mark and specific part number.

Revision Details: Rev. 0

Compiled By

Name:	Thando Landela	Tel:	012 484 5273	Date:	November 2015
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	HV Line Detailed Design Package Volume 3 - Bill of Quantities	Template Identifier		Rev	Rev 7 March 2014				
		Record Identifier		Rev					
		Authorization Date							
		Review Date							
<u>Watershed132kV Line deviation</u>									
1 Primary Plant Specifications									
1,1 Bill of Quantities - Watershed 132kV lines deviation									
Please note that no tender will be considered if the provided bill of quantities is not fully completed. The quantities provided in the schedules are estimated figures and are subject to be changed by the design engineer only									
Item	Refer	Description of the item	Unit	Qty	Rate		Total		Price (R)
					Material	Labour	Material	Labour	
A	SABS 1200A	PRELIMINARIES							
A.1		<u>Eskom's specific requirements</u>							
							-	-	-
							-	-	-
A.1.1		<u>Contractor's fixed-charge items:</u>							
A.1.1.2		Contractual requirements	item	1			-	-	-
A.1.1.3		Establishment of construction camp					-	-	-
A.1.1.4		Establishment of facilities in construction camp such as plant, sheds, water, electricity, lighting, etc	item	1			-	-	-
A.1.1.5		Other fixed-charges (Specify):							
A.1.1.6		1) Establishment of construction plant	item	1			-	-	-
A.1.1.7		2)	item				-	-	-
A.1.1.8		3)	item				-	-	-
A.1.1.9		Removal of site establishment	item	1			-	-	-
A.1.3		<u>Contractor's time related items:</u>							
A.1.3.1		Contractual requirements	mnth	3			-	-	-
A.1.3.2		Operation & maintenance of facilities	mnth	3			-	-	-
A.1.3.3		Supervision	mnth	3			-	-	-
A.1.3.4		Company & head office overhead costs	mnth	3			-	-	-
A.1.3.5		Other (Specify):							
A.1.3.6		1) Accommodation and LOA	mnth	3			-	-	-
A.1.3.7		2) Personnel transport	mnth	3			-	-	-
A.1.3.8		3) Cost of water supply for construction purposes	mnth	3			-	-	-
							-	-	-
A.1.4		<u>Contractor's expenses regarding Health and Safety</u>							
A.1.4.1		Contractor's cost to comply to the Construction Regulation (Volume 5, Annexure F) and the Health and Safety Specification (Volume 5, Annexure E)	item	1			-	-	-
A.1.4.2		Cost for workers to undergo safety and induction programs for the purpose to work on the property where necessary.	item	1			-	-	-
A.1.4.3		Cost to comply to the Environmental management Plan	item	1			-	-	-
							-	-	-
Subtotal carried to Item A1 of Summary							R	-	-

Item	Refer	Description of the item	Unit	Qty	Rate		Total		Price (R)
					Material	Labour	Material	Labour	
A		PRELIMINARIES continued							
A.2	Test Joint								
Supply all material and perform tests at an approved body as indicated below. Refer to Volume 4 for the required material.									
A.2.1	04TB-040	Supply all material and test complete Kingbird asse	each	1			-	-	-
A.2.1	04TB-040	Supply all material and test complete Wolf assemb	each	1			-	-	-
A.2.2	04TB-040	Supply all material and test complete 19/2.65 wire	each	1			-	-	-
Subtotal carried to Item A2 of Summary							R	-	-
Item	Refer	Description of the item	Unit	Qty	Rate		Total		Price (R)
					Material	Labour	Material	Labour	
B		BUSH CLEARING							
B.1	ESKASABG 3 Rev1 & DISTIZAC2	Project Engineer to identify the extent of bush clearing needed and quote to do bush clearing on the whole line in accordance with the standard.	Item	0			-	-	-
B.4	D-NT00004	Install Farm Gates (for fences crossed by line)	each	0			-	-	-
Subtotal carried to Item B of Summary							R	-	-
Item	Refer	Description of the item	Unit	Qty	Rate		Total		Price (R)
					Material	Labour	Material	Labour	
C		LINE CONSTRUCTION							
C.1		Foundations							
Soil nominations to be confirmed by the contractor. Project manager to be immediately consulted should the excavation vary from the nomination done by the geotechnical engineer.									
		Nominations of foundation types to be done on site by Civil Engineer. Civil Engineer to specify which of the foundation types must be used for each structure. Note: Design calculations are done on 120% of the structures (80% type 3, 20% rock)							
		Nomination of foundation type as determined by registered civil engineer and signed off by him/her in Volume 5, Annexure D, Construction Report.	item	1,00					-
Excavate, barricade, dispose of excavated material, transport to pole position imported material, supply and install complete foundations for soil type 2 on the following structures:									
Intermediate 3 pole Structures D-DT-7617									
C.1.1	D-DT-7850s2	Pole, St 132kV Int 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m) foundation	set	1			-	-	-
C.1.2	D-DT-7850s2	Pole, St 132kV Int 3 pole 18m,20m,18m 23kN (Bottom Att 15.8 m) foundation	set	1			-	-	-
Stayed Strain Planted Structures D-DT-7618 (2x7618c and 1x7618d)									
C.1.3	D-DT-7851s3	Pole, St 132kV Str 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m) foundation	set	2			-	-	-
Stayed Strain Planted Structures D-DT-7618 (1x7618d)									
C.1.4	D-DT-7851s3	Pole, St 132kV Str 3 pole 20m,22m,20m 23kN (Bottom Att 17.4 m) foundation	set	1			-	-	-
Self support Strain Structures (non-stock items)									
C.1.5	D-WC-7602s2	Pole, St 132kV Strain (2 degrees 18 m) (Bottom Att 11 m) self support foundation	ea	2				-	-
C.1.6	D-WC-7602s2	Pole, St 132kV Strain (45 degrees 18 m) (Bottom Att 11 m) self support foundation	ea	5				-	-
C.1.7	D-WC-7602s2	Pole, St 132kV Strain (90 degrees 18 m) (Bottom Att 11 m) self support foundation	ea	2				-	-
C.1.8	D-WC-7602s2	Pole, St 132kV Str 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m) foundation	set	1					-
Subtotal carried to Item C1 of Summary							R		

Item	Refer	Description of the item	Unit	Qty	Rates		Totals		Price (R)
					Material	Labour	Material	Labour	
C LINE CONSTRUCTION continue									
C.2 Tower Earthing: Supply, install and bond tower earthing for the following structures:									
C.2.1		Boulder excavation - Class A	m3	1			-	-	-
C.2.2	SCSASABF9	Test footing resistance and share results with Engineer before installing the TPS	ea	15					
C.2.3	D-DT-0642	Excavate, supply and install complete 3 point star earth electrode (incl. rocky terrain). Please note that this item is a re-measurable based on footing resistance results	ea	15			-	-	-
C.2.4	SCSASABF9	Bond the Terminal structures to the substation earth mat by using 50 x 3mm flat Cu strap buried 1m deep, including excavation, supply, installation and backfilling.	m	150			-	-	-
Subtotal carried to Item C2 of Summary							R	-	-
Item	Refer	Description of the item	Unit	Qty	Rate		Total		Price (R)
					Material	Labour	Material	Labour	
C LINE CONSTRUCTION continue									
C.3 Erecting of Structures									
Assemble and erect the steel pole for the following structures at specified positions, including backfilling. Costs to include the connection of the stay wire to the stay rod assembly for the strain structures. NOTE: The cost to supply the structures should be included in the bill of materials.									
Intermediate 3 pole Structures D-DT-7617									
C.3.1	D-DT-7617	Pole, St 132kV Int 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m)	set	1			-	-	-
C.3.2	D-DT-7617	Pole, St 132kV Int 3 pole 18m,20m,18m 23kN (Bottom Att 15.8m)	set	1			-	-	-
Stayed Strain Planted Structures D-DT-7618 (2x7618c and 1x7618d)									
C.3.3	D-DT-7618	Pole, St 132kV Str 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m)	set	2			-	-	-
Stayed Strain Planted Structures D-DT-7618 (1x7618d)									
C.3.4	D-DT-7618	Pole, St 132kV Str 3 pole 20m,22m,20m 23kN (Bottom Att 17.4 m)	set	1			-	-	-
Self support Strain Structures (non-stock items)									
C.3.5	strsce0218kw110	Pole, St 132kV Strain (2 degrees 18 m) (Bottom Att 11 m) self support	ea	2				-	-
C.3.6	strsce4518kw110	Pole, St 132kV Strain (45 degrees 18 m) (Bottom Att 11 m) self support	ea	5				-	-
C.3.7	strsce9018kw110	Pole, St 132kV Strain (90 degrees 18 m) (Bottom Att 11 m) self support	ea	2				-	-
C.3.8	str3psce3518kw158	Pole, St 132kV Str 3 pole 16m,18m,16m 23kN (Bottom Att 15.8 m)	set	1					
Subtotal carried to Item C3 of Summary							R	-	-
15									
Item	Refer	Description of the item	Unit	Qty	Rates		Totals		Price (R)
					Material	Labour	Material	Labour	
C LINE CONSTRUCTION continue									
C.4 Stay Rod assemblies									
The soil types for each stay position shall be nominated by a professional civil engineer or suitably qualified person in accordance with DSP-34-1657 Please Note: Stays based Type 3 soil									
Installation of 113kN, 19/2.65 stay rod assemblies:									
C.4.1	D-DT-7325 s2	Excavate and transport imported material, barricade and dispose of excavated material, supply & install complete stay rod assembly for type 2 soil.	ea	21			-	-	-
Proof Load Testing of Stays: Contractor to do proof load test on a sample of stays. Contractor to supply proof loading specification (approved by professional engineer) to the Project Engineer 2 weeks after contract award.									
C.4.3		Proof load testing of 19/2.65 permanent stay assemblies	ea	6,3			-	-	-

Item	Refer	Description of the item	Unit	Qty	Rates		Totals		Price (R)	
					Material	Labour	Material	Labour		
C										
LINE CONSTRUCTION continue										
C.5 Dressing										
Dressing must include the supply, transport to specific pole position and installation of complete hardware assemblies including shieldwire hardware and bird perching brackets for the following structures:										
Intermediate 3 pole Structures D-DT-7617										
C.5.1	D-DT-7321 & 2NT 627	Pole, St 132kV Int 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m) foundation	set	1			-	-	-	
C.5.2	D-DT-7321& 2NT 627	Pole, St 132kV Int 3 pole 18m,20m,18m 23kN (Bottom Att 15.2 m) foundation	set	1			-	-	-	
Stayed Strain Planted Structures D-DT-7618 (2x7618c and 1x7618d)										
C.5.3	D-DT-7311 & D-DT-7321 & 2WT 1421-1	Pole, St 132kV Str 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m) foundation	set	2			-	-	-	
Stayed Strain Planted Structures D-DT-7618 (1x7618d)										
C.5.4	D-DT-7311 & D-DT-7321 & 2WT 1421-1	Pole, St 132kV Str 3 pole 20m,22m,20m 23kN (Bottom Att 17.4 m) foundation	set	1			-	-	-	
Self support Strain Structures (non-stock items)										
C.5.5	D-DT-7311 & D-DT-7321 & 2WT 1421-1	Pole, St 132kV Strain (2 degrees 18 m) (Bottom Att 11 m) self support foundation	ea	2				-	-	
C.5.6	D-DT-7311 & D-DT-7321 & 2WT 1421-1	Pole, St 132kV Strain (45 degrees 18 m) (Bottom Att 11 m) self support foundation	ea	5				-	-	
C.5.7	D-DT-7311 & D-DT-7321 & 2WT 1421-1	Pole, St 132kV Strain (90 degrees 18 m) (Bottom Att 11 m) self support foundation	ea	1				-	-	
C.5.8	D-DT-7311 & D-DT-7321 & 2WT 1421-1	Pole, St 132kV Str 3 pole 16m,18m,16m 23kN (Bottom Att 13.4 m) foundation	set	1						
Subtotal carried to Item C5 of Summary							R	-	-	-
C										
LINE CONSTRUCTION continue										
C.6 Documentation										
C.6.1		Complete all parts of the Construction Handbook that applies to the construction of the line (Volume 5, Annexure D)	item	1			-	-	-	
Subtotal carried to Item C6 of Summary							R	-	-	-

Item	Refer	Description of the item	Unit	Qty	Rates		Totals		Price (R)	
					Material	Labour	Material	Labour		
D STRINGING and REGULATION										
D.1 Stringing										
Please Note: Phase conductor shall be ordered by Eskom										
Please Note: Contractor to ensure the necessary strength and size of Pilot wire for the purpose of stringing. Cost to include temporary stays required for stringing purposes.										
String the following (length is for all three phases):										
D.1.1	TRMSCAAC1	Phase conductor - Single Kingbird	phm	6 486			-	-	-	
D.1.2		Closing spans - Single Kingbird	phm	414			-	-	-	
D.1.3		shield wire - wolf conductor	phm	2 300			-	-	-	
D.2 Line and Road Crossings										
D.2.1	TRMSCAAC1	Prepare temporary structures and do stringing for the following type of crossings: Allow for all HV and MV lines, roads, telecom, rail, etc. crossing as per the profile	each	6			-	-	-	
D.3 Joints										
D.3.1	D-ST-34 1207	Supply and install the following compression joints: Midspan joint - kingbird	ea	0			-	-	-	
D.4 Damage Repair										
Install repair sleeves for damaged conductors:										
D.4.1	D-ST-34 1207	Mid span repair sleeve	ea	Rate only			-	-	-	
D.5 Making Off and Regulation										
D.5.1	D-ST-34 1207	Making off phase conductor - Kingbird	ea	90			-	-	-	
D.5.2	D-ST-34 1207	Making off shield wire - wolf	ea	30			-	-	-	
D.5.3	D-ST-34 1207	Regulating - Kingbird	ea	90			-	-	-	
D.5.4	D-ST-34 1207	Regulating - wolf	ea	30			-	-	-	
D.6 Clamping In										
D.6.1	D-ST-34 1207	Clamping-in phase conductor Kingbird	ea	6			-	-	-	
D.6.1	D-ST-34 1207	Clamping-in shield wire conductor wolf	ea	2			-	-	-	
D.7 Vibration Dampers										
D.7.1	D-ST-34 1207	Supply and install asymmetrical dampers on the pt	ea	84			-	-	-	
Subtotal carried to Item D of Summary							R	-	-	-
Item	Refer	Description of the item	Unit	Qty	Rates		Totals		Price (R)	
E										
E.1 Pole Identification Labels										
E.1.1	D-DT-5050 s1	Supply and install for: Pole identification label	ea	15			-	-	-	
E.4 Phase Disks										
E.4.1	D-DT-5050 s2	Supply and install on terminal structures Substation Terminal structure	ea	12			-	-	-	
Subtotal carried to Item E of Summary							R	-	-	-
Item	Refer	Description of the item	Unit	Qty	Rates		Totals		Price (R)	
F										
F.1 Dismantle the following items and remove from site										
		Steel poles including foundations	ea	6			-	-	-	
		Conductor including hardware	m	2 000			-	-	-	
F.2 Lowering of earthwire attachment point										
		lower earthwire on lattice structure to correct Zeerust line clearance	ea	1			-	-	-	
Subtotal carried to Item F of Summary							R	-	-	-

1,2 Summary					
Item No	Description	Page	Total Material Cost (R)	Total Labour Cost (R)	Total Price (R)
A1	Eskom's specific requirements	1,00	-	-	-
B	BUSH CLEARING	2,00	-	-	-
C1	Foundations	2,00	-	-	-
C2	Tower Earthing		-	-	-
C3	Erecting of Structures		-	-	-
C4	Stay Rod assemblies	4,00	-	-	-
C5	Dressing	5,00	-	-	-
C6	Documentation	7,00	-	-	-
D1	STRINGING and REGULATION	8,00	-	-	-
E	LABELLING	8,00	-	-	-
F		9,00			
Total of above Prices excluding VAT		R			
Value added Tax		R	-	-	-
Total of the Prices including VAT		R	-	-	-

BOQ ACCEPTED BY :		
PRINT NAME	PROJECT ENGINEER	DATE
PRINT NAME	PORTFOLIO MANAGER - NED	DATE
PRINT NAME	PROGRAMME MANAGER	DATE
PRINT NAME	CONTRACTS MANAGER	DATE
PRINT NAME	PORTFOLIO MANAGER - PE	DATE
PRINT NAME	CONTRACTOR SIGNATURE	DATE

1.3 Works Information: Appendix A: Specifications and Standards

- This is a list of all the specifications and other documentation referenced or described as being part of the *Works Information*.
- This list includes publicly available standard specifications which may not be attached, but which are part of the *Works Information*.
- A detailed description of each part of the *Works* is given in Annexe C.

Table 1: Reference to detail specifications

Document	Rev./issue	Title and Publisher
		1. SABS Specifications
SABS 1083	1976	Aggregates from natural sources
SABS 82	1976	Bending dimension of bars for reinforced concrete
SABS 558	1973	Cast iron surface boxes and manhole and inspection covers and frames
SABS 1063		Earthing Rods, couplers and clamps
SABS 10240	1997	Hot dip (Galvanised) zinc coatings (In Part)
SABS ISO 1461	1999	Hot dip (Galvanised) zinc coatings (In Part)
SABS 135	1985	ISO Metric bolts, screws and nuts
SABS 675	1993	Zinc-coated fencing wire
SABS 677	1986	Non-pressure concrete pipes
SABS 626	1971	Portland blast furnace cement
SABS 471	1971	Portland cement
SABS 831	1971	Portland cement 15
SABS 986	1970	Pre-cast reinforced concrete culverts
SABS 1200	1986	Standard specification for Civil Engineering Construction
SABS 920	1985	Steel bars for concrete reinforcement
SABS 1186	1978	Symbolic safety sign
SABS 03		The protection of structures against lightning code of practice
SABS 1024	1974	Welded mesh for concrete reinforcing
		2. SABS Code of Practice
SABS 0144	1987	Detailing of steel reinforcement for concrete
SABS 0199		Earthing Rods, couplers and clamps
SABS 0198	1988	Installation of electric cables
SABS 0200		Neutral earthing in medium voltage industrial power systems
SABS 0157	1987	Quality Management systems
SABS 0400	1987	Standard Specification for the application of National building regulations
SABS 0100	1992	Structural use of concrete
SABS 0162	1993	The Structural use of steel
SABS 044	1963	Welding and Welding Symbols
SABS 0142	1987	Wiring of premises
		3. SABS Methods
SABS 863		Compressive strength of concrete
SABS 862		Slump of freshly mixed concrete
ESKPBAAD6		Environmental management policy
OPR 6204		Eskom Operating Regulations
DTOS 0071	0	Eskom Standard for Barricading
DTMG 0112		Guideline for the application of herbicides for weed eradication in substations
DTNG 0012		Guideline for the application of Herbicides for weed eradication in substations
ETP 023		Herbicide management policy
0.54/390	44	HV Yard Civil work - Standard Details
0.54/1790-1797	0	Label fixing detail
0.54/404	7	Label Types
SCSSCAAK3	0	Medium voltage indoor switchgear

SCSASAAA0	0	Passive and Active Fire Protection in Distribution Substation Yards
EVS 005	1	Quality requirements for quality related items and equipment
EVS 010		Quality requirements for quality related services
ESKSCAAA0	4	Specification for Outdoor, High Voltage Shunt Capacitor Installations
ESKASAA04	1996	Standard for Electric Protection and Fault Monitoring Equipment for Power Systems
ESKASAA0	0	Standard for Labelling of High Voltage Equipment
D-DT-5074	0	National Standard Control Building, Sheets 1 to 7
D-FS-887	7	Substation Civil work details
TRMASAAJ7	1	Earthing of Transmission Line Towers
SCSSCAAD3	1	Specification of Large Power Transformers up to 132 kV, in the Rating Range of 2.5 MVA to 80 MVA
SCSASABK3	0	Generic Substation Design
SCSASABF3	0	Distributions Group's Specific Requirements for the Use of Furniture in Substation Buildings
SCSSCAAQ4	2	Distributions Group's Specific Requirements for the Wiring of Breakers and In-built Current Transformers
SCSASAAQ1	2	Quality Control Process for the Checking of Distribution Substation Construction Before Handing Over for Commercial Operation.
ESKASAAC2	1	Management of Polychlorinated Biphenyl's (PCB)
ESKADAAO3		Corporate Directive for the Management of Polychlorinated Biphenyl's (PCB)
SCSPVABM9	0	Co-ordination of Safety on Capital Projects
SCSASABK2	0	Substation Earthing
SCSPVABF3	2	Occupational Health and Safety Requirements to be met by Contractors and Sub-Contractors Employed by Eskom.
D-DT-5085		Earthing Standard
		4. General National Standards and Acts
Act no. 43	1983	Conservation of Agricultural Resources Act.
NRS 008	1991	Enclosures to Cable Termination in Air: For rated a.c. voltages of 7,2 kV and up to and including 36 kV
Act no. 73	1989	Environmental Conservation act.
Act no. 31	1963	Fencing Act.
Act no. 122	1984	Forest Act.
TRH14	1985	Guidelines for road construction materials
Act no. 63	1970	Mountain Catchment areas act.
Act no. 85	1993	Occupational health and safety act.
SAISC	1990	South African Steel Construction Handbook
NWP 3109		Standard drawing practice
TMH1	1986	Standard methods of testing road construction materials
CSRA	1987	Standard Specifications for Road and bridge works
TRH4	1985	Structural Design of interurban and rural road pavements
		5. Eskom New Works Standards
NWS 1017		Accident Prevention
NWS 1431	1	Civil and Building works (Substations)
NWS 1215		Design for Battery Rooms
NWS 1109	0	Earthing of Transmission Line Towers
NWS 1494	3	Fire prevention and protection of contractors and Eskom premises on Engineering sites
NWS 1060		Injury prevention and protection
NWS 1116		Lethal Electrified Fence System
NWS 1031		Programming and progress monitoring services required from design consultants
NWS 1032		Programming and progress monitoring services turnkey and management contracts or consultants
NWS 1814/C1		Quality assurance requirements for civil and building contracts
NWS 1058	4	Safety at construction sites: Requirements to be met by Contractors
NWS 1531		Specification for Civil and Building Works

NWS 1607	1	Specification for electrical installations in buildings and associated cabling
NWS 1605	2	Specification for Lamps and Luminaires
NWS 1404	0	Substation steelworks and microwave tower manufacturing and erection
NWS 1512	2	Transmission Line towers and line construction
		6. General Eskom Standards
CEMS 0040	0	Control and Cutting of trees and bush for lines
0.54/393	20	Earthing Standard
ESKPVAAL7	2	Environmental impact assessment procedure for Eskom

1.4 Works Information: Appendix B List of contract drawings

List all drawings applicable to the *works* or the *asset* and temporary works, indicating whether they are Approved For Use (A.F.U.) or not.

Structure Drawings					
Item	Drawing Title	Drawing			Attch (Y/N)
		Number	Sht	Rev	
1.1			1	2	Y
1.2			1	3	Y
1.3	NWOU-STR - 3Pole, St 132kV Strain (35 deg 16m,18m,16m) (Bottom Attachment 15.8 self-support	NWOU-STR			N
1.4	NWOU-STR - Pole, St 132kV Strain (90 deg 18m)(Bottom Attachment 11 m)self-support	NWOU-STR			N
1.5	NWOU-STR - Pole, St 132kV Strain (2 deg 18 m) (Bottom Attachment 11 m) self-support	NWOU-STR			N
1.6	NWOU-STR - Pole, St 132kV Strain (45 deg 18 m) (Bottom Attachment 11 m) self-support	NWOU-STR			N
1.7	D-DT-7618 - Pole, St 132kV 3-Pole Strain Structure (16m,18m,16m) (Bottom Attachment 13.4 m)	D-DT-7618	1	2	Y
1.8	D-DT-7618 - Pole, St 132kV 3-Pole Strain Structure (20m,22m,20m) (Bottom Attachment 17.4m)	D-DT-7618	1	2	Y
1.9	D-DT-7617 - Pole, St 132kV 3-Pole Interm Structure (16m,18m 16m) (Bottom Attachment 13.4 m)	D-DT-7617	1	2	Y
1.10	D-DT-7617 - Pole, St 132kV 3-Pole Interm Structure (18m,20m,18m) (Bottom Attachment 15.8 m)	D-DT-7617	1	2	Y

Foundation Drawings					
Item	Drawing Title	Drawing			Attch (Y/N)
		Number	Sht	Rev	
Note: The following drawings are only guidelines. The actual foundations and stay assemblies to be used must be designed by a registered civil engineer.					
2.1	Pole, St 132kV Interm (16m,18m,16m) (Bottom Att 13.4 m) found	D-DT-7850	3	2	Y
2.2	Pole, St 132kV Interm (18m,20m,18m) (Bottom Att 15.8 m) found	D-DT-7850	3	2	Y
2.3	Pole, St 132kV Strain (16m,18m,16m) (Bottom Att 13.4 m) found	D-DT- 7851	3	2	Y
2.4	Pole found, St 132kV Strain (20m,22m,20m) (Bottom Att 17.4m)	D-DT- 7851	3	2	Y
2.5	Self-support Pole found, St 132kV Strain 550kNm	D-WC-7602	7	3	Y
2.6	Self-support pole found 132kV Strain 2500kNm	D-WC-7602	11	3	Y
2.7			3	2	Y
2.8			3	2	Y
2.09			3	2	Y
2.10			3	2	Y
2.11			3	2	Y
2.12			3	2	Y
2.13			3	2	Y
2.14			3	2	Y

Assembly Drawings					
Item	Drawing Title	Drawing			Attch (Y/N)
		Number	Sht	Rev	
3.1	Monopole foundation Cap and Earthing details for planted poles	D-DT-7857	1	2	Y
3.2	132kV Strain Assembly	D-DT7311	1	1	Y
3.3	Strain Jumper Assembly	D-DT-7321	1	3	Y
3.4	Intermediate Suspension Assembly	D-DT-7321	1	3	Y
3.5	Earth Wire Assembly – Non Insulated Strain	D-DT-7323	1	4	Y
3.6	Earth Wire Assembly – Non Insulated Intermediate	D-DT-7331	1	2	Y
3.7	Perching Bracket – Monopole Structures	D-DT-7347	1	3	Y

Detail Drawings					
Item	Drawing Title	Drawing			Attch (Y/N)
		Number	Sht	Rev	
4.1	Armour Grip Susp Unit Kingbird	D-DT-7033	1-3	3	Y
4.2	Armour Rod, HF Cond 23.61/24.79 Al	D-DT 7034	2	3	Y
4.3	Clamp,Trunnion L/Post Insul 13-27	D-DT-7010	1	2	Y
4.4	Socket-Tongue 16mm 120kN	D-DT-6061	1	8	Y
4.5	Cond,ACSR Kingbird 23.90D UNGRS	D-DT-3136	3	12	Y
4.6	Cond,ACSR Wolf 18.13D UNGRS	D-DT-3136	2	12	Y
4.7	Wire,Electrical:Earth CU-CLAD ST ;20 MM2	D-DT-3139	2	7	Y
4.8	Earth Rod Cu 1500x16D Threadless	D-DT-3091	1	5	Y
4.9	Set Screw, Hx Galv Nut+Wash	D-DT-3082	1-3	15	Y
4.10	Insul, L/Rod 132kV 120kN B/S 31C Comp	D-DT-7014	2	10	Y
4.11	Insul, Line Post 132kV 5.3kN D/E 31C	D-DT-7013	2	7	Y
4.12	Bracket, P/Top Inter SNG & DBL S/Wire Assy	D-DT-7048	1	0	Y
4.13	Insul, Shield Wire C+T 120kN	D-DT-7012	2	3	Y
4.14	Joint,M/Span Comp Kingbird 23.87	D-DT-7001	3	6	Y
4.15	Lug, Crimp Cu 50 SQ x M14 fixing Hole (as per D-DT-3102 but with M14 fixing hole)	McWade			Y
4.16	Shackle, Straight Bolt Type 120kN	D-DT-7017	1	5	Y
4.17	Clevis-Ball 16mm 120kN	D-DT-6059	1	9	Y
4.18	Sag Adjustor 120kN	D-DT-7042	1	6	Y
4.19	Shackle,Twisted Bolt Type 120kN	D-DT-7019	1	5	Y
4.20	Guygrip D/E St To Fit 19/2.65 Steel Wire	D-DT 7035	1	2	Y
4.21	Wire Strand,St 3X4.00 1100MPa	D-DT-7036	1	5	Y
4.22	Stayrod 133kN 2400X24 Adjust	D-DT 7023	2	15	Y
4.23	Clamp Shield M16 10.0-13.50	D-DT-7004	1	5	Y
4.24	Clamp,C D/End Assy K/Bird 23.88 ACSR	D-DT-7000	3	7	Y
4.25	Clamp Shield Wire 19/2.65	D-DT-7003	2	11	Y
4.26	Clamp, Earth Rod 16 RODPH/BRNZ	D-DT-3093	1	5	Y
4.27	Tower Identification Label	D-DT-5050	1	2	Y
4.28	Line Crossing Label	D-DT-5050s2	2	2	Y
4.29	PLATE, PH MKR blu w/blk B	D-DT-6114	1	5	Y
4.30	PLATE, PH MKR red w/blk R	D-DT-6114	1	5	Y
4.31	PLATE, PH MKR wht w/blk W	D-DT-6114	1	5	Y

1.5 Works Information: Appendix C List of other documents attached to this contract form

List all other documents which are attached and part of this contract so that a complete record exists of what the Parties agreed as constituting the contract. Do NOT include tenderer letters or any other document relating to the enquiry phase as the contract itself must reflect only what has been agreed as a result of the tender and its final acceptance.

Document No.	Rev.	Title
TRMSCAAC1		Transmission Line Towers and Line Construction standard
OHS Act		Occupational, Health and Safety Act and regulations (Act No.85 of 1993)
DST-34-1207		Eskom Standard on Sub-transmission lines Section 2: Conductors
DSP34-510		Eskom Distribution Specification – Part 6: Outdoor Post and Long rod insulators or new and refurbished power lines for 66kV and 132kV
DSP-34-2202		Eskom Specification: Outdoor Ceramic Post insulators for Systems with nominal voltages up to 765kV
SCSASABF9		Eskom Distribution Standard: Sub-transmission lines, Section 6: Earthing of sub-transmission line structures
DISASABL1		Eskom Distribution Standard: Sub-transmission lines, Section 3: Insulators
DSP-34-1204		Eskom Standard: Sub-transmission lines Section 4: Vibration Dampers
SCSASABK8		Eskom Distribution Standard Part 6: High Voltage lines, section 5: soil compaction for stay and pole foundations

2. Sequence of Events

NOTE:

- Install all towers
- String sections which do not require an outage
- On MTS 132kV Busbar outage install closing spans and string the remaining sections
- Test and commission lines

3. Technical Specifications

Note: Unless otherwise specified the material shall be in accordance to the specifications listed in the Eskom NEC Short Contract.

3.1 Preliminaries

3.1. A Work Specification

3.1. A.1 The contractor shall allow for the following specific requirements of Eskom:

- a) Office accommodation for meetings held on site.

3.1. A.2 In addition to the specific requirements of Eskom, detailed above, the contractor shall allow for his own preliminaries and/or overhead costs as required for the execution of the contract. It shall be divided into the following two sections:

- a) Fixed-charge items such as: (SABS 1200A - 8.3)
 - Contractual requirements.
 - Establishment of facilities on site such as plant, sheds, water, electricity, lighting, etc.
 - Removal of facilities from site after completion of work.
 - Any other fixed-charge items.
- b) Time related items such as: (SABS 1200A - 8.4)
 - Contractual requirements.
 - Operation & maintenance of facilities on site.
 - Supervision.
 - Company and head office overhead costs.
 - Other time related items.

3.1. B Material Specification

The specific contractor shall supply, transport and off-load his own facilities such as sheds, water, electricity, lighting, etc. on the site. The contractor shall also be responsible to remove all facilities established on site after his work is completed.

3.2 Line construction

3.2. A. Works Specifications

NOTES:

- a) All work shall be in accordance the relevant SABS 1200 documents and Eskom Specification TRMSCAAC1, TRMASAAJ7, SCSASABF9 and SCSASABG1.
- b) All labour cost shall be included in quoted rate.

3.2. A.1 Foundations shall include:

- a) Supply and erecting complete foundations according to the relevant drawing from SCSASABG1 including excavations, formation, reinforcing, holding down bolts, concrete casting and backfilling with the appropriate mixture.
- b) Risk of collapse and keeping excavations free of water shall be included in the quoted rate.
- c) All excavations shall be kept covered or barricaded, if not attended to, in a manner accepted by Eskom to prevent injury to people or livestock.
- d) The contractor shall notify the Clerk of Works upon completion of the excavation for the foundation. No shuttering, reinforcing steel or concrete shall be placed until the Clerk of Works has inspected the excavations and acknowledge his approval.
- e) For construction purposes the correct foundation shall be installed for the type of soil conditions and structure to be installed.
- f) The contractor shall do foundation type nominations before construction of the line takes place.
- g) The nominations shall be done in the vicinity of each supporting structure position where the foundation is to be installed.
- h) Steel plates shall be used for setting all holding down bolts.
- i) The nominated foundation types shall be re-evaluated on site by the contractor, in conjunction with the Clerk of Works, after the excavation of the initial foundation type has been done.
- j) The final foundation nomination shall be the responsibility of the contractor and shall be logged in the Construction Handbook.
- k) The authorised person responsible for the foundations shall sign the 'Foundation' certificate in the Construction Handbook.

3.2. A.2 Tower earthing shall include:

Steel Poles:

- a) Install an earthing electrode should the desired tower footing resistance not be achieved.
- b) Excavation in all materials 200mm wide trenches for the earth electrode.
- c) Risk of collapse and keeping excavations free of water shall be included in the quoted rate.
- d) The earth electrode for the steel poles shall be a three point star as shown on drawing 2-D-WT/763.
- e) The earth electrode shall be bonded to the steel pole using 7/2.12 (25mm²) stranded copper conductor having a crimped lug on the end that will be bonded to the steel pole.
- f) The lug shall be fastened to the pole with a M12 galvanised bolt.
- g) All visible copper protruding above the ground shall be painted with the same type and colour paints of the equivalent or supports which it is bonded to.
- h) The footing resistance of each tower shall be measured before stringing takes place and shall be logged in the Construction Handbook.
- i) The authorised person responsible for the tower earthing shall sign the 'Earthing' certificate in the Construction Handbook.
- j) The nominal tower footing resistance shall be less than 20Ω.
- k) The first five steel poles from the substation, shall have a footing resistance less than 10Ω, if not the shield wire on these structures shall be insulated.
- l) Where the specified tower footing resistance have not been obtained using standard earthing methods, additional earthing shall be installed.
- m) The additional earthing shall be counter poise conductors in accordance to SCSASABF9.

Terminal Structures:

- a) Earthing of the terminal structure shall be according to the latest revision of SCSASABF9 and to Eskom earthing Standard D-DT 5085.
- b) The terminal structure shall be bonded to the main substation earth mat with a single 50x3mm copper strap.
- c) The copper strap will be installed by the substation contractor and bonded by the line contractor.
- d) The copper strap shall be bonded to the terminal tower legs with M16 bolts.
- e) All visible copper protruding above the ground shall be painted with the same type and colour paint of the equivalent or supports, which it is bonded to.
- f) The footing resistance of the terminal tower shall be measured before stringing or bonding to the main substation earth mat takes place and shall be logged in the Construction Handbook.
- g) The authorised person responsible for the tower earthing shall sign the 'Earthing' certificate in the Construction handbook.
- h) The nominal tower footing resistance shall be less than 10Ω .
- i) Where the specified tower footing resistance have not been obtained using standard earthing methods, additional earthing shall be installed.
- j) The additional earthing shall be in accordance to SCSASABF9.

3.2. A.3 Planting of steel poles shall include:

- a) All steel poles shall be positioned plumbed vertical in the centre of the excavations viewed from any direction according to the relevant steel pole drawings.
- b) Nylon or fabric slings shall be used when handling steel poles.
- c) Backfilling shall be done according to SCSASABK8 – Distribution Standard for soil compaction for stay and pole foundations.
- d) Imported soil shall be used for the soil/cement mixture and shall not consist of any excavated Black Turf.
- e) The layers shall be compacted to a minimum density of 95% MOD AASHTO before the next layer of soil/cement mixture is placed.
- f) For stayed poles with concrete anchors, the pole shall not be erected until the concrete has had 21 days in which to cure.
- g) The authorised person responsible for the installation of the towers shall sign the 'Tower Installation' certificate in the Construction Handbook.

3.2. A.4 Assembly and erection of terminal structures shall include:

- a) The terminal towers shall be assembled and erected on the complete tower foundation.
- b) Towers shall not be erected until the concrete foundation has had 14 days in which to cure.
- c) Terminal tower material in storage shall be blocked off the ground with sufficient number of blocks to prevent bending or warping of individual members.
- d) Nylon or fabric slings shall be used when handling steel members.
- e) Tower material shall not be dumped or dropped from trucks, but shall be carefully off-loaded and stacked.
- f) Steel towers that become bent, twisted or deformed during transport, assembly or erection shall be replaced at the expense of the contractor.
- g) The threaded portions of any bolt shall project through the corresponding nuts by an amount not exceeding 15mm and not less than 3mm.
- h) All bolts shall be tightened and thereafter fixed in position by punching four indentations symmetrically around the threads with a round pointed centre punch.
- i) All nuts and exposed bolt threads shall be painted with accepted calcium plum bate based galvanised iron primer.
- j) The authorised person responsible for the installation of the towers shall sign the 'Tower Installation' certificate in the Construction Handbook.

3.2. A.5 Installing stay rod assembly shall include:

- a) Supply and install complete stay rod assembly according to specified drawings in Volume 6, including excavations, concrete casting, backfilling and compaction.
- b) Risk of collapse and keeping excavations free of water shall be included in the quoted rate.
- c) All excavations shall be kept covered or barricaded in a manner accepted by Eskom to prevent injury to people or livestock when no casting is done.
- d) The contractor shall notify the Clerk of Works upon completion of the excavation for the stay rod. No concrete shall be placed until the Clerk of Works has inspected the excavations and acknowledge his approval.
- e) For construction purposes the correct hole type shall be installed for the type of soil conditions and stay rod assembly to be installed.
- f) The excavation shall be done at a distance away from the pole so that the angle of the stay wire after being installed is 45° as shown on drawings (See Volume 6, drawing list, e.g. 2-WT/1143 Sheet 1).
- g) The contractor shall do excavation nominations before construction of the line takes place.
- h) The nominations shall be done in the vicinity of each supporting structure position where the stay rod is to be installed.
- i) The nominated excavations shall be re-evaluated on site by the contractor, in conjunction with the Clerk of Works, after the excavation of the stay rod hole has been done.
- j) The final excavation nomination shall be the responsibility of the contractor and shall be logged in the Construction Handbook.
- k) The soil will be compacted in strict accordance to SCSASABK8.

3.2. A.6 Perching Bracket

- a) Perching brackets must be installed on all structures.
- b) The attachment of the perching bracket must be done as indicated on drawing D-DT 7347.

3.2. A.7 Installing stay wire shall include:

- a) The stay wires shall be handled with care to prevent damage to the individual strands.
- b) The stay wire shall be long enough to be tied to the stay rod at, at least two positions as indicated on drawing e.g. 2-WT/1143 Sheet 1.
- c) All structures shall be stayed according to applicable drawings. Please ensure compliance.

3.2. A.8 Dressing structures shall include:

- a) Installing all hardware according to the relevant assembly drawings.
- b) All bolts shall be secured with stainless steel split pins.
- c) All bolts and split pins of the hardware shall be installed pointing in one direction so that the split pins are visible from one side of the line only.
- d) Earth wire insulators shall be installed on the steel structures where the line runs parallel to the railway lines and 800m or both sides of a pipe line crossing.
- e) Earth wire shall be terminated at the line terminal structures.
- f) The earth wire shall be bonded to the steel structure for all other structures.

3.2. A.9 Disposal of excavated material shall include:

- a) Removal of excavated Black Turf or any other soil unsuitable for backfilling and transporting it to borrow pits.
- b) The excavated material shall be disposed of in borrow pits or a suitable place, indicated by the Eskom site representative or the Eskom environmental representative.
- c) The contractor shall make own arrangements for the provision to dispose of the excavated material on such a disposal place.
- d) Free haul shall be the distance within a radius of 5km from the pole/tower position.
- e) Limited haul shall be the first 1km beyond the end of the free haul distance by the shortest practicable route.

- f) Long haul shall be the remainder of the distance beyond the limited haul by the shortest practicable route.

3.2. A.10 Importing soil shall include:

- a) Transporting imported soil from borrow pits to pole/tower position.
- b) In areas where the excavated soil is Black Turf, imported soil shall be used for the soil/cement mixture.
- c) The contractor shall make own arrangements for the provision of a suitable borrow pit for importing soil.
- d) Free haul shall be the distance within a radius of 5km from the pole/tower position.
- e) Limited haul shall be the first 1km beyond the end of the free haul distance by the shortest practical route.
- f) Long haul shall be the remainder of the distance beyond the limited haul by the shortest practical route.

3.2. A.11 Transportation shall include:

- a) Transporting all material and equipment from the construction camp to the pole/tower position.
- b) Free haul shall be the distance within a radius of 5km from the construction camp.
- c) Limited haul shall be the first 1km beyond the end of the free haul distance by the shortest practicable route.
- d) Long haul shall be the remainder of the distance beyond the limited haul by the shortest practicable route.
- e) If the contractor is planning to use a batching plant not located in the construction camp, the cost due to transporting the concrete from the batching plant to the construction camp shall be at the expense of the contractor.

3.2. B Material Specification

NOTES:

- a) Unless otherwise specified, the Eskom project manager shall specify what material will be provided by Eskom and what material must be provided by the contractor.
- b) The contractor shall book the material from the Eskom store, transport and off-load all material at the construction camp.
- c) The contractor shall transport all equipment and material for the day's work from the construction camp and off-load it at the specific pole position.

3.2. B.1 Foundations:

- a) Unless otherwise specified, the contractor shall supply all material and equipment necessary for the supporting structure foundations along the line route. The contractor shall transport all the material and equipment to the construction camp.
- b) At the end of the day, the contractor shall transport all the equipment and material not used back to the construction camp.

3.2. B.2 Tower earthing:

- a) The contractor shall supply all the equipment necessary for installing the tower earthing.
- b) Conductive concrete where required, shall be supplied by the contractor.
- c) The contractor shall supply the tower earthing bolts with nuts and washers in accordance to the relevant tower drawings.
- d) All bolts and nuts shall be in accordance to SABS 135 with a strength grade of 4.8.
- e) All bolts with nuts and washers used for bonding shall be hot dipped galvanised to SABS ISO 1461.

3.2. B.3 Planting poles:

- a) The contractor shall supply all the equipment necessary for planting the poles.
- b) All additional bolts with nuts and washers not supplied with the steel pole shall be supplied by the contractor and be in accordance to the relevant tower drawings.
- c) All bolts and nuts shall be in accordance to SABS 135 with a strength grade of 4.8.
- d) All bolts with nuts and washers used for bonding shall be hot dipped galvanised to SABS ISO 1461.

3.2. B.4 Terminal tower assembly and erection:

- a) The contractor shall supply all the equipment necessary for assembling and erecting the terminal towers.
- b) All additional bolts with nuts and washers not supplied with the steel pole shall be supplied by the contractor and be in accordance to the relevant tower drawings.
- c) All bolts and nuts shall be in accordance to SABS 135 with a strength grade of 4.8.
- d) All bolts with nuts and washers used for bonding shall be hot dipped galvanised to SABS ISO 1461.

3.2. B.5 Stay rod installation:

- a) The contractor shall supply all the equipment necessary for installing the stay rods.
- b) The contractor shall supply the concrete where applicable and imported soil for the stay rod assemblies.

3.2. B.6 Perching Bracket

- a) The contractor shall supply all the equipment necessary for installing the perching brackets.

3.2. B.7 Installing stays wires:

- a) The contractor shall supply all the equipment necessary for installing the stay wires.

3.2. B.8 Dressing the structures:

- a) The contractor shall supply all the equipment necessary for dressing all the structures.
- b) The contractor shall supply additional bolts with nuts and washers.
- c) Bolts, nuts and washers shall be hot dipped galvanised to SABS ISO 1461.
- d) Bolts shall be to SABS 135 with a strength grade of 4.8.

3.2. B.9 Disposal of excavated material:

- a) The contractor shall be responsible for disposing of excavated soil not used for backfilling.
- b) The contractor shall transport all the excavated soil not used for backfilling to the suitable borrow pit.

3.2. B.10 Importing soil:

- a) The contractor shall be responsible for supplying imported soil. If not otherwise specified, the imported soil shall be in accordance to SABS 1200.
- b) The imported soil shall not contain notable quantities of organic matter or stones of average dimension exceeding 150mm.
- c) The contractor shall transport all the imported soil from the borrow pit to the pole position.

3.2. B.11 Transportation:

- a) The contractor shall transport the concrete from the batching plant to the pole position.

3.2. B.12 Documentation:

- a) The Eskom Clerk of Works or the Eskom representative shall supply the Construction Handbook.
- b) The contractor shall complete all the sections of the Construction Handbook that applies to the construction of the line.
- c) The sections shall include all the job description and check list tables, building of the line table and earthing table.
- d) The contractor shall appoint a responsible person for each task listed on the 'Authorised Persons' sheet and fill their names in on this sheet.
- e) The contractor shall ensure that the authorised person shall sign the task certificate after the completion of the work.
- f) After completing the Construction Handbook, the contractor shall return the Construction Handbook back to Eskom for review.

3.3 Stringing and regulation

3.3. A Works Specifications

NOTES:

- a) All work shall be done according to Eskom Specification TRMSCAAC1.
- b) Stringing, jointing, conductor repairs and regulation shall be reported in the Construction Handbook.
- c) All labour cost shall be included in quoted rate.
- d) The successful tenderer shall prepare and test a test string according to TRMSCAAC1 before any stringing takes place. The tenderer shall submit four copies of the test report to Eskom for review.
- e) No stringing shall take place before written approval is received from Eskom.
- f) Copies of calibration certificates, test reports, etc. for all the instruments and equipment used in the stringing and regulation process shall be submitted to Eskom for review.

3.3. A.1 Stringing conductors shall include:

- a) The top phase on the steel poles shall be the WHITE phase.
- b) If the phases should be rotated, it should be done at the 90° strain tower.
- c) Tension Stringing shall be used to string the phase conductors and earth wires.
- d) All stringing shall be done according to the provided Sag and Tension Charts.
- e) Suitable structures under each phase conductors shall be erected to protect all fences from conductor damage during stringing.
- f) Adequate protection shall be provided where there may be danger of a conductor being crossed over by vehicles, or damaged by other equipment or objects.
- g) Conductors shall not be left in contact with the ground, vegetable matter or any conducting or semi-conducting material.
- h) Wood lagging shall be used to protect the conductor when working at ground level.
- i) Jumpers shall be formed in a manner as to provide the maximum amount of clearance from earthed hardware, and tower steelwork.
- j) Where temporary stays are required, the contractor shall be responsible for making the suitable arrangements.
- k) Conductors shall not be anchored to any part of the steel poles/towers.

3.3. A.2 Line and Railway crossings shall include:

- a) All line crossing shall be in accordance to TRMSCAAC1 - Installation of phase and earth conductors.
- b) All Railway crossing shall be in accordance to TRMSCAAC1 - Installation of phase and earth conductors.
- c) The price quoted shall include authorised temporary work carried out by the contractor, transport, erection and dismantling of temporary conductor supports at all crossings, excluding crossings requiring special scaffolding.

3.3. A.3 Conductor joints shall include:

- a) Only Eskom coded jointers shall be authorised to carry out joints on phase conductors and earth wires.
- b) Each coded jointer shall further be issued with his unique identification number or sign, which he shall use to punch, completed joints as a register of his acceptance.
- c) The number of joints over the total length of the line shall be kept to a minimum.
- d) Joints shall not be closer than 15m from suspension towers.
- e) Joints shall not be closer than 30m from strain towers.
- f) Joints shall not be installed in spans crossing railways, proclaimed roads, power or communication lines.
- g) In no case shall there be more than one joint in a given span.
- h) Joints shall not be installed in a span that is dead-ended at both ends.
- i) No joint shall pass through a stringing pulley.
- j) All conductor joints shall be reported on in the Construction Handbook.
- k) The authorised person responsible for the jointing shall sign the 'Joint and Damage' certificate in the Construction Handbook.

3.3. A.4 Conductor damage repairs:

- a) Damage to conductors caused by the contractor shall be repaired in a manner determined by the Clerk of Works, at the expense of the contractor.
- b) Where there is repeated damage in the same span, or in consecutive spans, the entire conductor in such spans shall be replaced.
- c) All conductor repairs shall be reported on in the Construction Handbook.
- d) The authorised person responsible for the conductor repairs shall sign the 'Joint and Damage' certificate in the Construction Handbook.

3.3. A.5 Making off shall include:

- a) Making off, phase conductors and earth wires at each steel pole structure, including clamping-in all conductors and attaching armour rods and vibration dampers to the conductor.
- b) Cutting the conductors where the new lines will be connected onto the existing lines
- c) Connecting the cut conductors onto the new towers.
- d) Connecting the jumpers from the old lines to the new lines.
- e) The earth wire at the terminal structure shall be made off according to drawing 2-D-WT/816.
- f) All regulation shall be done according to the provided Sag and Tension Charts.
- g) The conductor temperature shall be determined by means of a Celsius thermometer as shown in Annexure E of the Construction Handbook.
- h) All conductors in a regulated section shall be clamped-in, beginning at the second structure from the forward end of the pulling, and shall progress structure by structure, until the conductors at all structures are clamped-in.
- i) The conductors shall be clamped-in in such a manner that no additional tension is placed on the insulators
- j) Armour rods shall be installed according to the manufacturer's specifications.
- k) The suspension clamps and U-bolts shall be torque to manufacturer's specifications.
- l) Asymmetrical vibration dampers shall be installed on the phase conductors and Spiral vibration dampers shall be installed on the earth wires.
- m) The asymmetrical vibration dampers shall be installed on all tensioned spans as specified in the table and positioned according to the tables in Volume 2 of this document. The placement shall be measured from the middle of a suspension clamp and from the edge of a strain clamp.
- n) The Spiral dampers shall be installed on all tensioned spans, as specified in the table and positioned according to the tables in Volume 2 of this document.
- o) Helical preform connected vibration dampers shall be installed according to the manufacturer's specifications.
- p) The authorised person responsible for the regulation shall sign the 'Sag and Tension' certificate in the Construction Handbook.

3.3. A.6 Documentation:

- a) The contractor shall complete all the sections of the Construction Handbook that applies to the stringing and regulation of the line.
- b) The sections shall include all the job description and check list tables and the regulation table.
- c) The contractor shall appoint a responsible person for the stringing, jointing and regulation tasks listed on the 'Authorised Persons' sheet and fill their names in on this sheet.
- d) The contractor shall ensure that the authorised person shall sign the task certificate after the completion of the work.
- e) After completing the Construction Handbook, the contractor shall return the Construction Handbook back to Eskom for review.

3.4 Labelling

3.4. A.1 Works Specifications

NOTES:

- a) All labels shall be in according to Eskom Specification ESKASAAN0, SCSSCAAP5 and to drawings D-DT 5064 and 2-WT/1148.
- b) All labour cost shall be included in quoted rate.
- c) All labels shall be manufactured according to Eskom Specification TRMSCAAC5.
- d) All labels, except line crossing labels, shall be black lettering on yellow background.

3.4. A.1 Pole identification labels:

- a) The bottom of the identification labels shall not be less than 5000mm from the base of the steel pole.
- b) The pole identification labels shall be strapped to the pole with not less than three 12mm stainless steel straps.
- c) The off structure shall be numbered as the first structure.
- d) The numbers shall be changed to correlate with the existing numbering.

3.4. A.2 Line designation labels:

- a) A line designation labels shall be installed.
- b) The line designation labels shall be installed between the top phase conductor and the earth wire.
- c) The line designations shall be installed below the line-crossing label.
- d) The line designation labels shall be strapped to the pole with not less than three 12mm stainless steel straps.

3.4. A.3 Line crossing labels:

- a) All line crossing labels shall be installed so that it would be visible from the direction of approaching the line crossing, line deviation or T-off.
- b) All line crossing labels shall be installed above line designation labels.
- c) All line crossing labels shall be a black diagonal cross on an orange background.
- d) The line crossing labels on the steel poles shall be installed between the top phase conductor and the earth wire
- e) The line crossing labels shall be strapped to the pole with not less than three 12mm stainless steel straps.
- f) Line crossing labels will only be installed where the new line crosses underneath other lines

3.4. B Materials Specifications

- a) Unless otherwise specified, the Eskom project manager shall specify what material will be supplied by Eskom for installing the line labels.
- b) The contractor shall book the material from the Eskom store, transport and off-load all material at the construction camp. The contractor shall also supply all the equipment necessary for installing the line labels.
- c) The contractor shall transport all equipment and material from the construction camp to the pole positions.

3.4. B.1 Pole identification labels, Line designation labels and Line crossing labels:

- a) All fixing straps, bolts with nuts and the contractor shall supply washers for the labels.
- b) The fixing straps shall be 12mm stainless steel straps.
- c) All bolts, nuts and washers shall be hot dipped galvanised to SABS ISO 1461.
- d) All bolts shall be in accordance to SABS 135 with a strength grade of 4.8.
- e) All labels shall be in accordance to ESKASAAN0 and DISASZAA2.
- f) All labels shall have a vitreous enamel finish.

4. SAFETY RISK ANALYSIS-SPECIFICATIONS

Health and Safety Specification

Contractors shall comply with DISPVABF 3: Occupational Health and Safety requirements to be met by Contractors and Sub-Contractors employed by Eskom. This Act will be included in the document as Annexure E in Volume 5. Please see to it that the necessary attention is given to the document and that it is complied to. **Please ensure that a signed copy of Annex E, page 36, and Annex F, are kept on site as well as with the Project Manager.** Contractors shall comply with the **Construction Regulations** (Volume 5, Annexure F) and shall draw up a **Health and Safety Plan**. Specific risks to note are set out under the Risk Analysis Specification following below.

Risk Analysis Specification

A. Note:

The requirements to address the indicated risks are provided in DISPVABF3 and shall form the basis of the evaluation of the *Contractor's* Health and Safety Plan

The risks identified in this project as compiled by the experts regarding the mine activities, site activities and environment should be considered as the first approached to compile the site specific health and safety document. The risks identified in this should be considered but will be underlying to the risks identified by the experts and they should be consulted in the compilation of the health and safety documentation.

The table below presents a list of risks that will most likely be experienced while constructing the Marang – Waterkloof 88kV Line:

No.	TASK/ ACTIVITY/ WORKP	HAZARD / DANGER IDENTIFIED	PREVENTATIVE MEASURES TO BE IMPLEMENTED (INCLUDING PPE TO BE USED)
1	Housekeeping	Possible injury to staff due to poor housekeeping. Rubbish and materials lying around may increase the fire hazard.	The following requirements to be complied with: <ul style="list-style-type: none">• Excess material, scrap, waste or debris must be removed and be disposed of regularly.• Equipment and material to be stacked correctly and securely in designated areas.• Keep the site camp clean from materials that can cause fire.

2	Health and safety in housing complex (Camp).	Health effects suffered by staff due to poor health and safety standards maintained in housing complex.	The following requirements to be complied with: In accordance with the Act the following facilities must be provided: <ul style="list-style-type: none"> ○ One (1) toilet for every 30 staff members; ○ One (1) shower for every 15 employees; ○ Sheltered dining room facilities; and ● Ample quantities of drinking water to be available in the housing complex; and ● Sufficient quantities and types of fire fighting equipment to be available in the housing complex.
3	Use and maintenance of PPE	Injuries to staff due to improper or lack of use of Personal Protective Equipment	The following requirements to be complied with: <ul style="list-style-type: none"> ● Risk assessment to be conducted ● Copy of risk assessment to be kept on site ● Staff to be issued with and trained on appropriate use of PPE ● PPE to be maintained in good working conditions and stored appropriately ● Disciplinary action to be maintained against transgressors.
4	Poor ergonomics	Possible injuries to personnel: Working in an awkward / uncomfortable position; and / or Move or carry heavy objects.	The following requirements to be complied with as to minimize agronomical risks: <ul style="list-style-type: none"> ● Where possible manual handling will be limited and lifting machines be used; and ● Staff will be encouraged to use the correct method when lifting and / or carrying items.
5	Security	Material stored to be protected from theft and fire	<ul style="list-style-type: none"> ● Site office must be fenced and a security guard must be available on site. ● Keep the site camp clean from materials that can cause fire.
6	Unauthorised Entry	Possible theft or injury	No unauthorised person may enter onto construction site without permission.
7	Storage of flammable liquids	The storage of flammable liquids could increase the risk of fires.	The following requirements to be complied with: <ul style="list-style-type: none"> ● Not more than 40 litres to be stored as per SANS 10400. Quantities in excess of 40 litres are to be stored in a flammable liquid store or cabinet specially constructed for this purpose; ● Sufficient amounts of fire fighting equipment to be kept available on the premises; ● All staff to be trained in the use of the fire fighting equipment; ● All fire fighting equipment to be inspected by a Competent Person appointed for this purpose. ● All flammable liquids to be labelled properly

8	Fire prevention.	High risk of fires and property damage.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • Sufficient amounts of fire fighting equipment to be kept available on the premises; • All staff to be trained in the use of the fire fighting equipment; • Cooking fires in designated areas only and under controlled conditions • All fire fighting equipment to be inspected by a Competent Person appointed for this purpose; • The presence of all fires to be reported to the client immediately; • Staff to be trained in the correct fire fighting procedure; and • Staff only to be allowed to smoke in designated areas.
9	Stacking of articles	Possible injury to persons due to items falling, moving or rolling.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • All stacking to be done under the supervision of a person appointed in writing and assigned the duty of ensuring safe stacking on site; • Storage areas are to be kept clean and orderly at all times (Housekeeping) • Stacked items are to be secured as to prevent items from falling or rolling
10	Use of compressors	Possible injuries due to pressure vessels exploding. The equipment also generates noise that may result in hearing loss.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • All pressure vessels to be performance tested at intervals not exceeding every 3 years. All pressure tests are to be performed by a persons / company approved for this purpose by the Department of Labour; • A record to be kept of all inspections and tests conducted on the pressure vessels; • Only competent persons to be allowed to operate pressure vessels; • Pressure vessels to be fitted with the required safety appurtenances; and • Employees performing work in close proximity to compressor to be issued with and be required to wear hearing protectors.

11	Cranes and lifting machines (Vehicle mounted, chain blocks, electrical hoists, buckets and forklifts)	Possible injury to persons or property due to the incorrect use or failure of the lifting machine or gear.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • All lifting machines and other gear shall be tested and inspected at the required intervals in accordance with the relevant machinery regulations. • All lifting gear and cranes shall be inspected on a daily basis before use. • All load tests shall be performed by a persons / company approved by the Department of Labour; • Records shall be kept of all inspections and tests conducted on the lifting machines. • Cranes shall only to be operated by operators who are in possession of a valid training certificate issued by an approved training authority; • Personnel may under no circumstances be lifted by means of a crane, unless it is specifically built for such purpose. • All hooks to be fitted with catches to prevent the accidental un-hooking of slings. • The crane or vehicle shall be stabilized by setting the hydraulic pods prior to use. • The load to be properly secured before being lifted or moved. • Earthing of the machine to be done when used near Live equipment.
12	Working at elevated positions	Possible injuries due to staff falling from heights.	<p>The following requirements to be complied with as to prevent injuries:</p> <ul style="list-style-type: none"> • Cardinal Rule: Any person who performs work higher than two meters above ground level must wear a fall arrest system, and be attached to an anchor point at all times. • All work conducted at a height to be performed in accordance with the Construction Regulations, the OHS Act and must be performed under the direct supervision of a Competent Person who has been appointed in writing. • The requirements as per this Health and Safety as well as the Fall Protection Plan to be complied with at all times.
13	Use of ladders	Possible injury to personnel when falling from ladders.	<ul style="list-style-type: none"> • The safety precautionary measures as per the Safe Operating Procedure and standard. • Prescribed inspections to be performed
14	Working near "Live" equipment	Possible contact with high voltage equipment	<p>Work shall only be performed under direct supervision of an Authorized person in terms of ORHVS (Reg 5.03.63) when working in close proximity of live apparatus. Barricading of "live" parts of the structure / yard, prohibiting personnel entering barricaded areas.</p> <p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • The presence of overhead HV equipment to be indicated to personnel prior to construction on a daily basis. • All safety clearances as per NRS060 to be complied with. • Prohibition of the lifting of tools and other objects above the shoulder.
15	Use of portable electrical tools and	Possible injury due to electric shock or the use of unsafe or	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • All temporary electrical installations to be inspected weekly by accredited

	equipment and temporary electrical installations.	unguarded machines.	<p>person.</p> <ul style="list-style-type: none"> • All portable electrical equipment to be inspected daily or before use by accredited person; • The findings of inspections must be recorded in a register. The register must be kept on site. • All portable electrical equipment used must be: <ul style="list-style-type: none"> ○ Linked to a functional earth leakage system; or ○ Be double insulated; • Only portable electrical tools which are fitted with an on / off switch on the tool may be used. • All electrical cables and plugs must be in a good condition and free from any defects or damage, and • All breakers on temporary electrical supplies must be marked.
16	Hand tools	Possible injury due to the use of unsafe hand tools, or due to tools falling from a height.	<ul style="list-style-type: none"> • All hand tools used in elevated positions must be properly secured to prevent falling. • Persons using electrical tools shall have secure footing on a clean sound surface
17	Jack hammers and paving breakers.	Possible injuries to the operator or other persons standing close by. Damage to health due to noise and vibration.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • Wear the correct protective gear including ear protection. • Other personnel to stay clear of machines. • Operator to have secure footing on solid ground. • Regular removal of rubble around the place of work.
18	Power and Hydraulic tools such as power packs and crimpers	Possible hand injuries. Injuries due to items being ejected from the machine.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • Only skilled and competent operators to be allowed to operate the equipment. • The operator is required to inspect the equipment before use as to ensure that the equipment is safe for use. • Ensure that safety guards are always in place. • Wear the correct safety gear: <ul style="list-style-type: none"> ○ Overall; ○ Safety boots; ○ Eye protection; and ○ Leather gloves and ear protection where necessary.

19	Stringing of conductors (dead)	Personnel may fall from a height. Tools may fall from a height and cause injury to personnel below. Possible injury due to static electricity.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • Only competent persons to be allowed to perform this task. • All requirements pertaining to working at heights as per this Health and Safety Plan to be complied with. • All requirements as per the ORHVS standard to be conformed to, specifically with regard to earthing. • Proper and correct use of equipment such as slings, clamps, dynamometers etc.
20	Opening of cable ducts	Snake or Spider bites and Scorpion or Bee Stings	<p>The following measures shall apply:</p> <ul style="list-style-type: none"> • Be vigilant and on the lookout for these critters. • Use protective gear. • First aid to be available.
21	Excavation work	Possible injury to staff due to the collapse of the excavation. Possible contact with electrical cables.	<p>The following requirements to be complied with as to prevent injuries:</p> <ul style="list-style-type: none"> • All excavation work to be conducted under the supervision of a Competent Person who has been appointed in writing for this purpose; • No excavation to be conducted unless the required permits, wayleaves of drawings have been obtained; • The presence of all cables, water pipes or other services to be determined prior to any excavation being conducted; • All excavation to be inspected: <ul style="list-style-type: none"> ○ Daily before the shift; ○ After blasting; ○ After fall of ground; ○ After damage to the supports; and/or ○ After rain. Details of the inspections conducted to be entered into a register, which will be kept on site and be signed by the competent person appointed for excavation work. • To ensure the safety of staff excavations to be: <ul style="list-style-type: none"> ○ Braced or shored; ○ Excavated to the normal angle of repose; or ○ Inspected and be declared safe by the Competent Person appointed for excavation work. The decision to declare the excavation site; • All possible precautionary measures to be taken as to: <ul style="list-style-type: none"> ○ Ensure a safe distance is maintained between staff should excavations be dug manually by means of picks and shovels; ○ Limit the amount of material, ground or plant placed or moved on or near the edge of any excavations.

22	Work performed in hot environments and in direct sunlight.	Possible ill health effects such as heat stroke of skin cancer due to prolonged exposure to direct sunlight.	<p>The following measures shall apply:</p> <ul style="list-style-type: none"> • All staff members to be informed in the dangers of exposure to excessive heat and the illnesses associated with heat exposure; • First aid equipment and qualified first aiders to be available at all times; • Employees to be acclimatized prior to being required to perform working in hot environments; • Ample quantities of drinking water to be available on site; and • Employees to be provided with and be required to wear the required personal protective equipment and sun creams.
23	Construction of gantries	Overhead crane, falling items	Wear protective clothing. Keep away from under the lifted equipment.
24	Construction vehicles and Transportation of personnel	Possible injury to persons due to the use of construction vehicles.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • All construction vehicles are to be inspected on a daily basis by a competent person appointed for this purpose in writing; • The findings of all inspections to be recorded in a register kept for this purpose; • Only trained, competent and properly licensed persons to be allowed to operate construction vehicles; • The driver of vehicles to be in possession of a valid Public Drivers Permit(PDP) if: <ul style="list-style-type: none"> ○ More than 12 are transported on a vehicle; ○ A vehicle with a gross vehicle mass of more than 3500kg is being used • All staff to be informed of the danger of public violence and / or hijackings and the measures to be taken should they be exposed to such occurrences; • No persons or staff members are to be transported on the back of vehicles. • Proper seating facilities to be provided to all staff transported on vehicles. (Constr Reg.21.2(i)) • All construction vehicles are to be <ul style="list-style-type: none"> ○ Maintained in a safe working condition; ○ Fitted with signalling equipment; ○ Fitted with structures that will prevent items from falling onto the operator; ○ Fitted with an acoustic signalling device and a reversing alarm; ○ Fitted with a seat which is securely affixed into position; • All operators of construction vehicles must be in possession of a medical certificate of fitness which was issued by an Occupational Health Practitioner after evaluating employees physical and psychological fitness; • All tools and equipment transported on vehicles are to be secured as to prevent items from moving; • The operator of the vehicle must take care as to ensure that vehicles are not overloaded;

			<ul style="list-style-type: none"> • No employees, including contractor employees may be transported in the back of open vehicles or vehicle fitted with a canopy, unless approved seating and safety belts have been provided. • Only under special circumstances, where vehicles are driven for very short distances and at low speed (less than 40 km per hour), and proper seating and handrails have been provided, carrying of passengers in the back of such open vehicles may be allowed, provided that: <ul style="list-style-type: none"> ○ An assessment has been carried out indicating a very low risk. ○ Mitigating factors have been identified to control the risk. ○ Discussed and agreed upon at the Health and safety committee meeting. ○ Defined and in a formal written divisions or BU's own policy, including the appropriate mitigating factors. ○ Such a policy has been communicated to all employees and contractors. • Such risk assessment findings/outcomes must be available at all times for audit purposes. • All safety signs, speed limits and rules of the road or rules as specified for the premises are to be complied with at all times.
25	Use of slings (Material, chain and cable slings)	Possible injury to persons or property due to incorrect use or failure of the lifting tackle.	<p>The following requirements to be complied with:</p> <ul style="list-style-type: none"> • Lifting gear shall be inspected for damage on a daily basis before use. • All lifting tackle, slings and chains must be inspected by a competent person at intervals not exceeding three (3) months; • A record to be kept of all inspections and tests conducted on the lifting tackle; • All lifting equipment shall be marked with an identity mark which will indicate the maximum design load.
26	Making and breaking of jumpers	Electrocution as result of potential differences	Work only to be executed within equi-potential earthing zone
27	Cable Terminations	During energizing – failure of HV plant	Only persons trained and declared competent by Raychem or TANK may perform MV Cable jointing and terminations.
28	Static Induction	Electrocution as result of potential differences	Work only to be executed within equi-potential earthing zone

29	Exposure to noise	Noise induced hearing loss suffered by staff due to insufficient precautionary measures implemented.	The following requirements to be complied with as to prevent employees from contracting noise induced hearing loss when exposed to noise in excess of the prescribed noise rating limit of 85dB(A): <ul style="list-style-type: none"> • All staff exposed to noise in excess of the prescribed noise rating limit to be trained on the dangers of noise and the need for hearing conservation; • All staff to be provided with and be required to use hearing protectors when performing tasks which may result in them being exposed to excessive noise; and • All staff exposed to high noise rating levels to be subjected to audiometric tests as to determine and prevent possible hearing loss.
30	Staff performing work while intoxicated.	Possible injuries to staff due to the operation of equipment while under the influence of alcohol or drugs. Intoxicated employees could also pose a danger to others.	Staff members who are or who appear to be under the influence of alcohol or drugs are not to be allowed on site.
31	Environmental pollution	Oil or chemical substances being spilled.	The requirements as set out in the EMP must be applied.
32	Review and general compliance	Health and Safety Plan not being revised regularly	All health and safety documents to be evaluated and amended as and when required. Where necessary and possible the provisions of the Client's HSE regulations and instructions to be complied with.
33	Handover of contract	Possible civil action against the client or principal contractor due to poor workmanship.	The following requirements to be complied with: <ul style="list-style-type: none"> • All installations to be inspected and tested by a competent person after completion; • A completion certificate to be issued by the designer after construction • All construction work to be done as per the designer's specifications. • Implementation of Eskom Handover specification
34	Emergency Preparedness		<ul style="list-style-type: none"> • Staff to be trained on evacuation routes • Staff to be trained on handling of all types of emergencies. • Equipment to be provided as to enable staff to effectively deal with emergencies • Emergency numbers to be available on site. • Transport to be made readily available

35	Helicopter risks for construction purposes	Possible injuries to persons due to: Entering and exiting of helicopter Moving rotor blades. Risk of falling due to heights. Risk of falling objects being lifted by helicopter.	<ul style="list-style-type: none"> • No unauthorised persons in close proximity or inside helicopter • All persons to keep clear from helicopter when lift-off or landing is in progress • All persons to keep clear of rotating parts of helicopter • All persons to keep clear when overhead construction take place and movement of objects are in progress • Authorised persons making use of helicopter are to be aware of potential tripping hazard when boarding and disembarking helicopter • Any persons in helicopter are to secure themselves and/or doors to prevent falling from heights • Staff to be aware of all the possible risks with regard to a helicopter on site and construction by helicopter
36	Environmental work risks	Possible injuries to persons due to: Slipping on slopes. Sliding rocks Slipping on wet surfaces Slipping in streams Fast running streams after rains Falling from cliffs Animals – bees snakes etc. Weather conditions	<ul style="list-style-type: none"> • Workers should be fit and physical cape-able to work under the changing site conditions. • Workers should be issued with PPE required for the site conditions. • An emergency plan to address medical situations must be in place and workers must be trained accordingly. • Means of transport must be available. • Medical aid must be available on site. • Changing weather conditions must considered.

1. Procedures

The following are typical procedures for some of the risks listed in the table above. The contractor as part of his health and safety plan must draw up a procedure like this for all the risks shown on the previous page and all other risks identified by contractor/ Project Manager/

All Safe Work Procedures must be adhered to. Special attention must be given to the following procedures:

PC-09-GC-21	:	Stringing (Tension and Terminate)
PC-09-GC-29	:	Dismantling of MV and LV overhead power lines
PC-09-GC-31	:	Stringing of conductors across a road
PC-09-GC-34	:	How to do closing span on existing/new lines
PC-09-GC-39	:	Outages

The following sections are extracts from the above procedures.

2. Stringing (Tension and Terminate)

2.1 Definition

Stringing means the tensioning and termination of conductors in the prescribed manner and specifications.

2.2 Dangers

- 2.2.1. Falling objects
- 2.2.2. Workmen can fall from towers
- 2.2.3. Induction from other lines
- 2.2.4. Traffic-Roads and/or railway

2.3 Procedure

- 2.3.1 The equipment and methods used for stringing the conductors (including earth conductors) shall be such that the conductors will not be damaged. Particular care shall be taken at all times to ensure that the conductors do not become kinked, twisted or abraded in any manner.
- 2.3.2 Stringing shall be done in daylight hours only.
- 2.3.3 Tensions, while pulling, must be sufficient to clear all obstacles safely without damage to the conductor. At no time shall the pulling tension exceed the tension shown on the sag charts.
- 2.3.4 Adequate protection shall be provided where there may be danger of a conductor being crossed over by vehicles, or damaged by other equipment and objects.
- 2.3.5 Radio communications shall be used to relay information and instructions between the conductor tensioning station, intermediate check points, mobile stations and the pulling station at all times during the stringing-tensioning operation.
- 2.3.6 Whenever joints or dead-ends are made, auxiliary erection clamps and hauling devices shall not be placed closer than 8m to the point of joint or dead-end.
- 2.3.7 The conductor shall be cut with a ratchet or guillotine cutter to produce a clean cut, retaining the normal strand lay and producing minimum burrs. The aluminium strands shall then be stripped from the steel core by using an acceptable stripper. Under no circumstances shall high tensile hacksaw blades be used to cut conductor.
- 2.3.8 The contractor shall string all conductors and earth conductor to the appropriate sags and tensions as determined from the conditions specified in the contract documents.
- 2.3.9 Conductors and earth conductors shall be strung to the appropriate sag determined for the actual span length, and the equivalent span of the strain section involved.
- 2.3.10 The contractor shall provide, and maintain in good condition, suitable dynamometers, sag boards or other accepted apparatus for the proper checking of the work. Dynamometers shall read in Newtons and shall be tested and re- calibrated at regular intervals

- 2.3.11 In pulling the conductor, caution shall be used to avoid pulling the conductor above sag.
- 2.3.12 All conductors, except for conductors in sag sections over flat terrain, shall be plumb-marked at each structure for the complete section regulated, before clamping-in or dead-ending of the conductor is begun.

3. Dismantling of MV and LV overhead power lines (PC-09-GC-29)

3.1 Definition

Dismantling means; to break down redundant structures, in a safe way, under dead conditions.

3.2 Dangers

- 3.2.1 Falling from heights
- 3.2.2 Induction from other lines
- 3.2.3 Electrical contact with other lines
- 3.2.4 Falling objects

3.3 Procedures

- 3.3.1 Ensure that the system is isolated and earthed.
- 3.3.2 Disconnect the line to be dismantled (redundant line) from the network by cutting away the first span to create a visible gap. Remember to backstay first if needed.
- 3.3.3 Ensure that working earths are applied on the line to be dismantled (redundant line).
- 3.3.4 Ensure that existing poles are not rotten.
- 3.3.5 If poles are rotten refer to procedure PC-09-GC-30.
- 3.3.6 Cut and remove all earth wires on the overhead line. Remember to backstay first if needed.
- 3.3.7 Remove software from all attachment points on intermediate poles.
- 3.3.8 Lay conductor on cross arm or insulated spindle.
- 3.3.9 Cut off the conductor at the straining points.
- 3.3.10 Ensure that the worker doing the cutting is clear of the cross arm, to avoid injuries in case of the cross arm swinging.
- 3.3.11 Coil the conductor.
- 3.3.12 Remove insulators from structures, where applicable.
- 3.3.13 Cut off stay wires at attachment point at stay rod.
- 3.3.14 Remove poles and backfill holes.
- 3.3.15 Dismantle hardware from structures.
- 3.3.16 Recover stay rod and backfill hole.
- 3.3.17 If stay rod is not recovered, stay rod must be cut off at least 500mm under ground level.
- 3.3.18 All recovered material must be returned to stores.

4. Stringing of conductor across a road (PC-09-GC-31)

4.1 Definition

Stringing means the tensioning and termination of conductors in the prescribed manner and specifications.

4.2 Dangers

- 4.2.1 Traffic/Pedestrians
- 4.2.2 Falling from heights
- 4.2.3 Falling objects
- 4.2.4 Hand injuries

4.3 Procedures

- 4.3.1 Assign workers with red flags and road signs to strategic points on either side of the road crossing position.
- 4.3.2 The assistance of the Traffic Department can be requested where national roads are involved.
- 4.3.3 Regulate traffic as required to execute the work safely.
- 4.3.4 Run out conductor as per procedure number PC-09-RC-04.
- 4.3.5 String conductors as per procedure number PC-09-GC-13.
- 4.3.6 Tension and sag conductor as per procedure number PC-09-GC-11.
- 4.3.7 Ensure correct clearances are obtained as indicated on profile.
- 4.3.8 Recall workers with flags and road signs.

5. How to do closing span on existing/new lines (PC-09-GC-34)

5.1 Definition

Closing span means the connection of newly built lines onto an existing live line.

5.2 Dangers

- 5.2.1 Energised overhead power lines
- 5.2.2 Falling objects

5.3 Procedures

- 5.3.1 Ensure existing live line is isolated and earthed in accordance with Reg. 5.04.5 (HV Regs).
- 5.3.2 Dress the existing pole with the necessary hardware.
- 5.3.3 String conductor according to Procedures PC-09-GC-11 and PC-09-GC-13.
- 5.3.4 Install jumpers according to procedure PC-09-GC-22.
- 5.3.5 Remove all personnel, equipment and tools.
- 5.3.6 Cancel permit (if issued).

6. Outages (PC-09-GC-39)

6.1 Definition

Outages mean the switching off of all sources of supply of power so that work can be done on a specific point or apparatus.

6.2 Dangers

- 6.2.1 Switching, linking and earthing errors
- 6.2.2 Static
- 6.2.3 Fall from heights
- 6.2.4 Falling objects
- 6.2.5 Weather (e.g. lightning)
- 6.2.6 Back feed through network
- 6.2.7 Work on wrong line

6.3 Procedure

C1 Prior to outage date

- 6.3.1 Ensure work planning is complete and reflected in the duration of outage required.
- 6.3.2 Supervisor liaise with Project Management timeously to allow a 14 day notification period to national control liaison may occur on site with all stake holders present. A date, time and duration is set and minuted.

C1 On outage date

- 6.3.3 OTSC represented by the Appointed Operator perform the required operating. Make the area required safe for work and issues a work permit to Construction's appointed Responsible Person.
- 6.3.4 Responsible Person ensures asset to be worked on is safe according to regulations and accepts the permit by signing as Responsible Person.
- 6.3.5 Responsible Person informs all Construction persons under his supervision of the status of the asset as well as to their specific duties.
- 6.3.6 Responsible Person constantly supervises to ensure adherence to ORHVS and general safe working practices during the outage period.

C1 Completion and handing over

- 6.3.7 Responsible Person ensures that all elements of the asset are as per contract requirement and that all materials, personnel, equipment and machinery are removed to enable safe operation of the asset.
- 6.3.8 Responsible Person hands back the asset to the Appointed Operator by signing off the permit after which the Appointed Operator will carry out his function. This is also done in liaison with national control. In the case of a new asset being put into operation, a handing over certificate to TSC by Project Management.