Eskom	**METHOD STATEMENT** **Stringing and Regulation of Conductors and Earth wires**	**RTB NED** **NWOU** **Rev 1**

INDEX

SCOPE OF WORK OVERVIEW

Please refer to design document

Revision Details: Rev.1	

Compiled By					
Name:	Thando Landela	**Tel:**	(012) 484 5273	**Date:**	July 2021

1.1 General Information

1.1.1 **Definitions**:

Span : Between two structures (poles)

Section : Between two strain points

1.1.2 **Stringing Procedure**

See Section 1.5

1.1.3 **Information Tables**

Table 1 Conductor Properties.

Table 2 Standard Electrical and Working Clearances.

Table 3 Servitude and Building Restrictions.

Table 4 Standard Insulation Levels and Creepage Distances.

Table 5 Minimum Vertical Clearances of Power Lines at Maximum Sag and Swing.

Table 1: Conductor Properties

	Stranding & wire diameter (mm)	Overall diameter (mm)	Al area (mm^2)	Steel area (mm^2)	Total area (mm^2)	Weight Mass (kg/m)	N/m	UTS (kN)
MAGPIE	3/4/2.118	6.35			24.71	0.1397	1.3705	18.57
SQUIRREL	6/1/2.11	6.33			24.48	0.0852	0.8358	8.02
FOX	6/1/2.79	8.37	36.68	6.11	42.80	0.1490	1.4617	13.10
MINK	6/1/3.66	10.98	63.13	10.52	73.65	0.2570	2.5212	21.90
HARE	6/1/4.72	14.16	104.98	17.50	122.48	0.4270	4.1889	36.00
WOLF	30/7/2.59	18.13	158.06	36.88	194.94	0.7300	7.1613	69.20
CHICADEE	18/1/3.77	18.87	200.93	11.16	212.09	0.6430	6.3078	44.90
LYNX	30/7/2.79	19.53	183.4	42.77	226.20	0.8460	8.2993	79.30
PANTHER	30/7/3.00	21.00	212.06	49.48	261.54	0.9700	9.5157	90.80
PELICAN	18/1/4.21	20.70	242.31	13.46	255.77	0.7750	7.6028	53.80
BEAR	30/7/3.35	23.45	264.42	61.70	326.12	1.2200	11.9682	112.00
GOAT	30/7/3.71	25.97	324.31	75.67	399.98	1.5000	14.7150	136.00
KINGBIRD	18/1/4.78	23.88	323.01	17.95	340.20	1.0280	10.0847	69.80
TERN	45/3.38+7/2.25	27.00	403.77	27.83	431.60	1.3400	13.1454	98.70
ZEBRA	54/7/3.18	28.62	428.88	55.60	484.48	1.6300	15.9903	133.00
BERSFORT	48/4.27+7/3.32	35.58			747.96	2.369	23.24	177.65
Steel 19/2.65	19/2.65	13.25			104.8	0.826	8.1	113
Steel 7/3.35	7/3.35	10.50		61.70	61.70	0.4850	4.7579	67.45
Steel 3/3.35	3/3.35	7.35		26.44	26.44	0.2150	2.1092	29.10

Table 2: Standard Electrical Clearances

System	System	Min clearance (mm)		Working clearance (m)	
Nominal Voltage	**Highest Voltage**	**Phase to Earth**	**Phase to Phase**	**Vertical**	**Horizontal**
3.3	3.6	80	110	2.5	1.2
6.6	7.2	150	200	2.6	1.2
11	12	200	270	2.7	1.3
15	17.5	230	310	2.7	1.3
22	24	320	430	2.8	1.4
33	36	430	580	2.9	1.5
44	48	540	730	3	1.6
66	72	770	1050	3.2	1.8
88	100	840	1150	3.3	1.9
132	145	1200	1650	3.7	2.3
220	245	1850	2300	4.3	2.9

275	300	2350	2950	4.8	3.4
330	362	2900	3600	5.4	4
400	420	3200	4000	5.7	4.3

Table 3: Servitude's and Building Restrictions

kV	Building Restriction From Line Centre	Separation Parallel Lines	Timber Restriction Forestry Area
22 and below	11	12	-
33 (H-pole)	15.5	14	-
66	15.5	14	33
88 (Horizontal)	15.5	21	33.5
88 (Delta)	15.5	15	33.5
132	15.5	25	36
132 (Double)	15.5	32	36
275	23.5	32	38.5
400	23.5	35	38.5
765	40	60	-

Table 4: Standard Insulation Levels and Creepage Distances

System Nominal Voltage	System Highest Voltage	BIL at sea level kV	60 sec power Hz withstand test kV	Creepage dist over external insul Normal mm	Special mm	Extreme mm
3.3	3.6	45	16	70	70	125
6.6	7.2	75	22	140	140	180
11	12	95	28	240	240	300
15	17.5	110	38	350	350	440
22	24	150	50	480	480	600
33	36	200	70	720	720	900
44	48	250	95	960	960	1200
66	72	350	140	1400	1400	1800
88	100	380	150	2000	2000	2500
132	145	550	230	2900	2900	3600
220	245	825	360	3700	4900	6100
275	300	1050	460	4500	6000	7500
330	362	1300	570	5500	7300	9000
400	420	1425	630	6300	8400	10500

Table .5: Minimum Vertical Clearances of Power Lines at Maximum Sag and Swing

Description	Note										
System Nominal Voltage (kV)		6.6	11	22	33	44	66	88	132	275	400
Highest System Voltage (kV)		7.2	12	24	36	48	72	100	145	300	420
Minimum Safety Clearances		**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**
Phase to Ground		0.15	0.20	0.32	0.43	0.54	0.77	1.00	1.45	2.35	3.20
Phase to Phase		0.20	0.30	0.40	0.60	0.70	1.00	1.20	1.70	3.00	4.00
Minimum Vertical Clearances		**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**
Above ground outside townships	1	5.0	5.1	5.2	5.3	5.4	5.7	5.9	6.3	7.2	8.1
Above ground inside townships	1	5.5	5.5	5.5	5.5	5.5	5.7	5.9	6.3	7.2	8.1
Above roads in townships	7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8.4	9.3
Above proclaimed roads outside townships	7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8.4	9.3
To building, poles and structures not part of the power line		3.0	3.0	3.0	3.0	3.0	3.2	3.4	3.8	4.4	5.6
To other power lines	2	0.7	0.8	0.9	1.0	1.1	1.4	1.6	2.0	2.9	3.8
To telephone lines - Angle of crossing from right angle		45º	45º	30º	30º	30º	30º	30º	30º	30º	30º
To TELKOM telephone lines	3	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.9	3.8
To SPOORNET telephone lines	3	1.4	1.4	1.5	1.7	1.8	2.0	2.2	2.7	3.6	4.5
To SPOORNET railways non-electrified	4 & 5	9.6	9.7	9.8	9.9	10.0	10.2	10.4	10.9	11.8	12.7
To SPOORNET railways non-electrified	6	11.2	11.3	11.4	11.5	1.6	11.8	12.0	12.4	13.3	14.2
To SPOORNET electrification structures		3.0	3.0	3.0	3.0	3.0	3.2	3.4	3.8	4.8	5.5
To SPOORNET electrification live wires & track earth wires		2.0	2.1	2.2	2.3	2.4	2.5	2.8	3.3	4.2	5.0
To SPOORNET earth wires (Power Lines)		0.7	0.8	0.9	1.0	1.1	1.4	1.6	2.1	2.9	3.8
To SPOORNET other power lines	2	1.4	1.4	1.5	1.7	1.8	2.0	2.2	2.4	3.5	4.5

EXPLOSIVE MAGAZINES	
Spans	Clearance
Under 30m	15.2m
30 - 167m	31.3m
Over 167m	30.5m

QUARRIES
Only single shot blasting is permitted within 457m of a power line

AERODROMES & RIFLE RANGES
See Land Survey Manual Vol. 1

ROADS (From road reserve)	Parallel to roads	Crossings roads
National roads	60m to structure	20m to structure
Important main roads	32m to line centre	16m to structure
Less important main roads	32m to line centre	16m to structure
Low traffic dust roads (from centre)	40m to line centre	16m to structure

NOTES:

1. +0.6m on major line templating
2. Higher conductor at 50ºC, Lower conductor at -5ºC
3. Min. clearance as per letter Distribution Engineering Manager (A.Y.Poulton)
4. Single power lines not at station yard
5. Where electrification is not foreseen (See Land Survey Manual Vol. 1)
6. Multiple crossings & single power lines at station yard
7. For abnormal load route = 7.5m

1. 2 Scope

This document sets out the procedure to be followed for the preparation, stringing and regulation of Conductors & Earth Wires.

1.3 Reference

The following documents are applicable in the planning and execution for this procedure:

1. Tower Assembly and Erection Inspection PDPNEG-IRP-03
2. Tractor Inspection Checklist
3. Tractor Operator Medical certificate of Fitness
4. Tractor Operator Psychometric evaluation
5. Personal Protective Equipment issue register
6. Induction training related to the project
7. TRMSCAAC1 Rev 3 : Transmission Line Towers and Line Construction
8. ESKCAAB4 : Zinc Coated earth conductor, guy and stay wire of transmission lines
9. Earth Wire and Conductor technical and quality inspection release forms
10. Midspan Joints for Earth Wire and Conductor
11. Destructive test reports on Earth Wire and Conductor Midspan Joints from the CSIR
12. Material Receiving –Inspection
13. In Process Inspection and Test
14. Stringing of Conductors Inspection
15. Stringing of Earth wires Inspection
16. Regulation of Earth wires Inspection
17. Tower Earthing Resistance Reading
18. Conductor and Earth wire Drum Record
19. Working at Heights Fall Protection Plan for 132 kV, Section E working in elevated positions
20. Harness Daily Inspection Register
21. Risk Assessment Conductor Stringing Live Line Crossings
22. Viscas Corporation Safety Rules and Procedure for Construction of Overhead Transmission & Distribution Lines
23. Stringing Programme
24. Crossings requirements schedule
25. Calculated Tensions and Sags Tables – Conductor and Earthwire
26. Hardware Drawings
27. Hardware List and Schedules

1.4 Safety Precautions

1. The Stringing Supervisor is to ensure that no personnel are under the conductors whilst stringing is in process.

2. The ORHVS competent personnel must apply to Distribution (up to 132kV) for Authorization interviews.

3. Live line teams must be present at all times when stringing occurs over energized lines. The wooden H – Poles must have sufficient clearance to allow for a total slack onto the poles over an energized line. Nets must be placed over by the live line team if the risk identified at the tool talk is considered and required. The wooden poles will be 14m long x 300mm diameter and a hole will be dug 2m deep for the wooden poles to be inserted. Stay wires stayed onto concrete blocks will be used. Scaffolding if required will be by a recognized company and the SANS 085 standards will be complied. A scaffolding inspector will be appointed under the construction regulations 14(2). The scaffolding drawings related to the crossings will be submitted for approval together with a scaffolding erection method statement. The placement will be inspected and surveyed by an engineer. Staying of scaffolding will be required and the scaffolding concrete base slabs will be 2m wide by the required lengths as determined by the black soil and conditions on the ground to also avoid uneven surfaces.

4. Construction Regulation 21 (d) – training, medical and psychometric examinations will be will be required for the Winch and Tensioner operators. Tractors winch and brake operators must inspect and check their equipment on a daily basis.

5. PPE i.e. Overalls, hard hats, safety boots, leather gloves, must be worn. Tower climbers will have all the required equipment i.e. safety harness with double lanyard and pylon hooks, SANS 397 hard hats with chin straps, cabloc grabber unit for vertical and horizontal movement as an alternative to using the leapfrog technique, full finger gloves and safety boots.

6. The movement of tower climbers on the cross beam of self supporting towers will be done onto life lines with pylon hooks attached. The leap frog movement technique will always be used. Tower climbers must ensure that their harnesses are inspected prior to use and be recorded in the inspection register. The vertical climbing system must be inspected by the tower climber before he attaches himself and begins his climb. A certificate of inspection that the Fall Arrest System per tower position is safe to climb must be issued. A white Tag coupled on the bottom of the Fall Arrest System will confirm that the system is also safe to climb. The tower number and line designation and certificate number will be written in by UV resistant waterproof ink.

7. The Winch station must be cordoned by means of barbed wire barricading to avoid unnecessary movement of personnel during the stringing operation. This will avoid unnecessary injuries that could occur if the pilot cable should break during the tensioning process. The Certificate of fitness of each pilot cable drum must be available on site. All pilot cable drums must be individually numbered and an inspection record of daily visual inspection must be done prior to pulling. All running boards and necessary tools must have current certificates of inspections and must be available on site. Equipment left on working situations must be accounted for as to ensure that the stringing supervisor is able to account for this equipment.

8. Fibreglass/Aluminium Ladders must be numbered and registered. 3 x monthly inspections must be made. Induction could become present during high winds and stringing operation.

9. Tower climbers may not climb onto the insulators but must place a ladder parallel to the insulator.

10. In case of Tension Towers wherein the insulator tension set almost in horizontal position after sagging works and the use of a ladder is not suitable. It is recommended not to removed the wooden box during hanging of insulators and a

wooden platform to be used in replacement of the ladder to be placed parallel to the insulator tension set.

11. The contractor shall comply with all conditions specified in the Environmental Management Plan (EMP) and Water Use Licence requirements/recommendations during construction. In general, soil disturbance should be kept to a minimum. The disturbance of land contour banks or other erosion control structures shall be avoided.

12. There shall be no littering of the veld. The contractor shall provide suitable containers for any waste.

1.5 Procedure/Method Statement

The proposed development/procedure will entail the construction of power line tower structures and the associated power lines. The proposed procedure will therefore have construction phase and stringing method.

1.5.1 Construction Phase

The construction phase will essentially entail the following main points:

- The positions and levels of the foundations for structures are surveyed and marked accordingly.
- The ground will be excavated according to the soil type and structure that that will be erected in that soil type.
- The amount of soil to be excavated will amount to approximately 45m^3 for each tower.
- Shuttering will be installed to prevent collapsing of the excavation. This will either be wooden shutters or steel shutters.
- The re-enforcement steel and stubs will be assembled in accordance with the design.
- Pre-mixed concrete will then be poured into the excavation.
- The estimated amount of concrete required for each tower foundation is approximately 12m^3.
- All concrete work will be smoothened out and finalised.
- The surrounding area will be restored to its natural state.
- The structure will be pre-assembled and mounted onto the foundation stubs.
- The towers will be dressed with appropriate hardware assemblies.
- Stringing of the conductor will commence once the structures have been erected.
- No vehicles will be used for stringing through intermediate towers in wetlands. The pilot conductor will be sent through the pulleys manually.

- The stringing equipment will have installed on one side of a strainer (puller and tensioner) and stringing is done for that full tension section. However, we have some allowance in terms of where exactly this equipment will be installed relative to the strain structure.
- During stringing a rope will be used to cross the river and transported by either a boat or by foot. Tension stringing by means of a bull wheel will be used where the rope is attached to a steel cable and the steel cable to the conductor.
- Bird anti-collision/diverter devices will be installed by means of fitting diverters that is made up of a stainless steel sphere which will last as long as the power line to which it anchored.
  - All phase and earth conductors shall be tension strung.
  - The equipment and method discussed above for stringing the 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.
  - Stringing shall be done in daylight hours only.
  - All conductors shall be strung by the controlled-tension method by means of rubber faced bullwheel-type/tractor tension stringing equipment. This equipment must be so designed that there shall be no conduction of the heat generated by the braking action, to the bullwheels. There shall be appropriate mechanical braking on the reels to prevent loose conductors between the reels and the bullwheels, but sufficient tension to pull the conductor in between layers remaining on the reel.
  - Adequate protection shall be provided where there is danger of conductors being damaged by vehicle or other equipment and objects. Conductors shall not be left in contact with the ground, vegetable matter or any conducting or semi-conducting material. Wood lagging or similar material shall be used to protect the conductor when working at ground level.
  - 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 recalibrated at regular intervals.
  - On completion of regulating of a section of the line, the contractor shall measure and record all clearances over roads, power line, communication lines, railways, streams etc. along the route.
  - Construction activities must be scheduled to take place over the dry winter season when flows are low.
  - The site camp area will not be placed inside a wetland or the riparian habitat or any of the associated buffer zones of the delineated surface water resource.
  - Contractor will work within the servitude area of the proposed power lines and not into the surrounding surface water resource system.

- The required construction areas in the wetlands, watercourses or associated buffer zones are to be clearly demarcated and no access beyond these areas is to be allowed. The number and type of permissible vehicles or machinery into or near to the sensitive area will be preferable light vehicles where possible.
- A single access route or right of way (RoW) is to be established. The width of the RoW must be limited to the width of the vehicles required to enter the wetland. An area around the locations of the proposed tower structures will be required in order for construction vehicles and machinery to operate, this area will be limited to the smallest possible area to prevent unnecessary degradation.
- All vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery will be regularly serviced and maintain before being allowed to enter the construction RoW within the sensitive areas. No fuelling, re-fuelling vehicle and machinery servicing or maintenance is to take place in the sensitive areas.
- No hazardous materials are to be stored or brought into the sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from sensitive areas.
- Where foundations for the proposed power line structures are to be placed in a wetland, watercourse or the associated buffer zone, excavated topsoil should be stockpiled separately from subsoils so that it can be replaced in the correct order for rehabilitation purposes.
- Usually, wetland soils are inappropriate to provide suitable stable infill and will need to be removed and replaced by imported soil of suitable grade. Wetland soil will be removed only if is absolutely required. Furthermore, any removed soil and vegetation that are not required should be taken to a registered landfill site that has sufficient capacity to assimilate the spoil.
- The topsoil is to be used for rehabilitation purposes and should not be removed unless there is surplus that cannot be utilised. It is important that when the soils are reinstated, the sub soils are to be backfilled first followed by the topsoil. The topsoil contains a natural seedback from which the affected wetland, watercourse or buffer zone can naturally rehabilitate.
- Where the soil is excavated from the sensitive areas, it will be preferred for them to be stockpiled adjacent to the excavation pit to limit vehicle and any other movement activities around the excavation areas.
- Cement mixing will take place over the bin lined surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground of the wetland, watercourse

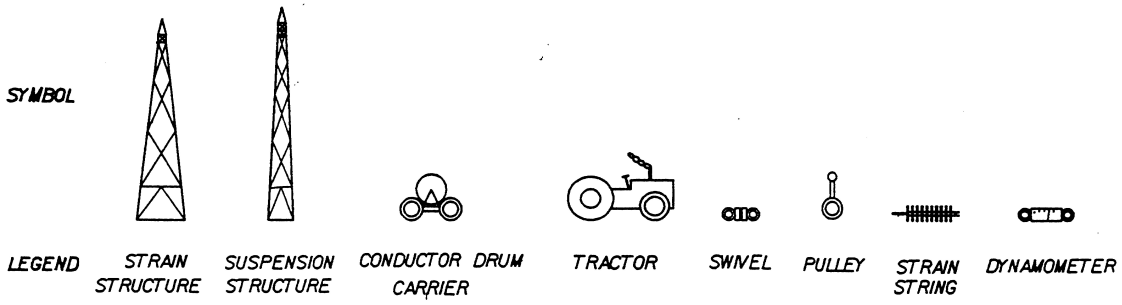
or associated buffer zone. Importantly, no mixing of cement directly on the surface is allowed in the sensitive and RoW areas.

- Stockpiled soil will be protected from wind and water erosion. Stockpiled soils are not to exceed a 2m height and are to be bunded by suitable materials. Stacked bricks surrounding the stockpiled soils can be adopted. Alternatively, wooden planks pegged around the stockpiled soils can be used.
- When stringing of the proposed power lines takes place through the wetland or watercourse areas, it is to be undertaken by hand. Vehicles must not be used for this exercise in order to limit compaction impacts to the soils of the wetland.
- The affected RoW zones in the sensitive areas must be reinstated with the wetland soil where possible, and the affected areas must be levelled or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish.
- An appropriate storm water management plan formulated by a suitable qualified professional must accompany the design.

1.5.2 Stringing equipment per phase

1	Conductor drum carrier.
2	Swivels.
1	Dynamometer (calibrated not longer than 6 months ago).
X	Amount running out pulleys
1	Come along
1	Tractor

Symbols:



With the phasing out of the glass disc insulators and the introduction of the long rod polymer type insulators, new stringing precautions must be taken.

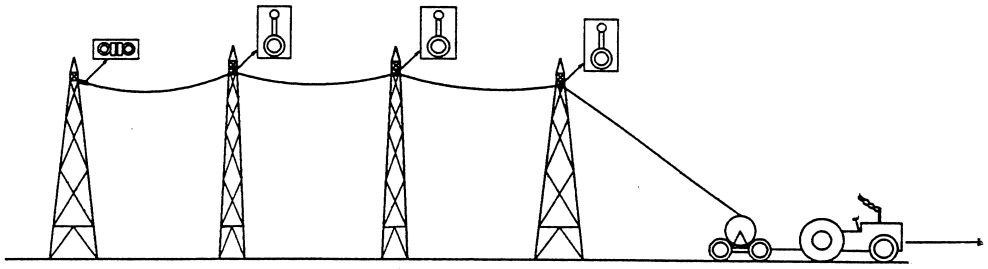
The new type long rod insulators have some disadvantages. The rubber-like appearance gives one the idea that they cannot break and that they cannot take any cantilever or torsion loads .Care should thus be taken whenever one does stringing with this type of insulators. Tension stringing is the recommended stringing technique but if it is not possible the alternative stringing procedure as described below must be used.

1.5.3 Stringing Procedure

STEP 1: RUNNING OUT OF THE CONDUCTOR

* Secure swivel onto the strain structure (anchor end).
* Terminate the conductor with the compression dead-end onto the swivel.
* Use a conductor drum carrier to run out the conductor along the line and lock the conductor onto the running blocks.
* All unnecessary slack shall be eliminated to prevent conductor friction during tensioning.
* The conductor must never be dragged on the ground, if it is not possible to achieve this, the conductor must be protected with wooden planks form damaging.
* Under no circumstances shall any vehicle be allowed to drive over conductors.

STEP (1)

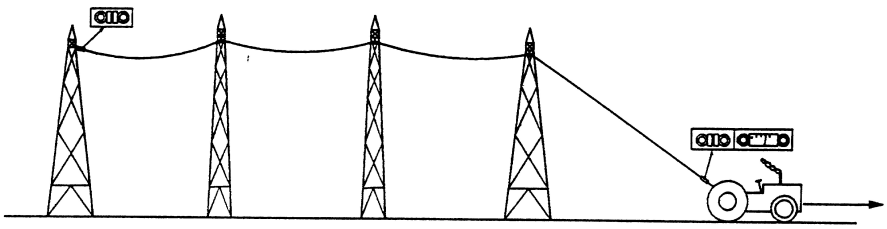


STEP 2: UNWINDING OF THE CONDUCTOR

* Cut the conductor.
* Install a swivel and dynamometer at the pulling end.
* Tighten conductor slightly and give the conductor time to unwind.

NOTE: The conductor shall not be tensioned more than 27kN for Wolf, 18kN for Chicadee, 21kN for Pelican, 28kN for Kingbird, 36kN for Panther and 44kN for Bear.

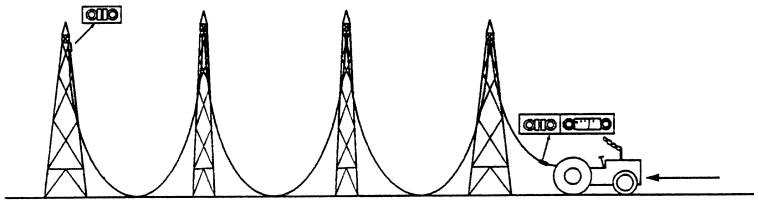
STEP (2)



STEP 3: SLACKING OF CONDUCTOR

- Conductor to be slacken after it has unwounded.
-

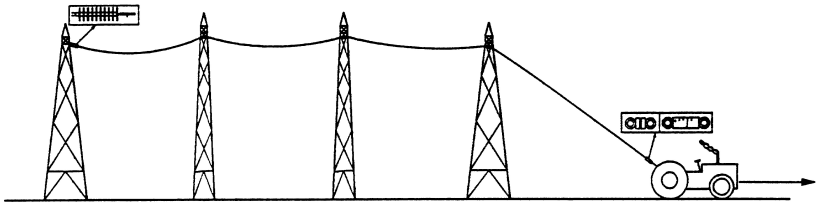
STEP (3)



STEP 4: SAGGING

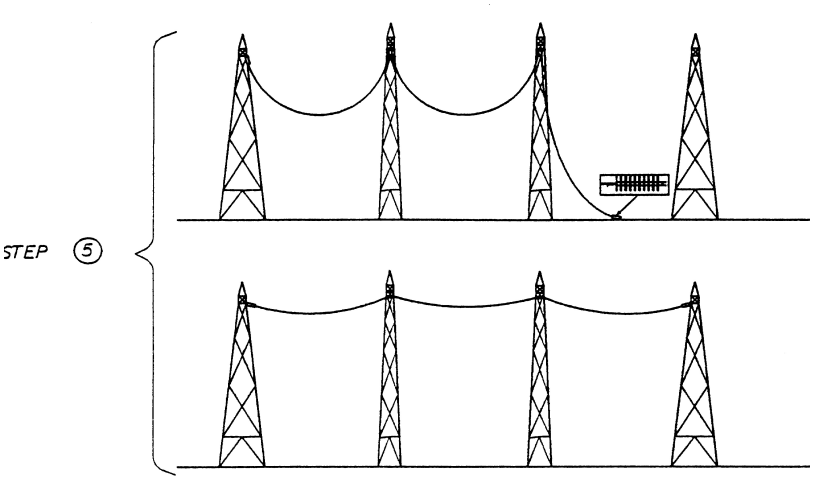
* Remove the swivel at the anchor end.
* Install the strain insulator.
* Sag conductor according to the provided Sag and Tension Chart.
* Ensure that conductor has not snagged on any of the running blocks.

STEP (4)



STEP 5: REGULATION

* Install the strain insulator at the pulling end.
* Hook conductor into position.
* Do regulation (fine tuning) with the turn buckle.
* Remove the running blocks and secure the conductor with the suspension clamps.



1.6 Execution

Stringing operations can only commence once the necessary Tower Foundations, Tower Assembly and Erection; Resistance Tower Earthing resistance readings inspection forms have been signed. This will ensure that all the quality and safety aspects have been checked. The drums stations will be cleaned manually with the racks and the fire break will be bladed around the drum stations. All safety and legal requirements must be adhered to. A survey of the line shall be carried out before commencement to identify difficulties and to determine the Winch and Brake Tensioner positions.

Environmental and Safety Officers need to be informed in advance where the stations will be to inspect the work site to ensure that there are no sensitive habitats or archaeological significant sites, e g. graves.

Clearing/levelling of the stations must be kept to a required minimum.

The landowners must be contacted and be informed that there will be a drum station in their property and assured that no dangers are present to his livestock or wild fauna. Good housekeeping must be maintained at these stations at all times.

If security guards are to be used then the landowner must be informed to avoid potential misunderstandings. Crossings, notices and permits must be arranged and statutory clearances must be adhered to.

Suitable structures under each phase will be erected to protect all fences from pilot cable damage during the stringing. Conductor may not touch or be dragged on the ground.

All equipment to be used must be identifiable by means of a unique control number and can be cross referenced to a certificate of test, calibrated and daily inspection.

The Winch and Brake must be suitably earthed and running earths must be on the conductor at all drum stations.

Phase and earth conductors will be pulled by the tension method to avoid them from being damaged by scraping the ground surface. Matched numbered drums will be used.

Instruments to be used – compression tool (hexagon):

The Eskom code number of the instrument must be provided (if applicable).

A maintenance certificate must be available for inspection, to prove that all compression tools were tested and accepted not more than one year before the commencement of the project.

INSTRUMENT	LAST DATE TESTED AND ACCEPTED	APPROVED		
		NAME	SIGNATURE	DATE

Midspan Joints and Damage:

All midspan joints must be identified:

Conductor
- On what phase
- In which span

Earthwire
- In which span

Any damage to the conductors or earthwire shall be reported to the Construction Supervisor. He, in turn, must investigate the damage and decide on corrective actions. The span on which the damage occurred, together with a short comment, must be noted on the checklist.

The Construction Supervisor or his delegate must certify that a qualified person did all repairs and midspan joints and the work was done to an acceptable standard.

Testing Dead-end and Midspan Joints:

Before stringing commences, compression samples shall be prepared as described in the Specification for Transmission Line Towers and Line Construction.

The Senior Engineer, Design Services, will advise the Contractor, on request, as to which laboratory such samples can be taken for testing.

Regulation

a) Dynamometer:

The instrument's Eskom code numbers must be provided, as well as the last date the instrument was calibrated. The calibration certificate must be available for inspection.

b) Section:

The line sections will be provided, as described in the Sag and Tension tables.

c) Ambient Temperature:

(See Annexure A)

The ambient temperature must be given in degrees Celsius and will be measured as described in TRMSCAAC1, Section 8.2.6.3.

d) Tension or Sag:

The tension in kN must be recorded in this document. (Alternatively Sag in m).

e) Acceptance:

The regulation must be accepted by the Construction Supervisor and the Project Co-ordinator / Clerk of Works.

1.7 Inspection

a) Stringing of Conductors Inspection
b) Stringing of Earth wires Inspection
c) Regulation of Earth wires Inspection
d) Tower Earthing Resistance Reading
e) Conductor and Earth wire Drum Record
f) Inspection and Test Plan

1.8 Environmental Consideration

a) Road and Route Access:

- Road and route access should already be identified prior to commencement of stringing to ensure that environmentally sensitive areas have been identified. No routing should be permitted through any environmentally sensitive areas i.e. wetlands (even during the dry season), drainage lines etc. Streams and drainage line crossings should be avoided.
- All private roads used for access to the servitude shall be maintained by the contractor and upon the completion of the works, be left in at least the original condition.
- If access is across the running water, the contractor shall take precautions not to impede the natural flow of water. If instructed the contractor is to stone pitch the crossing point. There shall be no pollution of water.
- Existing drainage systems shall not be blocked or altered in any way.

b) Vegetation and environmentally sensitive areas:

Vegetation should have been identified prior to removal to ensure that no protected species are removed without a permit. Vegetation should have been retained and already be cordoned off as should any sensitive areas i.e. rivers, streams, wetlands

etc. Any damage to sensitive areas must be recorded (noted in the remedial and rehabilitation register and photographed) but must be avoided as far as possible and once work in the area has been completed, rehabilitation must be put into effect.

c) Vehicle maintenance and re-fuelling:

Maintenance and re-fuelling of vehicles on site is prohibited. A spill kit must be available with a respective team vehicle which will be at the working station permanently. If this vehicle for any reason has to move away from the servitude then the spill kit must be off-loaded at the drum station position. The spill kit has the facility to place any contaminated soil for containment. Leaking vehicles should be identified and removed from site to a workshop for repairs. Spills should be recorded and cleaned immediately. Soil that has been contaminated should be removed and placed in a container and returned to the camp site in the designated bonded area. This must be reported to the Environmental Officer and recorded in the remedial and rehabilitation register.

d) Hazardous materials and flammable liquids:

Firefighting equipment will be kept with each team i.e. a fire extinguisher in each vehicle and 4 x fire beaters.

The following vehicles and equipment have large tank capacities of hydraulic, engine oils and diesel:

Brake : 200lt of diesel
45lt of hydraulic oil
12lt of engine oil

Winch: 220lt of diesel
200lt of hydraulic oil

4x4 Truck mounted with crane: 150lt of diesel
100lt of hydraulic oil

All vehicles can be refuelled at fuel depots only.

Fuels or oils stored temporarily (i.e. day to day) with each team will be kept in sealed containers away from the work area to prevent vehicles accidentally knocking over the fuels resulting in spills. Any spills must be immediately reported to the Environmental Officer and be sent to the registered waste disposal site. Housekeeping and Waste: Waste bins for general waste must be provided with each team and should be removed back to the camp at the end of each work day. Littering will not be tolerated and a clean work station policy will be enforced.
Hazardous waste i.e. oil drums, fuel containers etc. must be disposed of at an appropriate hazardous landfill and a safe disposal certificate must be obtained. Any broken insulators shall be removed and all shards picked up. Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site.