Eskom	**VOLUME 5** **INFORMATION SECTIONS** **Watershed 132kV lines diversion** **Project ID: CTXQ0827**	**NED** **NWOU-AC** **Rev 0**

INDEX

Revision Details: Rev.0	

Compiled By			
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Eskom	**Section A** **Quality Assessment Detail Instructions** **Watershed 132kV lines diversion** **Project ID: CTXQ0827**	**NED** **NWOU-AC** **Rev 0**

SEE ATTACHED DOCUMENT

Ensure that all work is done according to the following:

1. Delegation of Duties to Clerk of Works

The appointed Clerk of Works must:

- Enforce Eskom standards and specifications
- Ensure compliance with Eskom quality assurance requirements
- Document deficiencies and keep the Eskom Project Engineer, Project Co-ordinator and Project Manager informed.
- Review contractors Quality Assurance procedure to evaluate effectiveness and compliance with Eskom's Quality Assurance Program.
- Issue site instructions on consultation with the Project Engineer.
- Ensure that the Contractor does not deviate from the approved drawings.
- Accepts and verifies quality of delivered material.
- Witness all relevant tests carried out by contractors.
- Ensure neatness and quality finishing at all times.

2. Inspections

The appointed Clerk of Works shall inspect the following:

- Excavations of Earth mat trenches, Foundations for equipment, and fencing according to drawings and specifications.
- Concrete to specified bearing pressures according to the relevant foundation drawings.
- Compaction according to specifications
- Earthing installed and welded before backfilling.

The Clerk of Works shall accept no illegal, and/or substandard work. He must be impartial and non-biased in his findings and must be able to substantiate his verdict.

3. Communication

It is expected of the Clerk of Works to inform the Project Engineer on a weekly basis on the progress of the project. All discrepancies, whether solved or not, shall be communicated to the Project Engineer.

4. Personal Involvement

The Clerk of Works will be liable for the following items and shall report on these items on a weekly basis:

4.1 Foundations:

i) Check that foundation nominations done by contractor will be suitable for the soil conditions on site.
ii) Check that excavations are according to the relevant drawings.
iii) Check that all excavations that is not attended to are covered or barricaded.

4.2 Planting of Poles:

i) Ensure that the poles are planted according to the relevant tower drawings.
ii) Check that poles are planted plumb.
iii) Check that imported soil is used for the back filling not Black Turf.

iv) Compaction according to specifications must be witnessed.
v) Ensure that no pole is planted before the curing period for stay rods or foundations has passed.
vi) Check that the correct slings are used.
vii) Check the poles are planted to the correct depths.

4.3 Assembly and Erection of steel-pole towers:

i) Ensure that the towers are assembled and erected according to the relevant tower drawings.
ii) Check that the correct slings are used.
iii) Check that no damaged members are used.

4.4 Installation of stays:

i) Check that stay rod excavation nominations done by contractor will be suitable for the soil conditions.
ii) Check that excavations are according to the relevant drawings.
iii) Check that all excavations that are not attended to are covered or barricaded.
iv) Check that the stays are assembled and installed are according to the relevant drawings.
v) Check the angle of the stay relative to the ground is 45 degrees after installation of the stay.

4.5 Dressing Steel - pole towers:

i) Check that the correct hardware is installed on the poles and towers according to the relevant drawings.
ii) Check that the bolts and split pins are pointing in the same direction through out the length of the line.
iii) Check that all split pins are securely bent over.

4.6 Disposal of excavated material and importing of soil:

i) Check that all excavated material not used for back filling is disposed of according to specifications.
ii) Check that the imported soil is according to specifications.

4.7 Stringing:

i) Check that stringing is done according to specifications and drawings.
ii) Check that the necessary provision is made to ensure that the conductors are not damaged.
iii) Ensure that all crossings are done according to the relevant specifications.

4.8 Conductor joints and repairs;

i) Witness all jointing and conductor repairs.
ii) Check that the jointer is an Eskom jointer.
iii) Check that all joints and conductor repairs are done according to the relevant specifications.

4.9 Regulation:

i) Check that the regulations of the conductors are done to the relevant specifications, sag and tension charts.
ii) Check that the additional hardware such as vibration dampers is installed according to the relevant specifications.

4.10 Labelling:

i) Check that the correct pole identification labels are installed on each pole.
ii) Check that the line designation and line crossing labels are installed on the correct pole numbers.
iii) Check that all line crossing labels are pointing in the correct direction.

All findings shall be logged and kept for future reference.

Eskom	**Section B** **PROFILE & STAKING TABLE** **Watershed 132kV lines diversion** **Project ID: CTXQ0827**	**NED** **NWOU-AC** **Rev 0**

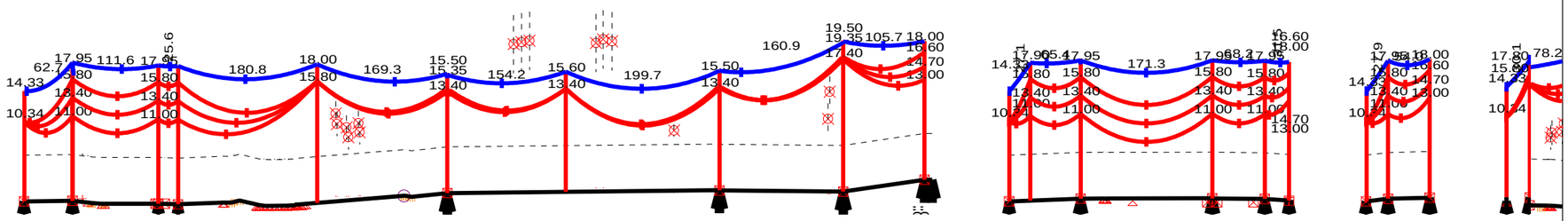
SEE ATTACHED DOCUMENT

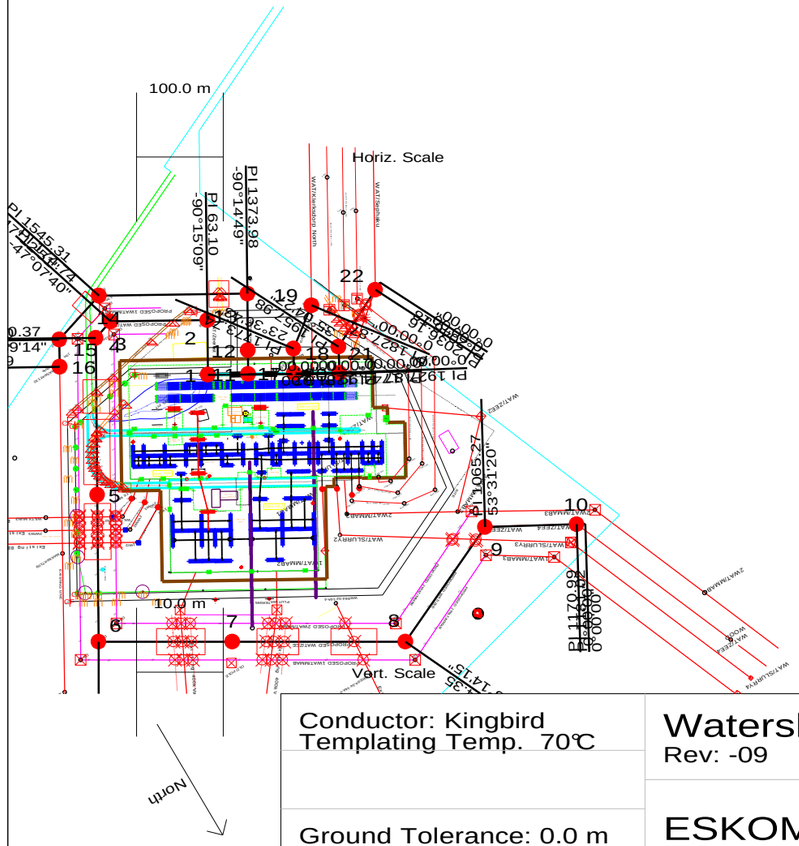
WATERSHED 132KV LINES DIVERSION - STAKING TABLE

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Centerline Z E	Ahead Span (m)	Line Angle (deg)	Transverse Axis	Structure Name	Structure Description	Struct. Height (m)	Embedded Length (m)
WAT/ZEE GANTRY	0.418	-85674.780	-2887295.412	1504.609	27.443	0.0000	300.1331	WAT-ZEE 132KV GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam	14.326m Columns & 12.	0
1WAT/ZEE1	27.861	-85688.556	-2887319.146	1504.644	35.239	0.0000	300.1331	strsce0218kw110.pol	132KV 02 deg 18m monopole self-support	18.000	0.000
1WAT/ZEE2	63.100	-85706.247	-2887349.623	1504.690	111.637	-90.2526	85.0068	strsce9018kw110	132KV 90 deg 18m monopole self-support	18	0
1WAT/ZEE3	174.738	-85609.450	-2887405.240	1504.310	25.633	-47.1279	6.3166	strsce4518kw110	132KV 45 deg 18m monopole self-support	18	0
1WAT/ZEE4	200.370	-85584.970	-2887397.640	1504.240	180.830	-42.6540	321.4257	strsce4518kw110	132KV 45 deg 18m monopole self-support	18	0
1WAT/ZEE5	381.200	-85494.286	-2887241.193	1504.419	169.266	0.0000	120.0987	7617a-k1-5w-r2.154	D7617 - 132kV 3-Pole Intermediate (0°)	18	2
1WAT/ZEE6	550.466	-85409.400	-2887094.750	1505.690	154.183	-89.4609	255.3682	7618d-k1-90-r2.134_tic	D7618 - 132kV Stayed 3-Pole Strain (5°-90°)	15,6	2,4
1WAT/ZEE7	704.649	-85542.060	-2887016.177	1505.851	199.697	0.0000	30.6378	7617a-k1-5w-r2.134	D7617 - 132kV 3-Pole Intermediate (0°)	15,6	2,4
1WAT/ZEE8	904.346	-85713.880	-2886914.410	1506.060	160.926	-55.2376	183.0190	7618c-k1-90-r2.134	D7618c - 132kV Stayed 3-Pole Strain (30°-60°)	15,6	2,4
1WAT/ZEE9	1065.272	-85860.200	-2886981.400	1505.880	105.722	53.5223	2.1613	7618d-k1-90-r2.174_tic	D7618 - 132kV Stayed 3-Pole Strain (5°-90°)	19,6	2,4
WAT/TLH GANTRY	1281.449	-85715.077	-2887272.413	1504.610	27.141	0.0000	300.1340	WAT-TLH 132KV GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam	14,326	0
1WAT/TLH1	1308.590	-85728.702	-2887295.886	1504.715	65.391	0.0000	300.1340	strsce0218kw110	132KV 02 deg 18m monopole self-support	18	0
1WAT/TLH2	1373.981	-85761.530	-2887352.440	1504.970	171.325	-90.2468	75.0106	strsce9018kw110	132KV 90 deg 18m monopole self-support	18	0
1WAT/TLH3	1545.306	-85612.990	-2887437.810	1505.000	68.195	-47.2141	6.2801	strsce4518kw110	132KV 45 deg 18m monopole self-support	18	0
1WAT/TLH4	1613.500	-85547.890	-2887417.500	1504.930	31.487	-42.8959	321.2251	strsce4518kw110	132KV 45 deg 18m monopole self-support	18	0
WAT/KLN GANTRY	1745.811	-85761.127	-2887246.577	1504.618	27.927	0.0000	299.5966	WAT-KLN 132KV GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam	14,326	0
1WAT/KLN1	1773.738	-85774.920	-2887270.860	1504.950	54.014	23.6119	311.4025	strsce4518kw110	132KV 45 deg 18m monopole self-support	18	0
WAT/SEP GANTRY	1927.870	-85806.260	-2887219.838	1505.168	30.111	0.0000	298.4619	WAT-SEP 132KV GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam	14,326	0
1WAT/SEP1	1957.981	-85820.610	-2887246.310	1505.110	78.179	35.0743	315.9991	7618c-k1-90-r2.134	D7618c - 132kV Stayed 3-Pole Strain (30°-60°)	15,6	0

PLS-CADD Drawing

1 132kv-12m beam.106
2 strsce9018kst110.pol
3 strsce4518kst110.pol
4 strsce4518kst110.pol
5 7617a-k1-5w-r2.154.pol
6 7618d-k1-90-r2.134_tic.pol
7 7617a-k1-5w-r2.134
8 7618c-k1-90-r2.134.pol
9 7618d-k1-90-r2.174_tic.pol
10 7615_k.020
11 132kv-12m beam.106
12 strsce0218kst110.pol
13 strsce9018kst110.pol
14 strsce4518kst110.pol
15 strsce4518kst110.pol
16 7615_k.020
17 132kv-12m beam.106
18 strsce4518kst110.pol
19 7615_k.020
20 132kv-12m beam.106
21 7618c-k1-90-r2.134_selfsup.pol





Conductor: Kingbird Templating Temp. 70℃	Watershed Transmission Lines re-routing Rev: -09	Surveyed by: Kenny Mbuli	Rev. -09 Rev. Date:
		Optimised by: Kenny Mbuli	Date Printed: 2020/0 Page: 1 of 2
Ground Tolerance: 0.0 m	ESKOM, DISTRIBUTION NORTH WEST OU	Approved by:	File Name: WATERSHED F

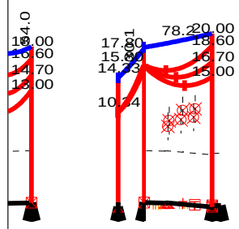
PLS-CADD Drawing

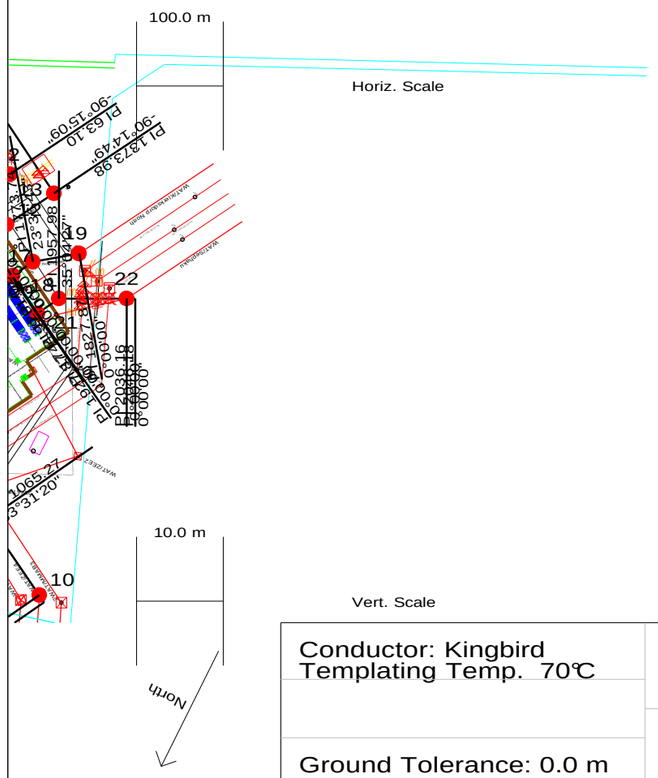
19 7615_k.020

20 132kv-12m beam.106

21 7618c-k1-90-r2.134_selfsup.pol

22 7615_k.022





Conductor: Kingbird Templating Temp. 70°C	Watershed Transmission Lines re-routing Rev: -09	Surveyed by: Kenny Mbuli	Rev. -09 Rev. Date:
		Optimised by: Kenny Mbuli	Date Printed: 2020/0 Page: 2 of 2
Ground Tolerance: 0.0 m	ESKOM, DISTRIBUTION NORTH WEST OU	Approved by:	File Name: WATERSHED F

Eskom	**Section C** **Stringing Charts** **Watershed 132kV lines diversion** **Project ID: CTXQ0827**	**NED** **NWOU-AC** **Rev 0**

SEE ATTACHED DOCUMENT

Criteria Notes:
Rev: 8 Criteria based on SANS-10280-2013 - Simplified method for Sub-transmission and Distribution lines build with mono- or multi- pole structures. Maximum wind loads applied as per IEC 60826-2003.
Deflection limits for Steel Pole structures as per ESKOM specification DSP_34-1683.

Selected sections include:
Structures: 1 - 22
Circuits: All

Section Sagging Data

Circuit Sec. No.				Cable File	From Str. Condition	To Str.	Voltage (kV)	Ruling Span (m)	Condition	Sagging Data Temp. (deg C)	Catenary Constant	Horiz. Tension (m)	Weather Case	Catenary Constant (m)
1				kingbird	1	2	132	62.9	Creep RS	15.0	400.0	4032.0	70°C Hot	276.5
2				kingbird	11	12	132	27.3	Creep RS	15.0	425.0	4286.1	70°C Hot	167.0
3				wolf	1	2	0	62.9	Creep RS	15.0	400.0	2864.0	-5°C Uplift	480.8
4				wolf	2	3	0	111.6	Creep RS	15.0	1798.0	12873.7	-5°C Uplift	2403.4
5				wolf	3	4	0	25.6	Creep RS	15.0	425.0	3043.0	-5°C Uplift	930.0
6				wolf	4	5	0	180.8	Creep RS	15.0	1798.2	12875.1	-5°C Uplift	2237.6
7				wolf	6	7	0	154.2	Creep RS	15.0	1799.3	12883.0	-5°C Uplift	2302.7
8				wolf	7	8	0	199.7	Creep RS	15.0	1799.7	12885.9	-5°C Uplift	2198.3
9				wolf	8	9	0	160.9	Creep RS	15.0	1799.3	12883.0	-5°C Uplift	2287.7
10				wolf	11	12	0	27.6	Creep RS	15.0	400.0	2864.0	-5°C Uplift	835.8
11				wolf	12	13	0	65.4	Creep RS	15.0	1753.8	12557.2	-5°C Uplift	2449.0
12				wolf	14	15	0	68.2	Creep RS	15.0	1757.4	12583.0	-5°C Uplift	2447.7
13				wolf	17	18	0	28.3	Creep RS	15.0	425.0	3043.0	-5°C Uplift	886.4
14				wolf	5	6	0	169.3	Creep RS	15.0	1798.3	12875.8	-5°C Uplift	2265.1
15				wolf	9	10	0	105.7	Creep RS	15.0	1799.8	12886.6	-5°C Uplift	2418.5
16				wolf	13	14	0	171.3	Creep RS	15.0	1798.3	12875.8	-5°C Uplift	2261.7
17				wolf	15	16	0	31.5	Creep RS	15.0	425.0	3043.0	-5°C Uplift	828.6
18	16ztt2s1_24b1	0_154-272.2lin.opg			20	21	0	30.5	Creep RS	15.0	425.0	2571.3	-5°C Uplift	841.7
19	16ztt2s1_24b1	0_154-272.2lin.opg			21	22	0	78.2	Creep RS	15.0	8754.2	52962.9	-5°C Uplift	9608.4
20				kingbird	2	3	132	111.6	Creep RS	15.0	1800.0	18144.0	70°C Hot	766.0

	21				kingbird	3	4	132	25.6	Creep RS	
15.0	425.0	4284.0	70°C Hot		Creep RS	159.8					
	22				kingbird	4	6	132	175.3	Creep RS	
15.0	1800.0	18144.0	70°C Hot		Creep RS	1018.9					
	23				kingbird	6	8	132	181.3	Creep RS	
15.0	1800.0	18144.0	70°C Hot		Creep RS	1038.5					
	24				kingbird	8	9	132	160.9	Creep RS	
15.0	1800.0	18144.0	70°C Hot		Creep RS	969.1					
	25				kingbird	9	10	132	105.7	Creep RS	
15.0	1800.0	18144.0	70°C Hot		Creep RS	737.4					
	26				kingbird	13	14	132	171.3	Creep RS	
15.0	1800.0	18144.0	70°C Hot		Creep RS	1005.6					
	27				kingbird	14	15	132	68.2	Creep RS	
15.0	1425.0	14364.0	70°C Hot		Creep RS	475.3					
	28				kingbird	15	16	132	31.5	Creep RS	
15.0	425.0	4284.0	70°C Hot		Creep RS	183.6					
	29				kingbird	17	18	132	28.1	Creep RS	
15.0	425.0	4284.0	70°C Hot		Creep RS	170.0					
	30				kingbird	18	19	132	54.0	Creep RS	
15.0	425.0	4284.0	70°C Hot		Creep RS	261.2					
	31				kingbird	20	21	132	30.0	Creep RS	
15.0	425.0	4284.0	70°C Hot		Creep RS	177.8					
	32				kingbird	21	22	132	78.2	Creep RS	
15.0	1200.0	12096.0	70°C Hot		Creep RS	493.2					
	33				kingbird	12	13	132	65.4	Creep RS	
15.0	1000.0	10080.0	70°C Hot		Creep RS	403.2					
	34			opgw-acs_12_12_67		18	19	0	54.0	Creep RS	
15.0	425.0	2234.7	-5°C Uplift		Creep RS	519.5					

Section Geometry Data

Notes: Lengths are arc lengths along the wire at 15 (deg C), Creep.
Lengths are adjusted for the number of phases, the number of subconductors and to exclude the length of strain insulators.
Lengths are computed with any concentrated loads removed.

Circuit Sec. No.			Cable File Name	From Str.	To Str.	Number of Phases	Wires Per Phase	Min. Span Length (m)	Max. Span (m)	Ruling Span (m)	Total Cable (m)
1			kingbird	1	2	3	1	63.0	63.0	62.9	177.8
2			kingbird	11	12	3	1	27.5	27.5	27.3	71.6
3			wolf	1	2	1	1	63.0	63.0	62.9	62.8
4			wolf	2	3	1	1	111.6	111.6	111.6	111.4
5			wolf	3	4	1	1	25.6	25.6	25.6	25.2
6			wolf	4	5	1	1	180.8	180.8	180.8	180.5
7			wolf	6	7	1	1	154.2	154.2	154.2	153.8
8			wolf	7	8	1	1	199.7	199.7	199.7	199.4
9			wolf	8	9	1	1	160.9	160.9	160.9	160.6
10			wolf	11	12	1	1	27.8	27.8	27.6	27.8
11			wolf	12	13	1	1	65.4	65.4	65.4	65.3

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          12                                wolf     14      15       1       1    68.2
68.2    68.2    67.8
          13                                wolf     17      18       1       1    28.6
28.6    28.3    28.4
          14                                wolf      5       6       1       1   169.3
169.3   169.3   168.9
          15                                wolf      9      10       1       1   105.7
105.7   105.7   105.3
          16                                wolf     13      14       1       1   171.3
171.3   171.3   171.1
          17                                wolf     15      16       1       1    31.5
31.5    31.5    31.1
          18 16ztt2s1_24b1 0_154-272.2lin.opg     20      21       1       1    30.7
30.7    30.5    30.4
          19 16ztt2s1_24b1 0_154-272.2lin.opg     21      22       1       1    78.2
78.2    78.2    77.8
          20                           kingbird      2       3       3       1   111.6
111.6   111.6   323.9
          21                           kingbird      3       4       3       1    25.6
25.6    25.6    65.8
          22                           kingbird      4       6       3       1   169.3
180.8   175.3  1039.8
          23                           kingbird      6       8       3       1   154.2
199.7   181.3  1051.0
          24                           kingbird      8       9       3       1   160.9
160.9   160.9   472.0
          25                           kingbird      9      10       3       1   105.7
105.7   105.7   307.5
          26                           kingbird     13      14       3       1   171.3
171.3   171.3   503.1
          27                           kingbird     14      15       3       1    68.2
68.2    68.2   193.5
          28                           kingbird     15      16       3       1    31.5
31.5    31.5    84.6
          29                           kingbird     17      18       3       1    28.3
28.3    28.1    74.0
          30                           kingbird     18      19       3       1    54.0
54.0    54.0   152.3
          31                           kingbird     20      21       3       1    30.4
30.4    30.0    82.4
          32                           kingbird     21      22       3       1    78.2
78.2    78.2   224.9
          33                           kingbird     12      13       3       1    65.4
65.4    65.4   185.1
          34                opgw-acs_12_12_67     18      19       1       1    54.0
54.0    54.0    53.7
```

Stringing Chart Report

Section #1 from structure #1 to structure #2, start set #2 'PH1b', end set #2 ''
Cable 'C:\Users\landelrt\North West OU Projects\Watershed line diversion\Watershed profile\kingbird', Ruling span (m) 62.9339
Sagging data: Catenary (m) 400, Horiz. Tension (N) 4032 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 6.7 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 0.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
63.0	1.03	1.16	1.28	1.39	1.50	1	3.15

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
4860	4319	3910	3597	3344

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
482	428	388	357	332

Stringing Chart Report

Section #2 from structure #11 to structure #12, start set #2 'PH1b', end set #2 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\kingbird', Ruling span (m) 27.2899
Sagging data: Catenary (m) 425, Horiz. Tension (N) 4286.13 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 7.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 2.2 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
27.5	0.10	0.16	0.25	0.33	0.41	11	3.17

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
9284	5902	3854	2870	2342

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
921	585	382	285	232

Stringing Chart Report

Section #3 from structure #1 to structure #2, start set #1 'SW1', end set #4 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 62.8697
Sagging data: Catenary (m) 400, Horiz. Tension (N) 2864 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 6.0 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 4.0 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
63.0	1.09	1.18	1.27	1.36	1.44	1	3.71

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
3267	3005	2791	2613	2465

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
456	420	390	365	344

Stringing Chart Report

Section #4 from structure #2 to structure #3, start set #1 '', end set #4 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 111.637
Sagging data: Catenary (m) 1798, Horiz. Tension (N) 12873.7 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 22.8 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 7.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
111.6	0.57	0.63	0.69	0.77	0.87	2	-0.38

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
19562	17835	16112	14434	12825

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2732	2491	2250	2016	1791

Stringing Chart Report

Section #5 from structure #3 to structure #4, start set #1 '', end set #4 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 25.6325
Sagging data: Catenary (m) 425, Horiz. Tension (N) 3043 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 5.8 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 4.8 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
25.6	0.11	0.16	0.21	0.27	0.33	3	-0.07

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
5276	3789	2767	2155	1790

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
737	529	386	301	250

Stringing Chart Report

Section #6 from structure #4 to structure #5, start set #1 '', end set #1 'SW1'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 180.837
Sagging data: Catenary (m) 1798.2, Horiz. Tension (N) 12875.1 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 23.9 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 10.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
180.8	1.61	1.75	1.91	2.09	2.28	4	0.23

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
18197	16726	15333	14032	12849

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2541	2336	2141	1960	1795

Stringing Chart Report

Section #7 from structure #6 to structure #7, start set #1 'SW1', end set #1 'SW1'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 154.191
Sagging data: Catenary (m) 1799.3, Horiz. Tension (N) 12883 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 23.3 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 9.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
154.2	1.13	1.24	1.36	1.50	1.66	6	0.41

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
18763	17171	15643	14186	12851

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2621	2398	2185	1981	1795

Stringing Chart Report

Section #8 from structure #7 to structure #8, start set #1 'SW1', end set #1 'SW1'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 199.703
Sagging data: Catenary (m) 1799.7, Horiz. Tension (N) 12885.9 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 24.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 10.4 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
199.7	2.00	2.17	2.36	2.56	2.77	7	0.11

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
17811	16437	15134	13945	12866

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2488	2296	2114	1948	1797

Stringing Chart Report

Section #9 from structure #8 to structure #9, start set #1 'SW1', end set #1 'SW1'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 160.884
Sagging data: Catenary (m) 1799.3, Horiz. Tension (N) 12883 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 23.5 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 9.5 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
160.9	1.24	1.36	1.49	1.64	1.80	8	3.67

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
18636	17060	15568	14147	12850

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2603	2383	2174	1976	1795

Stringing Chart Report

Section #10 from structure #11 to structure #12, start set #1 'SW1', end set #1 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 27.5778
Sagging data: Catenary (m) 400, Horiz. Tension (N) 2864 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 5.6 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 4.6 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
27.8	0.15	0.20	0.27	0.33	0.39	11	3.68

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
4735	3447	2615	2115	1795

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
661	481	365	295	251

Stringing Chart Report

Section #11 from structure #12 to structure #13, start set #1 '', end set #1 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 65.3903
Sagging data: Catenary (m) 1753.8, Horiz. Tension (N) 12557.2 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 21.4 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 6.7 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
65.4	0.19	0.21	0.24	0.27	0.31	12	0.30

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
19761	17910	16058	14190	12350

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2760	2501	2243	1982	1725

Stringing Chart Report

Section #12 from structure #14 to structure #15, start set #1 '', end set #1 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 68.1946
Sagging data: Catenary (m) 1757.4, Horiz. Tension (N) 12583 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 21.6 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 6.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
68.2	0.21	0.23	0.26	0.29	0.34	14	-0.07

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
19779	17947	16076	14228	12407

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2762	2507	2245	1987	1733

Stringing Chart Report

Section #13 from structure #17 to structure #18, start set #1 'SW1', end set #1 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 28.3156
Sagging data: Catenary (m) 425, Horiz. Tension (N) 3043 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 5.8 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 4.8 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
28.6	0.15	0.20	0.26	0.33	0.39	17	3.96

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
5076	3708	2797	2241	1890

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
709	518	391	313	264

Stringing Chart Report

Section #14 from structure #5 to structure #6, start set #3 'SW1', end set #3 'SW2'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 169.27
Sagging data: Catenary (m) 1798.3, Horiz. Tension (N) 12875.8 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 23.5 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 9.5 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
169.3	1.39	1.52	1.66	1.82	2.00	5	-1.23

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
18453	16912	15455	14099	12850

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2577	2362	2159	1969	1795

Stringing Chart Report

Section #15 from structure #9 to structure #10, start set #3 'SW2', end set #1 'OGW'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 105.722
Sagging data: Catenary (m) 1799.8, Horiz. Tension (N) 12886.6 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 22.6 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 7.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
105.7	0.51	0.56	0.62	0.69	0.78	9	0.04

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
19688	17927	16187	14472	12845

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2750	2504	2261	2021	1794

Stringing Chart Report

Section #16 from structure #13 to structure #14, start set #4 '', end set #4 ''
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 171.325
Sagging data: Catenary (m) 1798.3, Horiz. Tension (N) 12875.8 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 23.7 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 9.7 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
171.3	1.43	1.56	1.70	1.86	2.04	13	0.03

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
18398	16893	15436	14090	12850

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2570	2359	2156	1968	1795

Stringing Chart Report

Section #17 from structure #15 to structure #16, start set #4 '', end set #1 'OGW'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\ACSR\wolf', Ruling span (m) 31.4862
Sagging data: Catenary (m) 425, Horiz. Tension (N) 3043 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 6.0 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 4.6 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
31.5	0.18	0.25	0.31	0.38	0.44	15	-0.17

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
4815	3618	2827	2326	1996

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
673	505	395	325	279

Stringing Chart Report

Section #18 from structure #20 to structure #21, start set #1 'SW1', end set #3 'SW2'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\OPGW_ADSS\16ztt2s1_24b10_154-272.2lin.opg', Ruling span (m) 30.5348
Sagging data: Catenary (m) 425, Horiz. Tension (N) 2571.25 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 1.7 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 0.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
30.7	0.19	0.27	0.34	0.41	0.47	20	3.42

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
3815	2690	2101	1760	1535

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
631	445	347	291	254

Stringing Chart Report

Section #19 from structure #21 to structure #22, start set #1 'SW1', end set #1 'OGW'
Cable 'C:\Users\landelrt\PLS CADD Files 2018\P\zPLS2\Conductors\OPGW_ADSS\16ztt2s1_24b10_154-272.2lin.opg', Ruling span (m) 78.1625
Sagging data: Catenary (m) 8754.2, Horiz. Tension (N) 52962.9 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 39.4 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 0.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
78.2	0.07	0.07	0.08	0.08	0.09	21	1.60

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
66233	63137	60040	56943	53846

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
10948	10436	9924	9412	8900

Stringing Chart Report

Section #20 from structure #2 to structure #3, start set #2 '', end set #2 ''
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 111.637
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 18144 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 25.5 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 9.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
111.6	0.50	0.55	0.62	0.70	0.81	2	-0.38

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
31395	28499	25470	22391	19304

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
3115	2827	2527	2221	1915

Stringing Chart Report

Section #21 from structure #3 to structure #4, start set #2 '', end set #2 ''
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 25.6325
Sagging data: Catenary (m) 425, Horiz. Tension (N) 4284 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 7.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 2.2 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
25.6	0.09	0.14	0.22	0.30	0.37	3	-0.07

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
9554	6042	3828	2783	2246

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
948	599	380	276	223

Stringing Chart Report

Section #22 from structure #4 to structure #6, start set #2 '', end set #2 'PH3'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 175.323
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 18144 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 27.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 11.4 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
180.8	1.40	1.55	1.72	1.93	2.17	4	2.58
169.3	1.23	1.35	1.51	1.69	1.90	5	-1.13

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
29357	26655	23986	21399	18996

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2912	2644	2380	2123	1885

Stringing Chart Report

Section #23 from structure #6 to structure #8, start set #2 'PH3', end set #2 'PH3'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 181.277
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 18144 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 27.4 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 11.6 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
154.2	1.03	1.13	1.26	1.41	1.58	6	0.16
199.7	1.72	1.90	2.11	2.36	2.65	7	0.21

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
29144	26480	23827	21316	18981

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2891	2627	2364	2115	1883

Stringing Chart Report

Section #24 from structure #8 to structure #9, start set #2 'PH3', end set #2 'PH3'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 160.881
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 18144 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 26.9 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 11.0 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
160.9	1.09	1.20	1.34	1.51	1.71	8	3.82

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
29874	27103	24328	21621	19070

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2964	2689	2413	2145	1892

Stringing Chart Report

Section #25 from structure #9 to structure #10, start set #2 'PH3', end set #2 'Top Phase'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 105.717
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 18144 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 25.3 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 9.7 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
105.7	0.45	0.49	0.55	0.63	0.73	9	-1.09

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
31531	28643	25599	22473	19333

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
3128	2842	2540	2229	1918

Stringing Chart Report

Section #26 from structure #13 to structure #14, start set #2 '', end set #2 ''
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 171.325
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 18144 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 27.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 11.2 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
171.3	1.25	1.38	1.54	1.72	1.95	13	0.03

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
29498	26780	24091	21455	19011

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2926	2657	2390	2128	1886

Stringing Chart Report

Section #27 from structure #14 to structure #15, start set #2 '', end set #2 ''
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 68.1946
Sagging data: Catenary (m) 1425, Horiz. Tension (N) 14364 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 21.0 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 7.5 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
68.2	0.22	0.25	0.29	0.35	0.44	14	-0.07

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
26656	23403	19999	16559	13234

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
2644	2322	1984	1643	1313

Stringing Chart Report

Section #28 from structure #15 to structure #16, start set #2 '', end set #2 'Top Phase'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 31.4658
Sagging data: Catenary (m) 425, Horiz. Tension (N) 4284 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 7.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 2.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
31.5	0.15	0.22	0.32	0.41	0.49	15	1.15

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
8547	5598	3932	3060	2558

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
848	555	390	304	254

Stringing Chart Report

Section #29 from structure #17 to structure #18, start set #2 'PH1b', end set #2 '' Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 28.0551
Sagging data: Catenary (m) 425, Horiz. Tension (N) 4284 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 7.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 2.2 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
28.3	0.11	0.17	0.26	0.35	0.43	17	3.40

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
9133	5838	3871	2904	2382

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
906	579	384	288	236

Stringing Chart Report

Section #30 from structure #18 to structure #19, start set #2 '', end set #2 'Top Phase'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 53.993
Sagging data: Catenary (m) 425, Horiz. Tension (N) 4284 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 7.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 1.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
54.0	0.64	0.77	0.89	1.00	1.11	18	1.51

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
5765	4780	4127	3666	3323

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
572	474	409	364	330

Stringing Chart Report

Section #31 from structure #20 to structure #21, start set #2 'PH1b', end set #2 'PH3' Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 29.9724
Sagging data: Catenary (m) 425, Horiz. Tension (N) 4284 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 7.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 2.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
30.4	0.13	0.21	0.30	0.40	0.48	20	5.41

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
8808	5701	3906	2993	2484

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
874	566	388	297	246

Stringing Chart Report

Section #32 from structure #21 to structure #22, start set #2 'PH3', end set #2 'Top Phase'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 78.1775
Sagging data: Catenary (m) 1200, Horiz. Tension (N) 12096 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 19.0 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 6.7 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 5 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
78.2	0.34	0.41	0.49	0.61	0.76	21	0.46

Horiz Tension 5 C (N)	Horiz Tension 15 C (N)	Horiz Tension 25 C (N)	Horiz Tension 35 C (N)	Horiz Tension 45 C (N)
22335	19000	15734	12668	10166

Catenary Constant 5 C (m)	Catenary Constant 15 C (m)	Catenary Constant 25 C (m)	Catenary Constant 35 C (m)	Catenary Constant 45 C (m)
2216	1885	1561	1257	1009

Stringing Chart Report

Section #33 from structure #12 to structure #13, start set #3 '', end set #3 ''
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\kingbird', Ruling span (m) 65.3905
Sagging data: Catenary (m) 1000, Horiz. Tension (N) 10080 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 16.3 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 5.6 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
65.4	0.28	0.34	0.43	0.56	0.71	12	0.25

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
19105	15689	12422	9646	7615

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
1895	1556	1232	957	755

Stringing Chart Report

Section #34 from structure #18 to structure #19, start set #1 '', end set #1 'OGW'
Cable 'c:\users\landelrt\north west ou projects\watershed line diversion\watershed profile\opgw-acs_12_12_67', Ruling span (m) 54.0136
Sagging data: Catenary (m) 425, Horiz. Tension (N) 2234.65 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 0.1 (deg C) temperature increase
Weather case for final after load -5°C 0Pa Ice 10mm, Equivalent to 2.4 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length	Mid Span Sag 5 C	Mid Span Sag 15 C	Mid Span Sag 25 C	Mid Span Sag 35 C	Mid Span Sag 45 C	Left Struct Number	Span Vertical Projection
(m)	(m)	(m)	(m)	(m)	(m)		(m)
54.0	0.78	0.86	0.93	1.00	1.06	18	0.19

Horiz Tension 5 C	Horiz Tension 15 C	Horiz Tension 25 C	Horiz Tension 35 C	Horiz Tension 45 C
(N)	(N)	(N)	(N)	(N)
2451	2233	2062	1923	1805

Catenary Constant 5 C	Catenary Constant 15 C	Catenary Constant 25 C	Catenary Constant 35 C	Catenary Constant 45 C
(m)	(m)	(m)	(m)	(m)
466	425	392	366	343

SEE ATTACHED DOCUMENT

Eskom	**LINE CONSTRUCTION HANDBOOK** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU-AC** **Rev 0**

INDEX

SCOPE OF WORK OVERVIEW

Revision Details: Rev.0	

Compiled By

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

1.1 General Information

1.1.1 Definitions:

Span	:	Between two structures (poles)
Section	:	Between two strain points
Landowner	:	Person in whose name the title act is registered

1.1.2 Soil Classification

See Annexure A

1.1.3 Concrete

See Annexure B

1.1.4 Stringing Procedure

See Annexure C

1.1.5 Footing resistance measurement procedure

See Annexure D

1.1.6 Ambient temperature measurement

See Annexure E

1.1.7 Construction Guarantee Agreement

See Annexure F

1.1.8 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 (mm²)	Steel area (mm²)	Total area (mm²)	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

ANNEXURE A

Soil Classification Guideline

1. INTRODUCTION

The appropriate foundation can only be selected after soil classification has been done.

This guideline is compiled to help the Construction Supervisor to do a soil classification after excavation work has been completed. He will be able to classify 80% or more of all excavations. A Civil Engineer will be taken to site to do the classification of soils if the Construction Supervisor and the Project Engineer are unable to assess the type of soil.

2. PROCEDURE

During the design phase, foundations for type 2 soils were selected. These are considered most suitable for at least 80% of the tower positions.

Excavation work will be done for the chosen foundations. Following this, the Construction Supervisor, or his delegate, will inspect the excavation and classify the soil.

If the prescribed foundation is suitable, the excavation will be approved. If, however, the soil classification indicates that a different foundation type must be used, the correct or most appropriate foundation must be selected by the Construction Supervisor and the necessary excavation must be done.

3. DEFINITIONS

a) **Cohesive soils** : Silts and clays and combinations of silts and clay with sand and gravel. Generally slow draining.

b) **Cohesiveless soils** : Gravels and clean sands. Generally free draining.

c) **Decomposed rock** : Natural geological material which can be excavated without blasting. A solid core cannot be recovered by drilling with a single-tube core barrel using water as a drilling fluid. Coring requires sophisticated drilling practices. Such decomposed rock should be classified as a soil.

d) **Boulders** : Fragments of rock larger than 150mm in cross-sectional dimension. State whether these are rounded sub-angular, or angular. Record the rock types and range of sizes. State whether there is a matrix in the voids between the boulders. Describe this matrix as a soil and state whether or not it fills the voids between the boulders. (Where the volume of matrix material is significantly greater than that of the “minimum voids”, the engineering behaviour of the soil will be determined by this matrix and not by the boulders).

e) **Gravel** : Fragments of rock measuring between 3mm and 150mm across. The description shall follow that for “Boulders” above. Particular care shall be given to the description of the matrix.

f) **Sand** : Discrete particles which are clearly visible to the naked eye. Sand is clearly distinguished by these gritty particles which do not break down when rubbed with water in the palm of the hand.

g) **Silt** : Soil having particles which are smaller than 0.074mm but larger than 0.002mm. In general, silts are very fine discrete particles which may be felt when rubbed with water in the palm of the hand. When a small quantity of the wetted soil is placed on the tongue, the particles can be clearly distinguished against the teeth. When moulded with water into a ball, it exhibits dilatancy.

h) **Clay** : Soil having particles smaller than 0.002mm. In general the particles are flaky and when rubbed in the palm with water, this soil has a soapy or greasy feel. There is no feel of grittiness when a small quantity of the soil is placed between tongue and teeth.

i) **Water table** : That level or those levels in the soil where the water, in pores of the soil, is at atmospheric pressure.

j) **Permanent water table** : The water which persists throughout the seasons of the year with only minor fluctuations of level.

k) **Perched water table** : A water table which is only temporarily present in the soil. It will disappear and sometimes re-appear, depending upon seasons or draining conditions of the site.

4. EVALUATION AND CLASSIFICATION OF SOIL DEFINITIONS

Soil can be classified in six types:

Comment

Soil types are described according to the grain size of the soil.

Most neutral soils are a combination of one or more of the type described and, describing such a soil, the adjective is used to denote the lesser type; e.g. a silty clay is a clay with some silt, whereas a silt-clay has approximately equal portions of both types. The basic classification of soils into gravels, sands, silts and clays relates to the draining characteristics of the soils.

a) **ROCK** : Hard to very hard solid or moderately fractured continuous rock.

b) **WEATHERED OR DECOMPOSED ROCK** : Very soft or soft continuous rock.

c) **TYPE 1**

Consistency (degree of density)

Competent soil with equal or better consistency (strength or toughness) than one would encounter in stiff cohesive or medium dense non-cohesive soils.

Firm or stiff cohesive soils

* Moulding of soil with the fingers is difficult to impossible. Excavation with a spade is difficult and picking is required.

Medium dense non-cohesive soils

* Considerable resistance to shovelling or to penetrate by hand bar.

Texture

Cohesive soils

* Very stiff clay, sandy clay, silty clay, sandy silts, silty sands.

Cohesiveless soils

* Compact, well-graded gravels, sands and gravel sand mixtures, permanently above all water tables.

d) **TYPE 2**

Consistency (degree of density)

A less competent soil than Type 1 soil, with equal or better consistency than one would encounter in firm to stiff swelling cohesive soils or dry poor graded loose to medium dense soils above the water table.

Firm to stiff swelling cohesive soils

* Soil can be moulded with the fingers with strong to very strong pressure. Freshly exposed surface. Shows faint heel marks when stood upon. Excavation with a shovel is difficult.

Medium dense to loose soils

* Having little to considerable resistance to shovelling or penetration with hand bar.

Texture

Cohesive soils

* Firm to stiff clay, sandy clays, sandy silts, silty sands.

Cohesiveless soils

* Compact by poor to well-graded sands, gravels and gravel-sand mix permanently above all water tables.

e) **TYPE 3** (**Clay/mud**)

Consistency (degree of density)

Soft to very soft cohesive soils

* Mouldable with ease to manageable with fingers. Form faint to distinct heel marks on freshly exposed surface when stood upon.

Very loose to loose cohesiveless soils

* Easily excavated with a spade and penetration with a hand bar.

Texture

Cohesive soils

* Soft to very soft clay, sand-clay, sandy silts and silty sands.

Cohesiveless soils

* Compact by poorly graded sands, gravels and gravel-sand mixtures permanently above the water table.

f) **TYPE 4**

Submerged cohesive and cohesiveless soils

This includes all very moist to saturated soils below the permanent water table, including soils below re-occurring perched water tables, or permeable soils in low lying areas, subjected to confirmed seasonal flooding.

ANNEXURE B

Concrete

1. BACKGROUND

A tower is only as stable as its foundation. Therefore the strength of the concrete / reinforcing, that constitutes the foundation, is of utmost importance.

2. BATCH MIX

This is the preferred method of mixing to be used as it guarantees the required strength.

Concrete strength is normally specified as a certain strength after 28 days. The 28 days create a problem as Construction cannot afford to wait this long before commencing with erection work.

To overcome the problem, a stronger strength concrete must be ordered, as concrete reaches 60% of its 28 day strength after 7 days.

	MPa Concrete Ordered		
	35	**42**	**50**
7 Day strength MPa	20	25	30

NOTE:

(a) Never add any additional water if the concrete has been batch-mixed, as this weakens the concrete considerably.

(b) Order 13mm stone concrete for foundations with steel reinforcing.

(c) Records must be kept (delivery notes) of all batch mix deliveries.

(d) Take a random sample from such deliveries periodically and allow sample to cure for 28 days. Then get it tested at a reputable laboratory.

3. HAND MIX

Hand-mixed concrete should be avoided as far as possible as it is difficult to control the mixing ratios.

However, if concrete must be hand-mixed, the following precautions should be taken:

(a) Order 13mm stone.

(b) Adhere to the given ratio's.

(c) Do a slump test to prove your mix.

(d) Do not over vibrate!

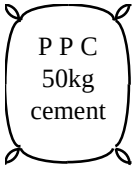
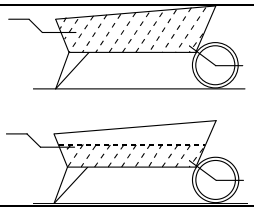
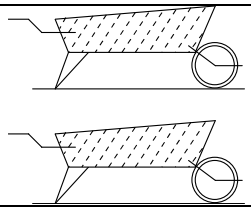
3.1 Ratios

1 Sack Cement	=	33 Litres	=	50kg
1 Wheelbarrow	=	65 Litres		
1kg Sand	=	0.8 Litres		
1kg 19mm Stone	=	0.75 Litres		
1kg 13mm Stone	=	0.73 Litres		

3.2 Hand mix 20Mpa concrete mechanically vibrated

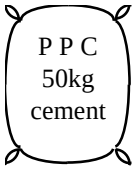
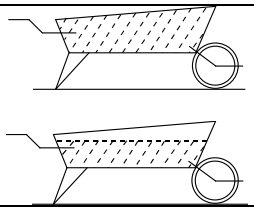
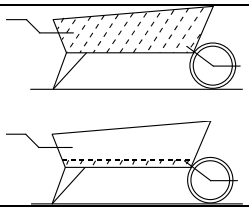
3.2.1 <u>19mm Stone: 20Mpa</u>

$1m^3$ concrete = 10 bags cement + $0.7m^3$ sand + $0.92m^3$ stone

Water	Cement	Sand	Stone 19mm
			
24 litres	1 bag	1 + ½ wheelbarrows	2 wheelbarrows
24 litres	33 litres	95 litres	125 litres
		12 + 6 shovels	12 + 12 shovels

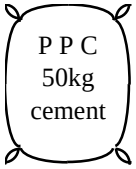
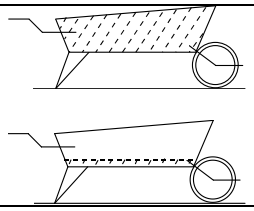
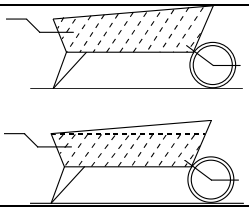
3.2.2 9.5 to 13.2mm Stone: 20Mpa

1m^3 concrete = 10 bags cement + 0.77m^3 sand + 0.6m^3 stone

Water	Cement	Sand	Stone 9.5 to 13.2mm
			
23.5 litres	1 bag	1.6 wheelbarrows	1.2 wheelbarrows
23.5 litres	33 litres	105 litres	80 litres
		12 + 7 shovels	12 + 2 shovels

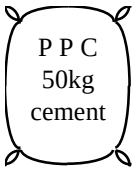
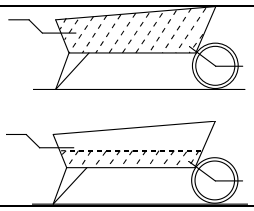
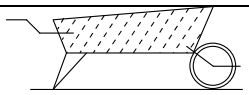
3.2.3 19mm Stone: 25Mpa

1m^3 concrete = 10 bags cement + 0.6m^3 sand + 0.81m^3 stone

Water	Cement	Sand	Stone 19mm
			
21.5 litres	1 bag	1.2 wheelbarrows	1.7 wheelbarrows
21.5 litres	33 litres	80 litres	110 litres
		12 + 2 shovels	12 + 8 shovels

3.2.4 9.5 to 13.2mm Stone: 25Mpa

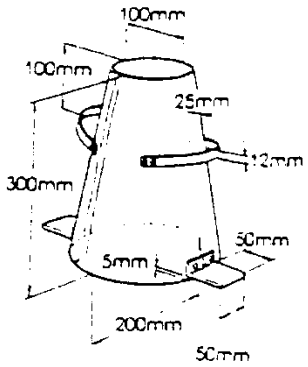
1m^3 concrete = 10 bags cement + 0.66m^3 sand + 0.6m^3 stone

Water	Cement	Sand	Stone 19mm
			
21 litres	1 bag	1.4 wheelbarrows	1 wheelbarrows
21 litres	33 litres	90 litres	70 litres
		12 + 5 shovels	12 shovels

4. TESTS ON CONCRETE: SLUMP TEST

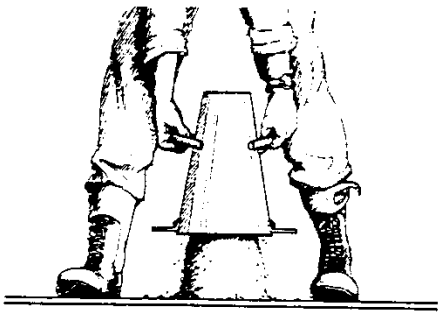
4.1 Materials and tools

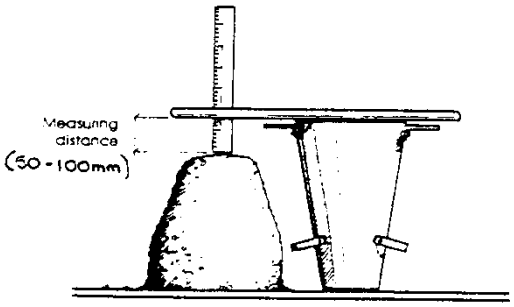
a) A wheelbarrow and shovel
b) A sample of freshly mixed concrete (about half a wheelbarrow full)
c) A flat steel plate about 600 x 600mm by 3mm thick
d) A metric rule or tape measure
e) A scoop
f) A steel tamping rod, 16mm in diameter by 600mm long with one end rounded
g) A small trowel (gauging trowel)
h) A standard slump cone



4.2 How to measure the slump

1) Mix the concrete in the wheelbarrow.
2) Wipe all the tools with a damp cloth.
3) Put the steel plate down on a level place so that it is firm, and then put the slump cone in the footpieces.
4) Fill the slump cone in four layers of about 75mm. Tamp through each layer 25 times with the rounded end of the tamping rod.
5) The last layer should more than fill the cone. After tamping the last layer, use the trowel to smooth off the top of the concrete so that it is level with the top of the cone.
6) Hold the cone by the handles to keep it steady while you step off the footpieces.
7) Slowly lift the slump cone straight up and off.
8) Turn the slump cone upside down and place it on the plate, next to the concrete.





ANNEXURE C

Stringing Procedure

1. INTRODUCTION

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.

2. STRINGING EQUIPMENT PER PHASE

1 Conductor drum carrier.

2 Swivels.

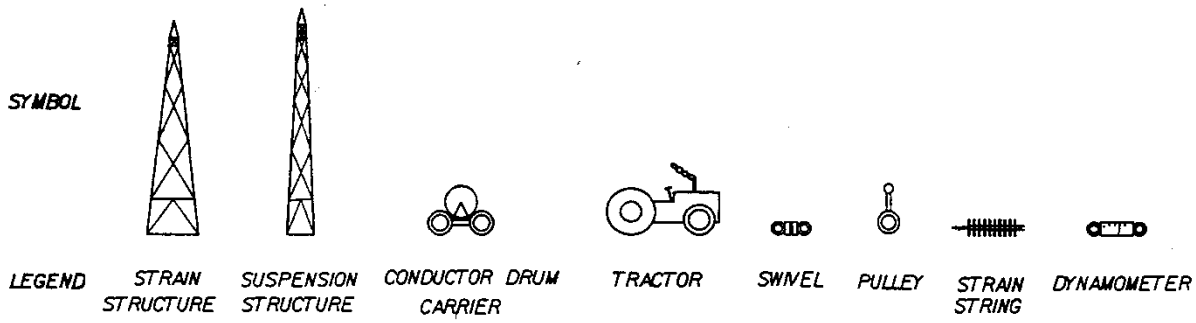
1 Dynamometer (calibrated not longer than 6 months ago).

X Amount running out pulleys

1 Come along

1 Tractor

Symbols:



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.

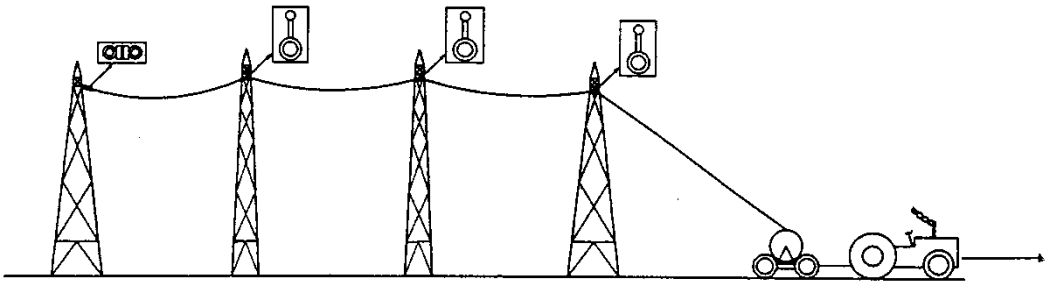
* Use a conductor drum carrier to run out the conductor along the line and lock the conductor onto the running blocks.

* 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

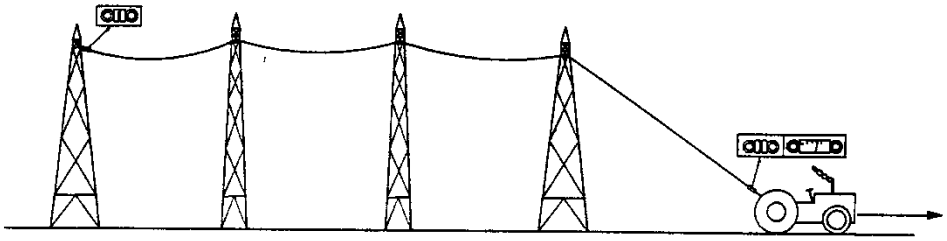
* Cut the conductor.

* 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.

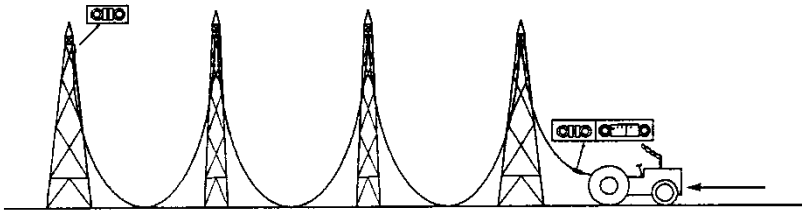
STEP (2)



STEP 3: SLACKING OF CONDUCTOR

- Conductor to be slacken after it has unwounded.
-

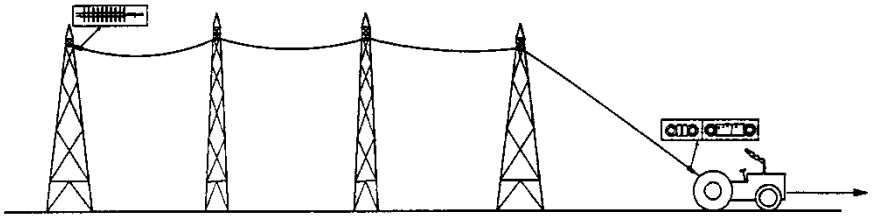
STEP (3)



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.

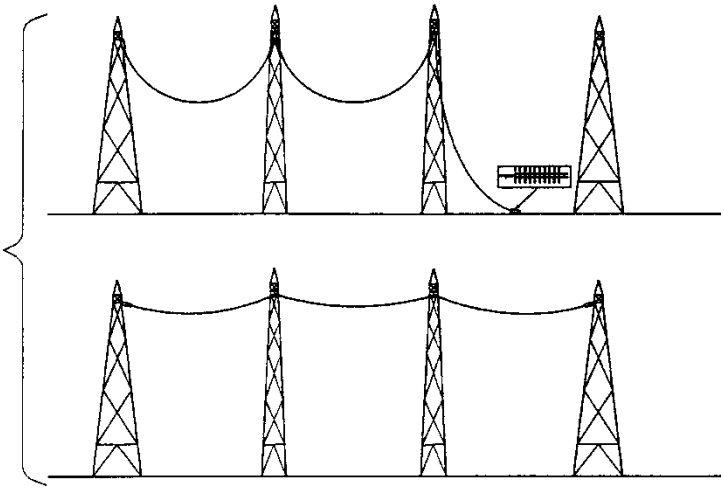
STEP (4)



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.

STEP (5)



ANNEXURE D

Footing Resistance Measurement Guideline

This guideline provides the minimum requirements for the measuring of the footing resistance of concrete poles and steel towers.

1. METHOD

Short fall-of-potential

The short version fall-of-potential method can be used by the contractor. The drawings show the equipment layout and how the measurements must be taken.

Three resistance values are measured, namely R1, R2 and R3. If the three values agree reasonably, the average can be calculated for the final resistance value. If not, the 61,8% method must be used.

61.8% Method

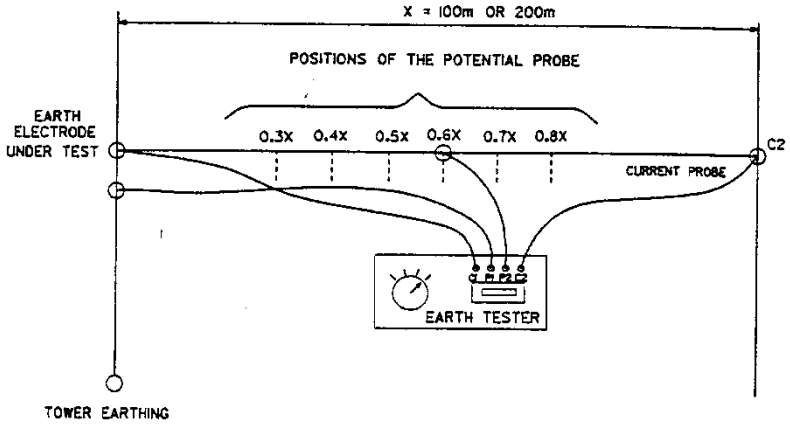


FIGURE 1: CONNECTIONS FOR EARTH ELECTRODES RESISTANCE MEASUREMENT - 61.8% METHOD

DEFINITION	POSITION	DISTANCE (m)	RESISTANCE (Ohm)
R_1	0.2X		
R_2	0.4X		
R_3	0.5X		
R_4	0.6X		
R_5	0.8X		

TABLE 1: EARTH ELECTRODE RESISTANCE - 61.8% METHOD MEASUREMENT RESULTS

R	=	-	0,1187 R_1	-	0,4667 R_2	+	1,9816 R_4	-	0.3961 R_6	=	_____ Ω
R	=	-	2,6108 R_2	+	4,0508 R_3	-	0,1626 R_4	-	0,2774 R_6	=	_____ Ω
R	=	-	1,8871 R_2	+	1,1148 R_3	+	3,6837 R_4	-	1,9114 R_5	=	_____ Ω
R	=	-	6,5225 R_3	+	13,6816 R_4	-	6,8803 R_5	+	0,7210 R_6	=	_____ Ω

Total = _____ Ω

Average = _____ Ω

TABLE 2: EARTH ELECTRODE RESISTANCE - 61.8% METHOD CALCULATED RESULTS

2. CONCRETE POLES

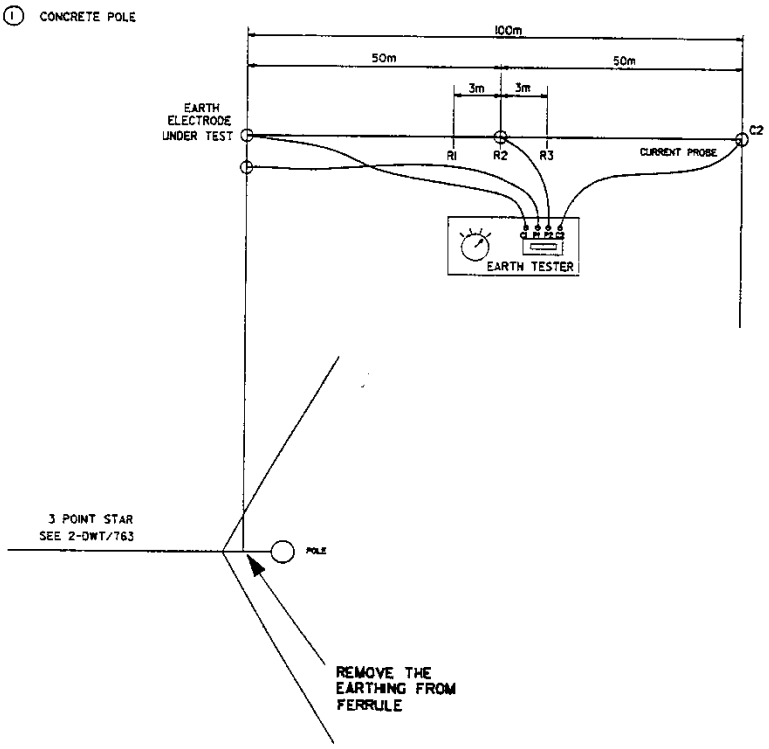


FIGURE 2: CONNECTIONS FOR EARTH ELECTRODE RESISTANCE MEASUREMENTS FALL-OF-POTENTIAL METHOD

3. STEEL TOWER

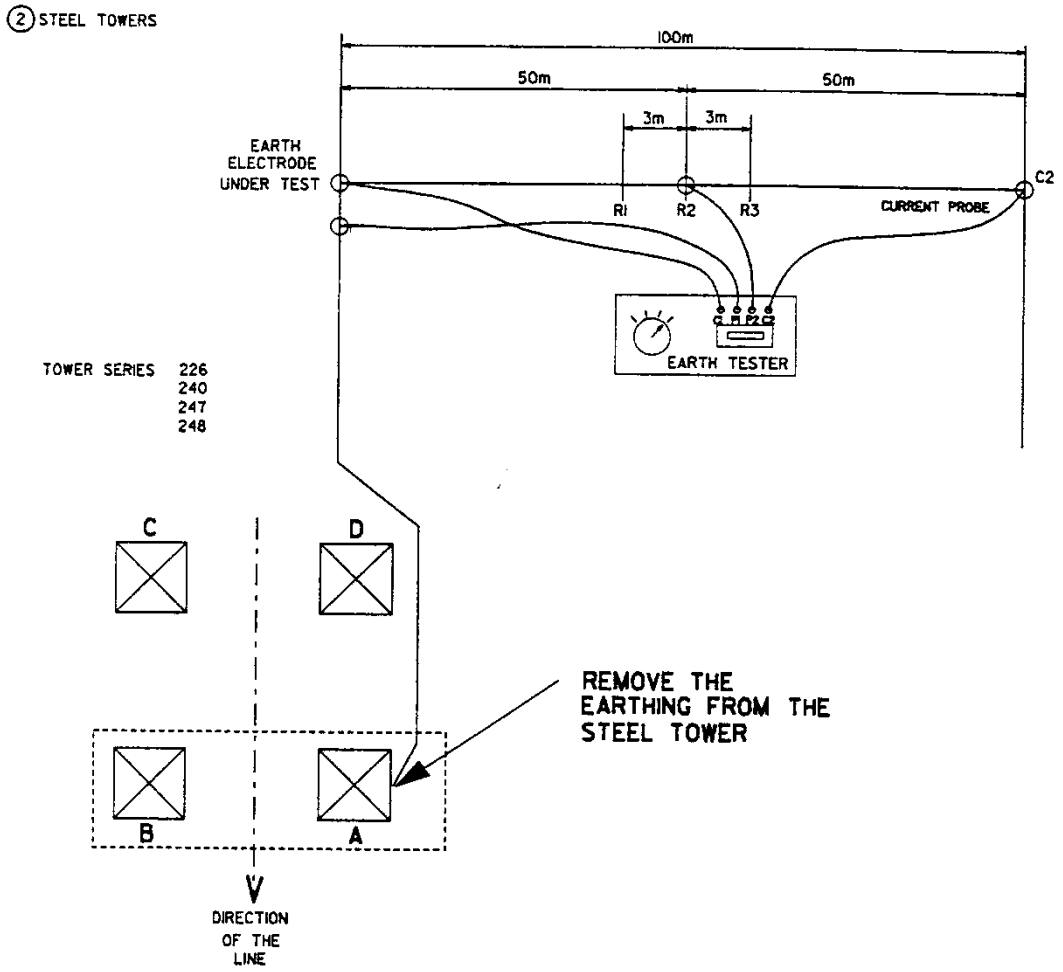


FIGURE 3: CONNECTIONS FOR EARTH ELECTRODE RESISTANCE MEASUREMENTS FALL-OF-POTENTIAL METHOD

Only one leg's footing resistance must be measured. If this value exceeds 30Ω, all the other legs must also be measured.

4. STEEL TOWER WITH 10m COUNTER POISE

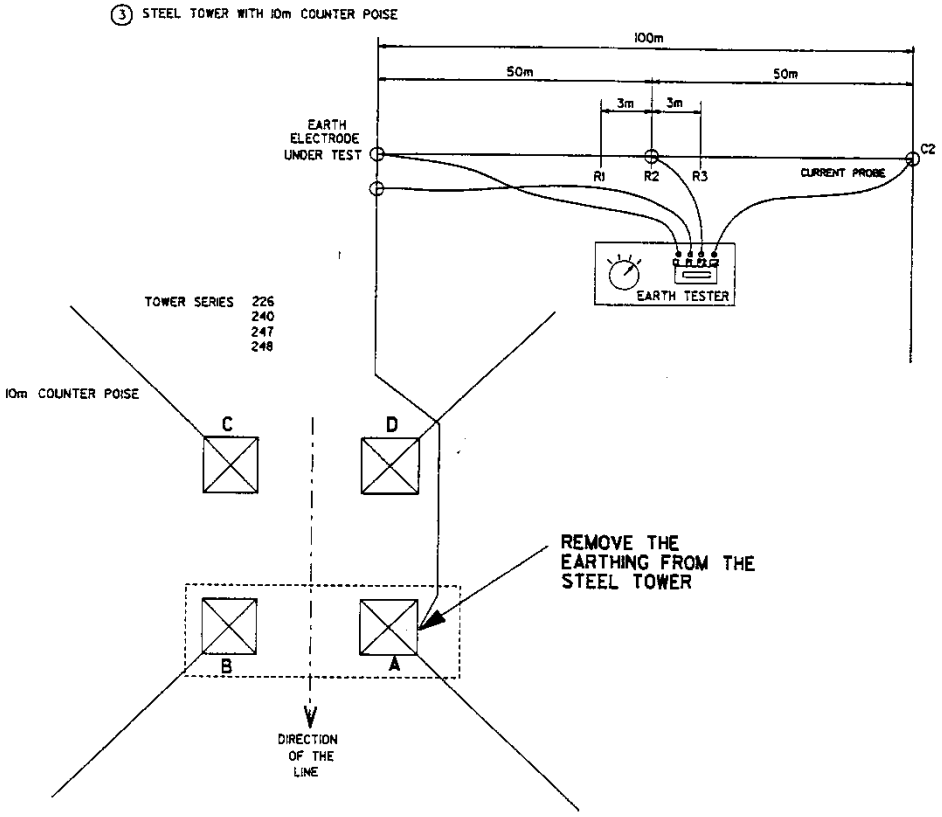


FIGURE 4: CONNECTIONS FOR EARTH ELECTRODE RESISTANCE MEASUREMENTS FALL-OF-POTENTIAL METHOD

Only one leg's footing resistance must be measured. If this value exceeds 30Ω, all the other legs must also be measured.

ANNEXURE E

Ambient Temperature Measuring Technique

FIGURE 1

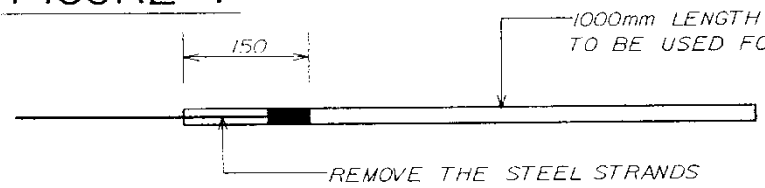


FIGURE 2

NOTES:

1. USING 1m OF A.C.S.R. REMOVE 15cm FROM CENTRE STEEL STRANDS

INSERT MERCURY BULB END OF THERMOMETER TO PREVENT THERMOMETER FROM FALLING OUT

2. ATTACH TO CROSS-ARM. AFTER TWO HOURS THE TEMPERATURE CAN BE READ

THIS DRAWING HAS BEEN CREATED ON A C.A.D. SYSTEM AND ANY AMENDMENT TO THE DRAWING MUST BE EFFECTED ON THE SAME CAD SYSTEM ONLY.

THE C.A.D. REFERENCE NUMBER IS:
(ELEC/0382542/CONTEMP/LV-1)

REV	AUTH MAG	DATE DATUM	REVISION/REVISIES INDEX REF/INDEKSVERW	BY DEUR	CHKD NAGES	REFERENCE DRAWINGS VERWYSINGSTEKENINGE
1		7/3/95	REDRAWN WITH AMMENDEMENTS	XEL		
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DRG.TEK REGISTR			PRETORIA	NORELEK	
			design	CONDUCTOR TEMPERATURE MONITORING FOR ASSR	
CHKD NAGES					
DRAWN GETEKEN	XELDEARNE LIVINGSTONE	3/3/90	APPROVED KROZMIAREK	GOEDGEKEUR	REV 1
SCALE SKAAL	NTS		3/9/90	2-ET/13736	

ANNEXURE F

Construction Guarantee Agreement

WARRANTY		PENALTY	
1.	We will guarantee our workmanship to Specifications and Eskom National Standards, or as specified by the Project Engineer. Guarantee Period - 1 Year? Retic Lines - 1 year * S/S < 5MVA - 1 year * S/S > 5MVA - 1 year * Distribution Lines - 1 year * S1 Areas - 1 year *	*	Re-do work identified within 21 days. * If not fixed after 21 days, the Project Manager will arrange for repairs (costs to be capitalised). * Emergency repairs (Loss of Supply) will be done by O&M at own cost and reclaim via the invoice system.
2.	We promise that all our work will be completed to standard within the agreed dates.	*	Within minor works penalty clause or otherwise agreed.
3.	We guarantee quality of work on first inspection.	*	All subsequent inspections will be for the Project Manager's account.
4(a)	We promise to produce all relevant Handing Over Documents	*	Projects will not be commissioned without proper documentation.
4(b)	Projects will be handed over with all maintenance procedures, manuals, special tools and equipment as specified by the Scope of Works.	*	Conditional take-overs must be finalised within 21 days. Outstanding manuals, tools, etc. will be purchased by O&M on the project's cost after 21 days.
5.	We promise to clear the site and remove excess material before handing over.	*	O&M will correct the situation, if not completed within 21 days, at project's cost.
6.	We guarantee that, on handing over, all existing plant, equipment, facilities and the environment, are left in the agreed condition.	*	O&M will correct the situation after the 21 days notified period for Project Manager's cost.

ONUS ON OPERATING AND MAINTENANCE TO PROVE NON-QUALITY IN WRITING

GENERAL COMMENTS

1. To manage within the guidelines set by the Quality Service Agreement between all sections doing Capital Work and Project Management, the following:

* Cost of non-conformance must be measured by the financial system. (Sub-account to be registered per project).
* All non-quality to be proved in writing.
* Scope of Works to be clearly specified by the Project Engineer prior to F150. Special note where deviating from existing Standard.
* Cost for repairs of non-quality work, being done by O&M, to be agreed upon between O&M and Project Management.
* Repairs by O&M during an emergency will be done on cost-without-profit. Proof will be tabled by O&M.
* To ensure success of the Agreement, sample inspections shall take place with all involved at the beginning of the project.
* This Quality Agreement pertains to all categories of projects.

Eskom	**JOB DESCRIPTION** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

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Comments:

Revision Details: Rev.0	

Compiled By

Name:	Ayanda Nzo	**Tel:**	018 464 7641	**Date:**	October 2016

1.2 Job Description

(See TRMSCAAC1, Section 4)

1.2.1 General

a) Bush clearing

No bush clearing shall be done without consulting the Environmental Impact Study or Environmental Management Plan done by Survey.

Bush clearing in sensitive areas shall only be done with the approval of the **landowner**. The owner must sign this document to confirm his approval of the planned bush clearing.

b) Use of roads

When privately owned roads need to be used, the owner must be approached and permission requested. The landowner must give his approval in writing. The roads shall be left in the same condition as before Construction started using the road.

c) New roads

If a new road needs to be built, the landowner is to give his approval before any work commences. The Project Co-ordinator will give a site instruction to build the new road. If the landowner wishes the ground surface to be restored after the line has been built, it shall be done and the landowner must accept the restoration.

d) Additional gates (other than servitude gates)

No new gates will be installed without the landowner's approval and site instruction by the Project Co-ordinator. The contractor will take full responsibility for the installation of the new gates. The contractor shall repair any damaged fences.

e) Road/Line crossings

The Project Co-ordinator will make all the necessary arrangements with all the appropriate authorities when Construction needs to string across any road or existing power line.

1.2.2 Building of the line

The building of the line is sub-divided into:

- Foundations
- Tower installation
- Stringing of the phase and earth conductors
- Earthing

Checklists are provided for the Construction Supervisor, Construction officials and Project Co-ordinator to highlight some of the areas seen by the Project Engineer as critical when a line is built.

The information which should be provided by the Project Engineer is the tower structure number, tower type and the predicted foundation type (drawing number).

a) Foundations

(See TMRSCAAC1, Section 7)

The foundation types specified by the Project Engineer are based on Type 2 soil. As soon as the excavation for each tower is completed, the Construction Supervisor, or his delegate, must do a soil classification (see Annexure A) to ensure that the correct foundation type has been specified in the Design.

If a different type of soil is discovered, the appropriate foundation type must be used.

The Project Engineer must be contacted if the soil cannot be classified with certainty. If necessary, a competent Civil Engineer will be consulted.

All concrete work will be done according to the foundation drawing specified. (See Annexure B).

The Construction Supervisor must confirm that excavation work is done properly, backfilling is done with appropriate material and correct compacting procedures are followed. The material used for the backfilling must be identified and noted in the Tower Installation Handbook (excavated soil, soil from a burrow pit or soil/cement mix).

A certificate, confirming that all the above was done as specified on all the towers for this line, shall be completed by the Construction Supervisor or his delegate.

b) Tower Installation

(See TRMSCAAC1, Section 6.18)

Fasteners:

All bolts and nuts shall be punched after final tensioning. The nuts and exposed bolts shall be painted with an acceptable plumbate-based galvanised iron primer.

Stay assemblies:

Stay layout and planting of the stay rod is critical and the Construction Supervisor must ensure that it is done according to provided drawings.

The towers must be plumb.

Ensure that all electrical clearances are met. (**See the Information Sheet**).
A certificate, confirming that all the above was completed according to Specifications, shall be completed by the Construction Supervisor or his delegate.

c) Stringing of Phase and Earth Conductors

(See TRMSCAAC1, Section 8)

Tension stringing (or the Alternative stringing – see Annexure C) 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.

1.2.3 Earthing

(See TRMASAAJ7)

a) Pole Number:

The pole numbers will be provided, as described in the Design Document.

b) Tower Type:

The tower types will be provided, as described in the Design Document.

c) Earthing Description:

If the tower/pole position requires that the specified earthing be modified, or that alternative earthing be installed, the changes must be noted in this document.

d) Footing Resistance:

(See Annexure D)

Footing resistance will be measured as described in Annexure D. **Note that all footing resistance must be measured before any stringing is done**. If, however, the stringing is completed (on existing lines), the earthing must be disconnected before the footing resistance is measured.

e) Confirmation:

The Construction Supervisor must accept the earthing installation.

f) Approval:

The Project Engineer or his/her delegate will approve the results provided by the Construction Supervisor.

1.2.4 Regulation

(See TRMSCAAC1, Section 8.2.6)

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 E)

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.

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Comments:

Revision Details: Rev.0	

Compiled By					
Name:	Ayanda Nzo	**Tel:**	018 464 7641	**Date:**	October 2016

Checklists

Table 1.3.1 Bush Clearing – Sensitive Areas

SPAN	BEFORE BUSH CLEARING				AFTER CONSTRUCTION OF LINE		
	LANDOWNER				LANDOWNER		
	NAME	SIGNATURE	COMMENTS/CONDITIONS	DATE	NAME	SIGNATURE	DATE

Table 1.3.2 Use of Existing Roads

FARM AREA	BEFORE USE OF THE ROADS				AFTER CONSTRUCTION IS COMPLETED		
	LANDOWNER				LANDOWNER		
	NAME	SIGNATURE	COMMENTS/CONDITIONS	DATE	NAME	SIGNATURE	DATE

Table 1.3.3 New Roads

FARM AREA	BEFORE CONSTRUCTION STARTS				AFTER CONSTRUCTION IS COMPLETED		
	LANDOWNER		COMMENTS/CONDITIONS	DATE	LANDOWNER		
	NAME	SIGNATURE			NAME	SIGNATURE	DATE

Table 1.3.4 Additional Gates

FARM AREA	BEFORE CONSTRUCTION STARTS				CONTRACTOR DETAILS		
	LANDOWNER		COMMENTS/CONDITIONS	DATE	NAME :		
					RESPONSIBLE PERSON		
	NAME	SIGNATURE			NAME	SIGNATURE	DATE

Table 1.3.5 Road or Line Crossings

SPAN	PROJECT CO-ORDINATOR			DATE ARRANGED	COMMENTS
	NAME	SIGNATURE	DATE		

Table 1.3.6 Building of the Lines

POLE NO. as per template	TOWER TYPE	FOUNDATION TYPE			TOWER INSTALLATION				MIDSPAN JOINTS AND DAMAGE			
		NOMINATED SOIL TYPE	FOUNDATION INSTALLED	COMMENT	FASTENERS		STAY ASSEMBLIES		MIDSPAN JOINTS		DAMAGE	
					PUNCHED	PAINTED	LAYOUT	INSTALL	COND	E'WIRE	COND/E'WIRE	COMMENTS
Watershed 132kV line diversion												
WAT/ZEE GANTRY	WAT-ZEE 132KV GANTRY											
1WAT/ZEE1	strsce0218kw110											
1WAT/ZEE2	strsce9018kw110											
1WAT/ZEE3	strsce4518kw110											
1WAT/ZEE4	strsce4518kw110											
1WAT/ZEE5	7617a-k1-5w-r2.154											
1WAT/ZEE6	7618d-k1-90-r2.134_tic											
1WAT/ZEE7	7617a-k1-5w-r2.134											
1WAT/ZEE8	7618c-k1-90-r2.134											
1WAT/ZEE9	7618d-k1-90-r2.174_tic											
WAT/TLH GANTRY	WAT-TLH 132KV GANTRY											
1WAT/TLH1	strsce0218kw110											
1WAT/TLH2	strsce9018kw110											
1WAT/TLH3	strsce4518kw110											
1WAT/TLH4	strsce4518kw110											
WAT/KLN GANTRY	WAT-KLN 132KV GANTRY											
1WAT/KLN1	strsce4518kw110											
WAT/SEP GANTRY	WAT-SEP 132KV GANTRY											
1WAT/SEP1	7618c-k1-90-r2.134											

Earthing

Table 1.3.7 Earthing

STEEL POLES			
POLE NO.	TOWER TYPE	EARTHING DESCRIPTION	FOOTING RESISTANCE
Watershed 132kV lines diversion			
WAT/ZEE GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam		
1WAT/ZEE1	132KV 02 deg 18m monopole self-support		
1WAT/ZEE2	132KV 90 deg 18m monopole self-support		
1WAT/ZEE3	132KV 45 deg 18m monopole self-support		
1WAT/ZEE4	132KV 45 deg 18m monopole self-support		
1WAT/ZEE5	D7617 - 132kV 3-Pole Intermediate (0°)		
1WAT/ZEE6	D7618 - 132kV Stayed 3-Pole Strain (5°-90°)		
1WAT/ZEE7	D7617 - 132kV 3-Pole Intermediate (0°)		
1WAT/ZEE8	D7618c - 132kV Stayed 3-Pole Strain (30°-60°)		
1WAT/ZEE9	D7618 - 132kV Stayed 3-Pole Strain (5°-90°)		
WAT/TLH GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam		
1WAT/TLH1	132KV 02 deg 18m monopole self-support		
1WAT/TLH2	132KV 90 deg 18m monopole self-support		
1WAT/TLH3	132KV 45 deg 18m monopole self-support		
1WAT/TLH4	132KV 45 deg 18m monopole self-support		
WAT/KLN GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam		
1WAT/KLN1	132KV 45 deg 18m monopole self-support		
WAT/SEP GANTRY	132kV S/S Gantry, 14.326m Columns & 12.129m Beam		
1WAT/SEP1	D7618c - 132kV Stayed 3-Pole Strain (30°-60°)		

APPROVED BY: _____ **DATE:** _____

DESIGNATION: _____

Table 1.3.8 Regulation & Stringing

TOOLS TO BE USED – DYNAMOMETER & COMPRESSION TOOLS				
INSTRUMENT NO.	LAST DATE CALIBRATED	ACCEPTED BY		
		NAME	SIGN	DATE

DONE BY CONTRACTOR: _____

WITNESSED BY CLERK OF WORKS:_____

APPROVED BY: _____

DESIGNATION: _____

DATE: _____

Table 1.3.9 Sag and Tension

Sag and Tension								
	AMBIENT TEMP &		ACCEPTED BY SUPERVISOR			ACCEPTED BY COW		
SECTION	TIME	TENSION/SAG	NAME	SIGNATURE	DATE	NAME	SIGNATURE	DATE
1km, 132kV Kingbird Line from Watershed to Zeerust								
Conductor: Kingbird								
1 Gantry to Str 1								
2 Str 1 to Str 2								
3 Str 2 to Str 3								
4 Str 3 to Str 5								
5 Str 5 to Str 7								
6 Str 7 to Str 8								
7 Str 8 to Str 9								
0.5km, 132kV Kingbird Line from Watershed to Tlhabologang								
1 Gantry to Str 1								
2 Str 1 to Str 2								
3 Str 2 to Str 3								
4 Str 3 to Str 4								

Eskom	AUTHORISED PERSONNEL Watershed 132kV Line diversions Project ID: CTXQ0827	NED NWOU/AC Rev 0

0.2km, 132kV Kingbird Line from Watershed to Sephaku								
1 Gantry to Str 1								
2 Str 1 to Str 2								
1km, 132kV Kingbird Line from Watershed to Klerksdorp North								
1 gantry to str1								
2 Str 1 to str2								

1.4 Authorized Personnel

ENVIRONMENTAL MANAGEMENT PROGRAMME					
Name	**Signature**	**Designation**	**Delegate**	**Signature**	**Designation**
FOUNDATIONS					
Name	**Signature**	**Designation**	**Delegate**	**Signature**	**Designation**
TOWER INSTALLATION					
Name	**Signature**	**Designation**	**Delegate**	**Signature**	**Designation**
JOINTING & CONDUCTOR REPAIRS					
Name	**Signature**	**Designation**	**Delegate**	**Signature**	**Designation**
REGULATION & STRINGING					
Name	**Signature**	**Designation**	**Delegate**	**Signature**	**Designation**
EARTHING					
Name	**Signature**	**Designation**	**Delegate**	**Signature**	**Designation**

Eskom	**CERTIFICATES** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

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Comments:

Revision Details: Rev.0	

Compiled By

Name:	Ayanda Nzo	**Tel:**	018 464 7641	**Date:**	October 2016

Eskom	**TOWER INSTALLATION CERTIFICATE** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

I, _____ (name in print) hereby certify that all tower or pole installations were done according to the appropriate Eskom Specifications and Drawings, as specified in the Design Document.

Signature :	**Date :**
Designation :	

Eskom	**FOUNDATION CERTIFICATION** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

I, _____ (name in print) hereby certify that all tower or pole foundations (soil type, foundation type, excavation, concrete, concrete work and backfilling) were done according to the Foundation Drawings and the appropriate Eskom Specifications.

Signature :	**Date :**
Designation :	

Eskom	**Environmental Management Programme** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

The following deviations / contravention of the Environmental Management Programme have occurred during the construction phase of the project.

Date of occurrence	Deviation	Corrective Action (include date)

I, _____ (name in print) hereby certify that the Environmental Management Programme (EMP) as authorised by Eskom and the DEAT has been implemented. All deviations / contravention of the EMP have been listed above and have been rectified to the satisfaction of the Environmental Management Section of the Network Services Department and the Landowner.

Further, all deviations / contraventions that have been reported to the Environmental Management Section of the Network Services Department whose responsibility it is to report all deviations / contraventions to the relevant DEAT.

Signature :	**Date :**
Designation :	

Eskom	**JOINTS AND DAMAGE CERTIFICATE** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

I, _____ (name in print) hereby certify that all mid-span joints, compression dead-ends and conductor damage repairs were done by an Eskom coded person and that the work done was completed according to the appropriate Eskom Specifications. All joints have been marked with the jointers unique mark. Sample joints have passed the specified tests. I further certify that all equipment used was working at the original technical specifications as provided by the manufacturer of such equipment. Copies of the test certificates are attached.

List of Relevant Coded Persons

Name	**Code Number**	**Discipline**	**Signature**

ESKOM Jointers Code :

Signature :	**Date :**
Designation :	

Eskom	**REGULATION CERTIFICATE** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

I, _____ (name in print) hereby certify that the sag and tension of the conductors and the earth wires was done according to the Sag and Tension Charts provided. The sag and tensioning was done by a Eskom Coded person as per Eskom Specifications and the ambient temperature was measured as specified. All equipment used was suitable for the conductor and was working at the original technical specifications as provided by the manufacturer of such equipment.

List of Relevant Coded Persons

Name	Code Number	Discipline	Signature

Signature :	**Date :**
Designation :	

Eskom	**EARTHING CERTIFICATE** **Watershed 132kV Line diversions** **Project ID: CTXQ0827**	**NED** **NWOU/AC** **Rev 0**

I, _____ (name in print) hereby certify that all tower or pole earthing was done according to the appropriate Eskom Specifications and Drawings. That the specified earthing electrodes were installed and bonded to the structures as specified. That all visible copper protruding above ground level was painted the same colour as the structure it is bonded to. That all the footing resistances were measured in accordance to the specifications as specified and that all installations meet the specified values.

Signature :	**Date :**
Designation :	

Eskom	**Section E** **OHS Act Requirements to be met by Principle Contractors** **Watershed 132kV lines diversion** **Project ID: CTXQ0827**	**NED** **NWOU-AC** **Rev 0**

SEE ATTACHED DOCUMENT

SEE ATTACHED DOCUMENT

SEE ATTACHED DOCUMENT

Annexure E

OHS Act

Eskom Distribution

DOCUMENT CLASSIFICATION: DISTRIBUTION PROCEDURE

TITLE: OHS ACT REQUIREMENTS TO BE MET BY PRINCIPAL CONTRACTORS EMPLOYED BY ESKOM DISTRIBUTION

REFERENCE DISPVABF3 REV 3
DATE APRIL 2004
PAGE 1 OF 47
REVISION DATE: APRIL 2007

COMPILED BY	FUNCTIONAL RESP.	TESCOD APPORVED APPROVED BY	AUTHORIZED BY
Signed	*Signed*	*Signed*	*Signed*
.....	.....	.....	.....
S Isaacs	B Misrole DRM	B Misrole for TESCOD	M N Bailey DTM for MD (D)

This document has been seen and accepted by:

Contents

Foreword

This procedure was prepared by:

B Kriel
C Booth
T Barnard
L Dikgale
S Sentle
S Isaacs

1 Scope

1.1 Purpose

The purpose of this procedure is to set out the minimum legislative and organizational requirements that are applicable to principal contractors working at Eskom Distribution sites and premises.

1.2 Applicability

This procedure is applicable to all Distribution Division sections, departments and units who have entered into contractual agreements with principal contractors to perform work for then, including construction related work.

2 Normative references

The following documents contain provisions that, through reference in the text, constitute requirements of this procedure. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this procedure are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards and specifications can be obtained from the Information Centre and Technology Standardization Department at Megawatt Park.

ESKADAAT6: Rev.4, *Procurement by Eskom from Black Suppliers.*

ESKADAAX1: Rev.0, *Supplier Management in Eskom.*

ESKARAAG4: Rev. 6, Op*erating Regulations for High Voltage Systems (ORHVS).*

ESKASAAN0: Rev.1, *Standard for the labelling of high voltage equipment.*

ESKPVAAZ1: Rev.2, *Environmental management programme*.

ESKPVAAZ6: Rev.1, Supplier *Management guideline.*

DISASAAR3: Rev. 2, *Emergency preparedness.*

DISASABZ7: Rev. 1 *First aid.*

DISPVACK0: Rev. 1, *Identifying, analyzing, documenting and observing critical tasks. (Draft)*

DISPVACU1: Rev. 2, *Pre-task planning, toolbox/tailgate talk, risk assessment and feedback process. (Draft)*

DISSCABD3: Rev.0, *Specification for the supply of labour to Distribution Field Services. (Draft)*

SCSASAAJ6: Rev.1, *Distribution fire risk management.*

SCSASABH6: Rev.1, *Risk Management Training.*

SCSASACI2: Rev. 0, *Selection, purchase and use of hazardous material.*

SCSASACA2: Rev. 0*, Medical surveillance.*

SCSPVABN2: Rev. 0, *Training, Testing and Authorization of persons for the Operation and Maintenance of the Power System.*

SCSPVABO6: Rev.3, *The reporting, recording, investigation, costing and follow-up of incidents/accidents*.

SCSPVABP4: Rev.2, *Management of substance abuse procedure.*

SCSPVABX4: Rev. 0, *Procedure for the handling of non-conformances.*

SCSASACH6 Rev. 0, *Symbolic signs and colour coding.*

SCSSCAAP5: Rev.1, *Manufacturing specification for Distribution equipment labels.*

3 Definitions and abbreviations

All definitions in ESKARAAG4, the Operating Regulations for High Voltage Systems are applicable to the procedure as well as the following:

3.1 agent: Means any person who acts as a representative of a client.

3.2 client: Means any person for whom contracted work is performed. (Within the Engineering and Customer Services environment the term “client” implies the Eskom Distribution employer and within the Eskom Distribution commercial context the term “client” implies the requestor of the service.)

3.3 competent person: In relation to construction work, means any person having the knowledge, training and experience specific to the work or task being performed: Provided that where appropriate qualifications and training are registered in terms of the provisions of the South African Qualifications Authority Act, 1995 (Act No. 58 of 1995), these qualifications and training shall be deemed to be the required qualifications and training.

3.4 construction work: means any work in connection with:

(a) the erection, maintenance, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure;
(b) the installation, erection, dismantling or maintenance of a fixed plant where such work includes the risk of a person falling;
(c) the construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or
(d) the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work.

3.5 contractor’s employees: All those persons employed by the contractor to perform the work stipulated in the contract and who are remunerated by the contractor, including sub-contractor employees.

3.6 design: In relation to any structure includes drawings, calculations, design details and specifications.

3.7 designer: Means any person who:

(a) prepares a design;
(b) checks and approves a design;
(c) arranges for any person at work under his control (including an employee of his, where he is the employer) to prepare a design, as well as;
(d) architects and engineers contributing to, or having overall responsibility for the design;

(e) building services engineers designing details for fixed plant;
(f) surveyors specifying articles or drawing up specifications;
(g) contractors carrying out design work as part of a design and building project;
(h) temporary works engineer designing form work and false work; and
(i) interior designers, shop-fitters and landscape architects.

3.8 emerging contractor: A contractor who in terms of government's economic policy needs to be given equal opportunities. For example a contractor typically listed as a (BEE) Black Economic Empowerment Company.

3.9 employer: Any person who employs or provides work for any person and remunerates that person or expressly or tacitly undertakes to remunerate him.

3.10 fall protection plan: Means a documented plan, of all risks relating to working from an elevated position, considering the nature of work undertaken, and setting out the procedures and methods to be applied in order to eliminate the risk.

3.11 GMR: General Machinery Regulations.

3.12 hazard identification: Means the identification and documenting of existing or expected hazards to the health and safety of persons, which are normally associated with the type of construction work being executed or to be executed.

3.13 health and safety file: Means a file, or other record in permanent form, containing the information required as contemplated in these regulations.

3.14 health and safety plan: Means a documented plan, which addresses hazards, identified and includes safe work procedures to mitigate, reduce or control the hazards identified.

3.15 health and safety specification: Means a documented specification of all health and safety requirements pertaining to the associated works on a construction site, so as to ensure the health and safety of persons.

3.16 method statement or safe work procedure: Means a written document detailing the key activities to be performed in order to reduce as reasonably as practicable the hazards identified in any risk assessment.

3.17 mandatory: Includes an agent, a contractor or a sub-contractor for work, but without derogating from his status in his own right as an employer or user.

3.18 OHS Act: Occupational Health and Safety Act, Act 85 of 1993.

3.19 ORHVS – Operating Regulations for High Voltage Systems.

3.20 PPE: Personal protective equipment.

3.21 Principal Contractor: Eskom Distribution enters into a commercial contract with an independent person/registered business to provide a very specific service to the business. The principal contractor in this instance operates independently, and can at any point in time also render services to other companies. The relationship between Eskom Distribution and the principal contractor is managed in terms of the conditions stipulated in a contract via the applicable commercial and procurement process. (The term does not include sub-contractor(s). The principal contractor is responsible for ensuring that all sub-contractors working for him adhere to contractual requirements and obligations.)

3.22 Principal contractor and sub-contractor management: The management of the company that the contract is awarded to and their management of their sub-contractors. The relationship between the principle contractor and the sub-contractor will be governed by the contractual arrangements into which they have entered.

3.23 Project Manager: The Project Manager is the duly authorized Eskom Distribution representative who acts on Eskom Distribution's behalf as the administrating officer for the purposes of the contract. (The term "Project Manager" in the context of this procedure should be used in its' broader context and should not be restricted to the designation of Project Manager in any specific work environment.)

3.24 Risk Auditing System (RAS): RAS is an Eskom, computer-based auditing system. With the exception of risk finance, RAS covers all risk control disciplines such as safety, health, security, operating, maintenance, environment and fire.

3.25 Risk Management: All activities related to accident and disease prevention, fire prevention and protection, occupational health and hygiene, damage and loss control, public safety, emergency preparedness, security and environmental management.

3.26 Sub-contractor: A contractor who is contracted in by the principal contractor to the business.

3.27 Structure: Means

(a) any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, batching plants, pylon, surface and underground tanks, earth retaining structure or any structure designed to preserve or alter any natural feature, and any other similar structure;

(b) any formwork, false work, scaffold or other structure designed or used to provide support or means of access during construction work; or

(c) any fixed plant in respect of work which includes the installation, commissioning, decommissioning or dismantling and where any such work involves a risk of a person falling two meters or more;

3.28 Temporary Employment Service

(As defined in the (LRA) Labour Relations Act 66 of 1995, Section 198):

1. Any person who, for reward, procures for or provides other persons to a client.

a) renders service to, or performs work for, the client, and

b) is remunerated by the Temporary Employment Service.

2. For the purposes of this Act, a person whose services have been procured for or provided to a client by a Temporary Employment Service is the employee of that Temporary Employment Service, and the Temporary Employment Service is that person's employer.

3. Despite subsections (1) and (2), a person who is an independent contractor is not an employee of a Temporary Employment Service, nor is the Temporary Employment Service the employer of the person.

NOTE: Our contract should clearly identify Temporary Employment Services as contractors as per the Labour Relations Act and they too shall comply with this procedure. Refer to DISSCABD3 for further information regarding procuring labour from a Temporary Employment Service; this document stipulates the specifications for these contracts.

3.29 The company: Means Eskom Distribution.

3.30 T & Q: Technology and Quality department.

4. Responsibilities of the various role players in terms of the contract

4.1 Eskom Distribution Departments

The following departments represent the key role players within Eskom Distribution in terms of contractor management.

- Line Management (Representing a Distribution department, as the internal client requesting the service)
- Commercial – Supplier Management and Procurement
- Risk Management
- Technology and Quality
- Training and Development

These five departments must work closely together through the following five phases to ensure the successful completion of the contractual requirements:

Phase 1: Supplier management (Supplier evaluation)
Phase 2: Tendering phase (Contractor selection)
Phase 3: Precaution phase (After the selection of the contractor but before the commencement of work)
Phase 4: Execution phase (During the execution of the work)
Phase 5: Post execution phase (After the completion of the project)

4.1.1 Line Management requesting the service (The client)

Line Management as the internal Eskom Distribution department wanting to procure a service shall be held responsible for providing the Procurement Department with the scope of work and the project specific technical and safety requirements that need to be met in order to successfully complete the project. These project job specific requirements need to be included, by the buyer, in the tender documentation in order to ensure that the contract is awarded to a competent contractor. Once the contract has been awarded Line Management (the client) shall nominate a competent person (a Project Manager) to co-ordinate all activities relating to health and safety for the duration of the contract.

Thereafter the Eskom Distribution Project Manager shall:

a) Prepare and provide the principal contractor with health and safety specifications and any other information, which might affect the health and safety of any persons carrying out any work for the duration of the contract.

b) Ensure that the pre-project risk assessment results are included in the design hand over document to ensure that all identified risks are known, addressed and managed by the principal contractor during the contract.

c) Ensure that the principal contractor remains in good standing and is registered with the Compensation Commissioner for the duration of the entire contract period as opposed to only being registered at the time of the contract being awarded.

d) Ensure that the principal contractor's site-related appointments are in place and that they are specific and indicate for which areas within OHS Act individuals are responsible.

e) Approve the principal contractor's documented health and safety plan and ensure that it is implemented, maintained and available on request, so as to ensure that the principal contractor is able to manage his/her risks. This will include audits conducted by the client/employer at intervals as agreed upon between the client/employer and the principal contractor. (A requirement specifically relating to construction related projects)

f) Provide the principal contractor with timeous health and safety information when circumstance change in the working environment.

g) Have a signed copy of the contract that was entered into with the contractor working in his/her area of responsibility.

h) Share the content of the contract document with the relevant supervisors in whose areas of responsibility the contractual work will be completed and the supervisor shall ensure that annex E, is completed and filed for audit purposes.

i) Ensure that the Project Management Clerk of Works attends all site meetings. (A requirement specifically relating to construction related projects.

j) Issue the principal contractor with a "work stop" or a "non-conformance report" if the Project Manager becomes aware of any sub-standard acts or conditions or any non-compliance with legislation, regulations or procedural requirements relating to health and safety aspects that are not being fulfilled by the principle contractor or any of his employees, sub-contractors or agents. (The work stop order or the non-conformance report shall be restricted to the site where the non-conformance had occurred).

k) Refuse any principle contractor employee, sub-contractor or agent access to its premises if that person had committed any unlawful act, any sub-standard working practice or is found to be unauthorized or unqualified in terms of the Occupational Health and Safety Act, until the non-conformance has been investigated and resolved by the Distribution Project Manager.

l) Implement in each area a contractor ORHVS authorization tracking system to ensure that the necessary re-training takes place prior to the expiry of authorizations.

m) Participate in contractor related incident investigations where Eskom Distribution is invited to participate. However the Eskom Distribution representative attending shall be mandated or appointed to attend the relevant contractor related incident investigation. Attendance is required primarily where Eskom plant and/or equipment are involved in an incident, in these instances the matter will be investigated in accordance with SCSPVABO6.

n) Ensure that the Project Management Clerk of Works conducts periodic quality assessments at the principle contractor's premises, his work places and on his employees to ensure that the contractor complies with agreed standards and system performance during the contract period.

o) Ensure that the final contractual post-project inspections are undertaken to determine that mandatory warrantee inspection requirements are met.

p) Ensure that where reasonably practical Field Service Officers are involved in the take over process to tighten control and assist with quality verifications.

q) Ensure that the requirements of the contractual agreement are met and if they are not satisfactorily met, based on evidence, provide feedback to this effect to the responsible Line Manager and the Supplier Management Department

to ensure that unscrupulous and poor performing principal contractors are removed from the approved suppliers list both regionally and nationally.

4.1.1.1 Authorization of persons for the operation and maintenance of the power system

Unless specifically stated in a contract it shall not be the responsibility of Eskom Distribution to train principle contractor employees.

The Distribution Field Service Centre Managers shall ensure that the principal contractor is authorized by them, as a Responsible Person, in terms of ESKARAAG4 to accept a permit, where applicable. In the event of a permit being issued the principle contractor shall accept full responsibility for the due compliance with the relevant duties, obligations and prohibitions imposed by the regulations.

The principal contractor shall, in particular ensure that the work is being carried out under the direct supervision of the contractor's Responsible Person, within the confinements specified in the work permit and that the employees concerned understand and appreciate the risks and dangers involved.

4.1.2 Commercial Department

4.1.2.1 Distribution Corporate Commercial

The Distribution Corporate Commercial Department shall devise national mechanisms to effectively deal with problematic contractors and share contractor information, good and bad, with other regions to promote reliable contractors and neutralize problematic contractors.

4.1.2.2 Supplier Management

The Supplier Management Department shall:

a) Ensure that the supplier management function qualifies suppliers in accordance with ESKPVAAZ6.

b) Evaluate prospective contractors in terms of their compliance with applicable commercial, financial, quality, technical, environmental, legal, safety capability/capacity and human resources requirements, as well as performance ratings (where applicable), as determined by the specific functional areas within Eskom Distribution. If prospective contractors do not meet these requirements they should not be listed.

c) Consult with the necessary role players e.g. Risk Management, Environment, Training and Development and Technology and Quality etc. before approving suppliers. (Refer to ESKADAAX1 Revision 0, Supplier Management in Eskom.)

d) Ensure that the contractor database contains sufficient detail in order to accurately portray each contractor's field of expertise and limitations.

e) Determine the applicability of the Construction Regulations in relation to the nature of the services that may be requested in future.

f) Develop an approved suppliers list for Eskom Distribution.

g) Ensure the removal of qualified suppliers from the approved suppliers list, after receiving substantiated motivation from line management (the requestor), based on the fact that the principal contractor's business track record no longer meets Eskom Distribution's standards.

4.1.2.3 Procurement Department

The Procurement Department shall:

a) Evaluate prospective contractors in terms of their compliance with applicable commercial, financial, quality, technical, environmental, legal, safety capability/capacity and human resources requirements, as well as performance ratings (where applicable), as determined by the specific functional areas within Eskom Distribution, in relation to the specific contract.

b) Determine the applicability of the Construction Regulations in relation to the scope of work.

c) Obtain the required health and safety specifications from line management / the requestor.

d) Ensure that the health and safety specifications prescribed by line management / the requestor forms part of the tendering information.

e) Invite all tendering principal contractors to attend the pre-project site meeting to ensure that they are able to tender having full knowledge of the project criteria.

f) Consult with the necessary role players e.g. Risk Management, Environment and Technology and Quality etc. in order to establish the competency of the contractor before a contract is awarded and to ensure that the specifications of the contract and the project will be met during the execution of the contract. (Refer to ESKADAAX1 Revision 0, Supplier Management in Eskom.)

g) Not appoint a principal contractor to perform construction work, unless the client (Eskom Distribution line management / the requestor) is reasonably satisfied that the principal contractor, which he or she intends to appoint, has the necessary competencies and resources to carry out the work safely.

h) Ensure that there is written confirmation of insurance cover on all services and construction work contract files.

i) Appoint the principal contractor.

j) Ensure that all contract documentation is properly signed and approved prior to the commencement of the contract.

k) Ensure the provision of the relevant Eskom standards, procedures and processes were the principal contractor is not in possession of a sophisticate communication system e.g. access to the internet.

l) Incorporate a formal contractor performance appraisal system whereby Project Managers, Clerks of Work and Field Service Officers and any other persons who perform a controlling function over the contractors may register their appraisals with the Procurement Department.

m) Participate in contractor related incident investigations where Eskom Distribution is invited to participate, specifically where the interpretation of contractual clauses have become an issue.

n) Establish and conduct regular contractor forums, and invite all stakeholders to participate e.g. Risk Management, Technology and Quality, Training and Development and Capital Programme, to provide an opportunity to share information with them, thereby ensuring that contractors are in possession of, and are familiar with, the latest Regional requirements, standards, procedures and processes, as well as information on recent accidents that may be used to enhance their own safety programmes. This will also give the region the opportunity to receive feedback from the contractors on generic issues.

4.1.3 Risk Management Department

The Risk Management Department shall:

a) Participate in the contractor selection process.

b) Assist the Project Manager with pre-project risk assessments.

c) Conduct periodic risk assessments at the principal contractor's premises, his work places and on his employees to ensure the contractor's compliance with agreed standards and system performance during the contract period.

d) Consolidate statistics on principal contractor related accidents and/or incidents.

e) Participate in contractor related incident investigations where Eskom Distribution is invited to participate, and where mandated or appointed to attend. Attendance is primarily required where Eskom plant and/or equipment are involved.

f) Recommend to both Line Management and the Supplier Management Department the removal of a qualified principal contractor from the approved suppliers list where there is evidence of non-adherence to OHS Act requirements and where the principal contractor has an unacceptably high incident rate, during the contract period.

4.1.4 Technology and Quality Department

The Technology and Quality department shall

a) Participate in the contractor selection process.

b) Conduct periodic quality assessments at the principal contractor's premises, his work places, material and on his employees to ensure the contractor's compliance with agreed standards and system performance during the contract period.

c) Monitor contracts during the execution of the project for conformance.

d) Participate in contractor related incident investigations where Eskom Distribution is invited to participate, and where mandated or appointed to attend. Attendance is primarily required where Eskom plant and/or equipment are involved.

e) Recommend to both Line Management and the Supplier Management Department the removal of a particular contractor from the approved suppliers list where there is evidence of non-adherence to Eskom Distribution's quality standards both during the contract period and after the project was handed over.

4.1.5 Technology and Development Department

a) Provide the necessary training to bring contractors up to Eskom's level of Responsible Person in terms of the Operating Regulations for High Voltage Systems.

b) Where requested provide contractors with the Eskom list of approved service providers for safety training.

4.2. Principal Contractor

The principal contractor shall:

a) Ensure that the minimum legislative, regulatory and Eskom Distribution risk management requirements are complied with on all Eskom Distribution work sites.

b) Notify the Provincial Director of the Department of Labour in writing of all construction work if it falls within the scope of Section 3 of the Construction Regulations.

c) Be responsible for any risk management matters, standards and legal requirements that may stem from his/her contract.

d) Provide the Eskom Distribution Project Manager with a copy of his/her health and safety plan.

e) Demonstrate adequacy and suitability of his/her health and safety plan.

f) Provide the Eskom Distribution Project Manager with a health and safety file which should include a record of all drawings, designs, materials used, list of contractor employees, the agreement and the type of work to be done.

g) Submit to the Eskom Distribution Project Manager the contractor's Compensation Commissioner's registration number and all current goodwill certificates before the commencement of work and renewal periods, for record keeping purposes.

h) Appoint a full time competent employee in writing to supervise the construction work. He shall also appoint a full time or part time construction officer in writing depending on the size of the project or the degree of dangers.

i) Ensure that all appropriate precautions are taken to protect persons present at work or in the vicinity of a construction site from all risks, which may arise from such site.

j) Before the commencement of any construction work the principal contractor shall conduct a risk assessment, this should be done by a competent person appointed in writing. The risk assessment shall form part of the health and safety plan.

k) Appoint competent staff to perform the work and ensure that all his/her staff are trained on the health and safety aspects relating to the work and that they understand the hazards associated with all other work being carried out on the premises.

l) Submit the names of the person(s) charged with OHS Act responsibilities to the Eskom Distribution Project Manager.

m) Submit to the Eskom Distribution Project Manager a record of the names of contractor employees working on equipment or the network in his area of responsibility.

n) Unless specifically stated in the contract it shall not be the responsibility of Eskom Distribution to train contractor employees. In terms of OHS Act, Section, 37(2) Eskom contracts out its responsibility as the employer. The contractor's OHS Act 16(2) appointee shall have the responsibility.

o) Ensure that where the Distribution Division is requested to train the contractors' employees, in terms of the Operating Regulations for High Voltage Systems (ORHVS), this request shall be managed contractually and the relevant principal contractor staff members shall be trained and authorized in terms of the scope of the contractor's responsibilities for that particular contract. The requirements stipulated in SCSPVABN2 shall apply to the training and authorization of principal contractor staff members.

p) Ensure that staff are conversant with work procedures and that they adhere to such procedures.

q) Ensure that all equipment and tools used comply with OHS Act requirements with respect to condition, use, care, storage, maintenance and the management thereof.

r) Erect its' own site huts, temporary buildings, storage areas, toilets fencing and any other structure as may be required by it. Any such structures shall be positioned and erected in compliance with any instructions from Eskom Distribution and the relevant safety and fire prevention requirements.

s) Ensure that no alcohol or other intoxicating substance is brought onto the premises. Eskom Distribution will not permit the presence of anyone who is or who appears to be under the influence of alcohol, or any other intoxicating substance. Contractor employees' shall avail themselves for breathalyzer testing.

t) Immediately report all incidents referred to in the OHS Act Section 24, to the Department of Labour and to the Eskom Distribution Project Manager. In this respect Eskom Distribution obtains an interest in the matter of any formal inquiry conducted in terms of section 32 of the OHS Act.

u) Give the Eskom Distribution Project Manager its full participation and co-operation whenever the company inquires into any matter related to health and safety at the premises.

v) On completion of the work or whenever instructed by Eskom Distribution, remove all structures erected by it, as directed by the company and rehabilitate the environment where required by law.

4.2.1 Principal contractor employees

The principal contractor's employees shall:

a) Co-operate as closely as possible with their employer in the application of the prescribed health and safety measures.

b) Avoid any act that may endanger their own health and safety or that of fellow employees or members of the public who may be affected by their acts or omissions at work.

c) Adhere to all legislative requirements, Eskom and/or Distribution standard and procedures, the Contractor and the Local Authorities requirements.

d) Have the right to obtain proper information from their employer regarding health and safety risks and health and safety measures related to the work processes. This information should be presented in forms and languages, which the workers easily understand.

e) Use facilities placed at their disposal and not misuse anything provided for their own protection or that of others.

f) Have the right to remove himself/herself from danger when he/she has good reason to believe that there is an imminent and serious danger to his/her safety or health, and the duty to inform his/her supervisor immediately.

g) Have the right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work adopted as they may affect health and safety.

h) Report to the Eskom Distribution Project Manager any sub-standard acts and or conditions which may come to their attention.

i) Maintain the surrounding area of the work site in a neat and tidy condition.

j) Participate in regular Health and Safety meetings.

4.3 Sub-contractors

a) In terms of the Construction Regulations, all the duties that the client has towards the principal contractor, the principal contractor in turn has towards all his or her sub-contractors. It must be noted that the principal contractor remains accountable and responsible for his/her sub-contractors.

b) The relationship between the principle contractor and the sub-contractor will be governed by the contractual arrangements into which they have entered.

c) Whilst the principle contractor has overall responsibility for the site, this does not remove from the sub-contractor any of their responsibilities. Any areas of concern should be discussed urgently with the principle contractor.

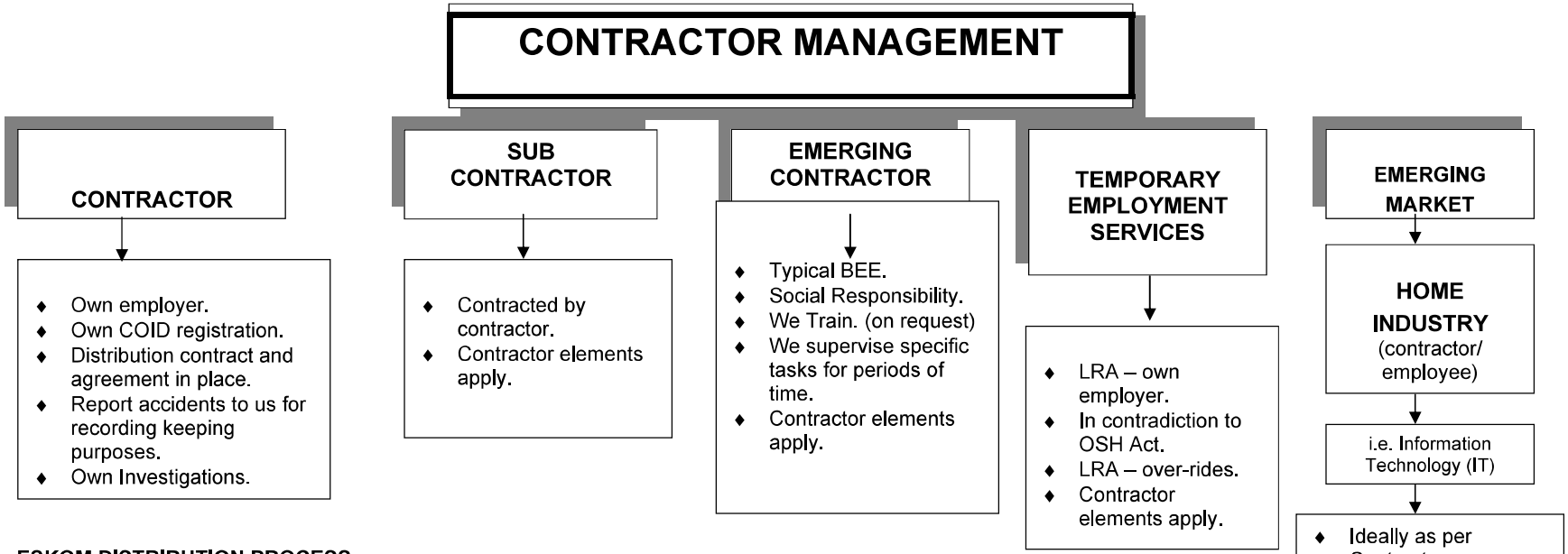
4.4 Emerging contractors

a) The development of Black or Black Empowering Suppliers/Contractors shall be done in accordance with the policy on Procurement from Black Suppliers ESKADAAT6.

b) Development areas or areas for improvement shall be identified during the supplier management / qualification process. Record shall be kept of the action required and an agreed time period shall be given to the supplier/contractor to develop to the required standards in accordance with ESKADAAT6.

Annex A

(informative)



ESKOM DISTRIBUTION PROCESS:

- Line Management, Procurement, Project Management, Risk Management and T&Q need to be involved in finalizing contracts.
- We have shared legal liability based on negligence and contractual agreements.
- Distribution proper induction and understanding.
- Principle contractors report accidents to Eskom and the Regional Risk Managers provides statistics when required.
- Project Manager to review contract requirements as per the requirements of the contract.

Legend:

- BEE – Black Economic Empowerment
- LRA – Labour Relations Act

Annex B (Part 1)
(informative)

Contract guidelines and OHS Act requirements

Contract guidelines

Note 1: The foundation on which these guidelines were developed is the Occupational Health and Safety Act and related legislation in so far as they may have a bearing on occupational health and safety matters.

Note 2: The information covered below may be used as a guideline on legislative and risk management standards that need to be included, as minimum requirements, in an agreement or a contract with a principal contractor.

Note 3: Depending on the nature of the service required the guidelines below may not be applicable to all contracts.

1. Scope of work

a) Eskom Distribution shall ensure, prior to the tendering process that a risk assessment is carried out to determine which occupational health and safety risks are likely to have an influence on the execution of the project. This occupational health and safety hazard identification and risk assessment is necessary to inform prospective tenders of the health and safety risks attached to the project and what preventative action may be taken in order to avoid unnecessary health and safety risks.

b) Following the risk assessment, the preventative activities identified shall be incorporated in the tender/contract documents in order to enable prospective principle contractors to make provision for it in their tenders.

2. The nature of the contractual relationship

a) The principal contractor shall acknowledge that the relationship between himself/herself and Eskom Distribution is for the provision of services as an independent contractor and not as an employee of Eskom Distribution, in terms of the Labour Relations Act, Act 66 of 1995 (as amended).

b) The principal contractor and/or its' employees shall in no way be deemed or regarded as employees of Eskom Distribution.

c) The principal contractor will be fully accountable for his/her sub-contractors in terms of contractual conditions.

3. Occupational Health and Safety Agreement

a) The principal contractor shall acknowledge that the contract constitutes an agreement in terms of Section 37(2) of the Occupational Health and Safety Act, whereby all responsibilities for health and safety matters relating to the contractor and/or its staff, the work that they are to perform on the premises/plant and the equipment that they use shall be the responsibility of the principle contractor.

b) It shall be the principal contractor's primary obligation to ensure that any person appointed by the principle contractor in terms of the OHS Act possess the knowledge and/or experience and/or qualifications required for such appointment, and shall be familiar with all the relevant provisions of the OHS Act.

c) Where it is a requirement of the OHS Act that any appointments which are to be made by the principal contractor or any sub-contractor in terms of OHS Act, or any terminations of any such appointments, are to be notified to the relevant Divisional Inspector of the Department of Labour, within the time specified in the OHS Act, the principle

contractor shall copy such notifications to the Eskom Distribution Project Manager within seven (7) days of submitting the same information to the Divisional Inspector.

4. OHS Act Section 10 - undertaking

The principal contractor must assume responsibility, in terms of Section 10 of the Occupational Health and Safety Act, for taking the necessary steps to ensure that any article or substance that it designs, manufactures, imports, sells or supplies for use at work is safe and without risk to the health when properly used and complies with all prescribed requirements.

5. Sub-contracting

a) The principal contractor shall enter into written contracts with his sub-contractors in terms of section 37(2) of the Occupational Health and Safety Act, whereby all safety procedures and arrangements are agreed upon amongst them.

b) All sub-contractor have to be approved by Eskom Distribution before they may be appointed by the principal contractor.

c) The principal contractor shall accept full responsibility for any acts or omissions of his sub-contractors, when creating a safety, health or environmental hazard.

6. Compensation for occupational injuries and diseases

The contractor shall be required to furnish the Eskom Distribution Project Manager with a statement or a goodwill certificate obtained from the Compensation Commissioner's Office, certifying that the contractor is registered and is in good standing with the Compensation Commissioner's Office.

7. Insurance

Refer to the following Insurance Policy for further details regarding insurance cover offered to contractors.

Policy Number: MS ENG 426 5174 - Eskom contract works maintenance and overhaul and public liability insurance.

8. Indemnities

Refer to the following Insurance Policy for further details regarding indemnity protection offered to contractors.

Policy Number: MS ENG 426 5174 - Eskom contract works maintenance and overhaul and public liability insurance.

9. Disclosure of confidential information

a) The principal contractor shall ensure that he and his staff members, including sub-contracted employees, shall at all times, treat as confidential, and shall not make unauthorized use of information which is disclosed to or acquired by them, regardless of whether such information is expressly classified as confidential or not.

b) The principal contractor shall ensure that he and his staff adequately protect any confidential information which they may obtain.

c) The principal contractor shall immediately inform the Eskom Distribution Project Manager of any event of breach of confidentiality.

10. Incorporation by reference in contracts

External standards, Eskom and/or Distribution procedural documents may be incorporated by reference into Eskom's Conditions of Contract.

a) Therefore, this procedure supplements Eskom's Conditions of Contract but shall not be considered as including all the responsibilities of principle contractors regarding the occupational health and safety requirements in terms of the Occupational Health and Safety Act, Act 85 of 1993.

b) The overall responsibility for occupational health and safety requirements at the Distribution Division sites and work to be carried out on public property of local authorities shall remain with the principal contractor and his sub-contractor/s.

c) All documents referred to in this procedure will be made available to the principal contractor by the Procurement Department who will consult with the necessary role players (i.e. Line Management, Risk Management, Environmental Management, and or other specialist as the need may be).

d) The employer may however from time to time order variations, alternations, modifications, amendments, additions, changes, revisions, cancellations or insertions to health and safety requirements to be met by principal contractors, via the organizational documentation control processes, provided that such requirements are communicated in writing to the other party.

Note: No extension of time will be allowed as a result of any action taken by Eskom Distribution in terms of, point c mentioned above, and the principal contractor shall have no claim against Eskom Distribution as a result thereof. Furthermore, no amendments to legislation or the regulations or reasonable amendments to Eskom Distribution's Safety and Operating procedures shall entitle the principal contractor to claim any additional costs incurred in complying therewith from Eskom Distribution.

e) If a principal contractor considers any of the requirements in the procedure as being too onerous, exemption from specific clauses may be requested in writing through the Procurement Department who will consult with the relevant role players (i.e. Risk Management, Field Services, Major Engineering Works and Capital Programme)

f) Any difficulty experienced with the interpretation of this procedure may be discussed at any time with the Procurement Department who will consult with the necessary role players.

g) The OHS Act Requirements Acknowledgement of Receipt form for principal contractors shall be completed and signed by the principal contractor on award of the contract (Refer to annex E).

11. Payment

Payment to the principal contractor may only be authorized after the final contractual post project quality and safety conformance inspection has been completed by the Eskom Distribution Project Manager.

12. Dispute resolution mechanisms

Dispute resolution mechanisms shall be available to parties both during and after the termination of a contract in terms of the NEC contract conditions.

Annex B (Part 2)
(continued)

OHS Act requirements

1. Occupational Health and Safety Programme

a) The principal contractor shall have his own approved Health and Safety Policy, which must be displayed, at his work site, if practical.

b) The principal contractor shall formulate, implement and maintain an Occupational Health and Safety Programme, ensuring that his employees avoid any act, which may endanger their own health and safety or that of other persons who may be affected by their conduct.

c) All aspects concerning occupational health and safety shall be a permanent standing item on all relevant site-meeting agendas.

d) The principal contractor's Occupational Health and Safety Programme shall ensure that his employees and sub-contractor employees adhere to Eskom Distribution's instructions, standards, procedures and Operating Regulations for High Voltage Systems. The programme shall ensure that his/her employees:

- stay within clearly signed barricading and do not work in close proximity to live apparatus unless if live work is performed,
- only work above ground level under continuous and direct supervision of the contractor's appointed supervisor,
- wear appropriate personal protective equipment and/or clothing,
- refrain from proceeding with the work in the absence of the appointed supervisor; and
- adopt Eskom Distribution's policy on the management of substance abuse in its entirety.

2. OHS Act legal appointments

a) The appointment of contractors in terms of the applicable legislation will depend on the following factors:

- The duration of the contract.
- The scope of the contract.
- The hazards and risks involved in the work.

Thereafter the successfully appointed principle contractor shall draw up an Occupational Health and Safety structure for the contract, which will form part of his/her Occupational Health and Safety Programme.

b) Examples of statutory appointments required:

- OHS Act Section 16(2) Employer
- OHS Act GMR 2 (1) Supervisor of Machinery
- OHS Act GMR 2 (7) Supervisor of Machinery Assistant

- OHS Act Section 17 Health and Safety Representative

Depending on the nature of the contract the assignations will be expanded.

3. Safety at workplaces

3.1.1 All appropriate precautions shall be taken:

a) to ensure that all workplaces are safe and without risk of injury to the health and safety of workers.

b) to protect persons present at or in the vicinity of a construction site from all risks, which may arise from such site.

3.1.2 All openings and other areas likely to pose danger to workers shall be clearly indicated.

4. Means of access and egress

Adequate and safe means of access to and egress from all workplaces shall be provided, indicated where appropriate and maintained in a safe condition.

5. Good housekeeping on construction sites

a) A suitable housekeeping programme shall be established and continually implemented on each construction site which should make provision for:

1) the proper storage of material and equipment;

2) the removal of scrap, waste and debris at appropriate interval.

b) Loose materials, which are not required for use, should not be placed or allowed to accumulate on the site so as to obstruct means of access to and egress from workplaces and passages.

c) All combustible refuse must be removed from the inside of all buildings at the close of each day. All other waste must be removed at least once a week.

d) The construction site should be suitably and sufficiently fenced off and provided with controlled access points to prevent the entry of unauthorised persons.

e) Waste and debris shall be disposed of from a high place with a chute, unless the chute complies with the requirements as set out in Construction Regulation 12(6).

f) Material left lying about after completion of the contract will be removed by Eskom Distribution and the cost debited to the contract price.

g) Eskom Distribution will not be held responsible for the loss of any material dealt with in this manner.

h) The principal contractor must ensure that the work site is kept tidy for the duration of the contract.

6. Prevention of unauthorised entry

a) Construction sites in built-up area or along traffic routes should be fenced off to prevent the entry of unauthorised persons.

b) Visitors should not be allowed access to construction sites unless accompanied by or authorised by a competent person and provided with the appropriate protective equipment.

7. Fire prevention and fire fighting

a) The principal contractor shall take the necessary precautions to prevent fires and/to minimize the consequences of fire, while performing work on Eskom Distribution sites and public property.

b) Fire extinguishing equipment shall be properly maintained and inspected at suitable intervals by a competent person.

c) Access to fire extinguishers such a hydrants, portable extinguishers and connections for hoses shall be kept clear at all times.

d) All supervisors and a sufficient number of workers shall be trained in the use of fire extinguishing equipment, so that adequately trained personnel are readily available during all working periods.

e) Workers shall be suitably trained in the action to be taken in the event of fire, including the use of means of escape.

f) Where appropriate, suitable visual signs shall be provided to indicate clearly the direction of escape in the case of fire.

g) Sufficient and suitable means to give warning in case of fire shall be provided, where this is necessary, to prevent danger. Such warning should be clearly audible in all parts of the site where persons are liable to work. There should be an effective evacuation plan so that all persons are evacuated speedily without panic and accounted for and all plant and processes shut down.

h) Notices should be posted at conspicuous places indicating:

1) the nearest fire alarm;

2) the telephone number and address of the nearest emergency services.

8. Use and storage of flammable liquids, solids and gases

a) The principal contractor shall ensure that none of his/her employees work in an area where the vapour of any flammable liquid, solid or gas generated is of such an extent that a potential fire or explosion hazard is created, endangering the safety of any persons.

b) The principal contractor shall ensure that all flammable liquids, solids and gases are stored in stores built for that purpose.

c) Secure storage areas should be provided for flammable liquids, solids and gases in order to prevent trespassers.

d) Flammable liquids on site should be stored in a well-ventilated, reasonably fire resistant container, cage or room and kept locked with proper access control measures in place.

e) When decanting, the metal containers should be bonded or earthed.

f) Gas cylinders should be stored under cover and ± 6 meters from the nearest chains.

g) The appropriate type and adequate amount of fire-fighting equipment shall be installed in suitable locations around the flammable liquid, solid or gas store.

h) The appropriate signs shall be affixed at all entrances, prohibiting smoking and naked flames at all entrances.

i) Combustible materials such as packing materials, sawdust, greasy/oily waste and scrap wood or plastic should not be allowed to accumulate in workplaces but should be kept in closed metal containers in a safe place.

9. Eskom Distribution security measures and general principal contractor obligations

a) The principal contractor and his staff and/or sub-contractor staff shall only access and exit premises through the main gate(s) and/or checkpoint(s) designated by Eskom Distribution.

b) The principal contractor shall ensure that his/her staff observe the security rules of Eskom Distribution at all times and shall not permit any person who is not directly associated with the work from entering the premises.

c) The principal contractor and its' staff shall not enter into any area of the premises which is not directly associated with the work.

d) The principal contractor shall ensure that all material, machinery or equipment brought on to the premises is registered at the main gate(s) and/or checkpoint(s). Failure to do this may result in a refusal by the company to allow the materials, machinery or equipment to be removed from the premises.

e) All belongs, materials, machinery or equipment of the principle contractor and its' staff shall be subject, at any time, to spot searches by Eskom Distribution.

f) The principal contractor shall ensure that all road vehicles used on the premises are in a roadworthy condition are licensed and insured. All drivers shall have the relevant valid driving licenses and no vehicles shall carry passengers unless it is specifically designed to do so.

g) The principal contractor shall ensure that no hindrances, hazards, annoyance or inconvenience is inflicted on other contractors, Eskom Distribution or tenants. Where such situations are unavoidable, the relevant contractor shall give prior notice to Eskom Distribution.

10. Health hazards

a) Where a worker is liable to be exposed to any chemical, physical, biological hazard/agent and climatic conditions to such an extent that it is liable to be dangerous to his or her health, appropriate preventive measures shall be taken against such exposure.

b) The preventive measures referred to in paragraph (a) should place emphasis on the need to eliminate or reduce the hazard at the source and in particular should require:

1) The replacement of hazardous substances by harmless or less hazardous substances wherever possible;

2) Technical measures applied to the plant, machinery, equipment or process;

3) Control the release of harmful agents or chemicals into the working environment;

4) Training in manual lifting;

5) Appropriate protection against climatic conditions likely to jeopardise health;

6) Proper working posture when workers are required to work in fixed working positions or when they are carrying out repetitive work;

7) Where workers are required to enter any area in which toxic or harmful substances may be present, or in which there may be an oxygen deficiency, or a flammable atmosphere, adequate measures shall be taken to guard against danger.

8) Waste shall not be destroyed or otherwise disposed of on a construction site in a manner, which is liable to be injurious to health.

Note: Where it is not possible to comply with the above mentioned sub-paragraphs, other effective measures, including the use of personal protective equipment and clothing shall be applied.

c) The employer should make arrangements for the identification and assessment by competent persons of health hazards presented by the use of different operations, plant, machinery, equipment, substances and radiations at the construction site and take appropriate prevention and control measures against the identified health risks in conformity with legislative requirements.

11. Occupational health services

a) The employer shall provide for the setting up of or access to an occupational health service.

b) All workers shall be subjected to health surveillance.

c) Monitoring and control of the working environment and planning of safety and health precautions shall be performed in accordance with legislative requirements.

d) A multiplicity of hazards are present in construction work and every effort shall be made to promote awareness of this fact and the need to safeguard health.

e) Wherever new products, equipment and working methods are introduced, special attention should be paid to informing and training workers with respect to the implications for safety and health.

12. First aid and facilities

a) The principal contractor shall ensure that a sufficient number of trained first aiders are appointed for the number of employees on site.

b) Taking into account the type of injuries that are likely to occur on site, the nature of the activities performed and the number of employees at such a work site, the principle contractor shall ensure that the first aid box contains the minimum requirements in accordance with the General Safety Regulations.

c) First aid kits or boxes shall not contain anything besides material for first aid emergencies.

13. Hazardous chemical substances

a) If the principal contractor's activities in performing the work, involve the handling of any hazardous chemicals or substances the contractor shall implement such precautionary measures as may be required by the relevant acts.

b) The principal contractor must conduct an assessment to determine which employees are exposed to which hazardous chemical substances and shall provide the affected employees with the required training and personal protective equipment.

c) Training shall also be provided by the principal contractor on the correct use, care and limitations of such personal protective equipment.

14. Personal Protective Equipment

a) The provision and use of personal protective equipment by employees is the principle contractor's responsibility. The contractor shall be responsible to ensure that such equipment is worn at all material times.

b) It is also the responsibility of the principle contractor to do a risk assessment to establish what type of PPE his employees are required to wear based on the nature of the hazard and the type, range and performance of the protection required.

c) The principal contractor shall ensure that contractor employees are trained in the correct use, care, maintenance and limitations of PPE.

d) Workers working alone on construction sites in confined spaces, enclosed premises or in remote or inaccessible places should be provided with an appropriate alarm and the means to rapidly summons assistance in an emergency.

e) All personal protective clothing provided by the principle contractor to his/her employees should clearly display its' company logo.

15. Construction welfare facilities

a) At or within reasonable access of every construction site an adequate supply of wholesome drinking water should be provided.

b) At or within reasonable access of every construction site, the following facilities should, depending on the number of workers and the duration of the work, be provided, kept clean and maintained:

1) Sanitary and washing facilities or showers.

2) Facilities for changing and for the storage and drying of clothing.

3) Accommodation for taking meals and for taking shelter during interruption to work due to adverse weather conditions.

4) Men and women workers should be provided with separate sanitary and washing facilities.

16. Information and training

a) The training of principle contractor employees in Occupational Health and Safety matters relevant to their work is the responsibility of the principle contractor, unless other arrangements have been made contractually.

b) The principal contractor shall ensure that his officials and employees are acquainted with all relevant provisions of the Occupational Health and Safety Act, the Regulations and the requirements of all relevant Environmental legislation.

c) The principal contractor shall provide his/her employees with information on potential health and safety hazards to which they may be exposed at their workplace.

d) The principal contractor shall instruct and train his/her employees in the measures available for the prevention, control and protection against those hazards.

e) No person shall be employed in any work at a construction site unless that person has received the necessary information, instruction and training so as to be able to do the work competently and safely.

f) The information, instruction and training should be given in a language understood by the worker and written, oral, visual and participative approaches should be used to ensure that the worker has assimilated the material.

g) The principal contractor shall provide his employees with all personal protective equipment and the appropriate tools required for the safe and proper execution of the work.

h) The principal contractor shall, if requested to do so by the Procurement Department, demonstrate to the satisfaction of the Risk Management Department, that his employees and any sub-contractors have completed site and job orientation and any other qualifications and safety training that may be required by Eskom Distribution.

i) The project manager shall ensure that the principal contractor and his staff undergo compulsory on site safety induction prior to commencing work on Eskom Distribution work sites.

17. Symbolic safety signs

The principal contractor shall display all the necessary health and safety warning signs in accordance with the identified hazards for the applicable work site. (General Administration Regulation 13)

18. Communication

The principal contractor shall have a system in place to ensure the immediate communication to his/her employees and the on-site application, of any new legislation, regulations or relevant Eskom Distribution standard that may come into effect during the course of the contract.

19. Reporting, recording and investigation of accidents and diseases

19.1 Reporting

a) Incidents, accidents and diseases shall be reported to the relevant authorities as stipulated in the Occupational Health and Safety Act, the Compensation for Occupational Injuries and Diseases Act and the various Environmental legislation.

b) These incidents shall also be reported to the Project Manager, within 24 hours after the incident, who will be responsible for reporting it to the relevant Distribution Risk Manager.

c) The principal contractor shall collect all safety-related statistics and shall report it to the Eskom Distribution Project Manager at the end of each month.

19.2 Investigations

a) All incidents and accidents shall be investigated as stipulated in the Occupational Health and Safety Act.

b) Thereafter corrective actions and recommendations agreed upon shall be followed-up on to assess the effectiveness of the remedial measures taken.

19.3 Damage incidents

All damage to Eskom Distribution or contractor buildings, structures, vehicles equipment and the environment shall be reported to the Project Manager and investigated promptly by the contractor to ensure that action is taken to minimize possible production delays.

19.4 Monthly incident/accident statistical information reports

At the end of each month the principle contractor on site shall submit the following information to the Project Manager and forward a copy to the relevant Eskom Distribution Risk Co-ordinator/Practitioner (see annex H).

19.4.1 Injury types

a) The number of fatal incidents.

b) The number of diagnosed and reported occupational diseases.

c) The number of disabling injuries.

d) The number of medical incidents.

e) The number of first aid incidents.

19.4.2 Incident types

a) The number of electrical contact incidents.

b) The number of public incidents.

c) The number of vehicle incidents.

d) The number of environmental incidents.

e) The number of damage incidents.

f) The number of near-miss incidents.

The principal contractor shall, briefly, provide the relevant details for each incident reported monthly.

20. Environmental management

a) No scrap or refuse shall be left on site.

b) No fires shall be made for waste destruction.

c) The principal contractor's hygiene facilities shall be of such a nature that the impact on the environment is minimized.

d) Under no circumstances shall surface or ground water be polluted.

e) The Polluter Pays Principle (PPP) is now legislated and defined in the National Environmental Management Act, Act 107 of 1998. The cost of remedying pollution, environmental degradation and consequent adverse health effects shall be paid by those responsible for causing the pollution, degradation and adverse health effects. The same shall apply to the cost of preventing, controlling or minimizing further pollution, or environmental damage, or adverse health effects.

f) The principal contractor shall issue the Project Manager with a list of all hazardous chemical substances that he will be using on site.

g) All hazardous substances at the site shall be adequately stored and accurately identified, recorded, labelled and a Material Safety Data Sheet for each chemical shall be available on site.

h) All waste hazardous substances shall be disposed of at a licensed class H disposal site.

i) All environmental incidents shall be reported to the Project Manager and the designated Provincial Departments and measures shall be taken to control, minimize and clean up the pollution.

j) The site shall be kept neat and tidy at all times during the construction period.

21. Occupational Health and Safety Representatives and Committees

The principal contractor shall appoint Health and Safety Representatives and they shall form part of a statutory Health and Safety Committee.

22. Notification of construction work

1. The principal contractor who intends to carry out any construction work shall before carrying out that work; notify the Provincial Director, at the Department of Labour, in writing of the construction work if it includes:

a) The demolition of a structure exceeding 3 meters;

b) The use of explosives to perform construction work;

c) The dismantling of fixed plant at a height great than 3 meters;

Before carrying out that work, notify the Provincial Director in writing when the construction work

a) Exceeds 30 days or will involve more than 300 person days of construction work;

b) Included excavation work deeper than 1 meter, and

c) Includes working at a height greater than 3 metres above the ground or on a landing.

2. The notification to the Provincial Director contemplated in sub-regulation (1) of the Construction Regulations must be done on a form similar to Annexure A of the said regulations.

3. A principal contractor shall ensure that a copy of the contemplated form Annexure A of the Construction Regulations is kept on site by an inspector, client, client's agent or employee.

23. Site hand-over

Before the principal contractor starts with the required construction work, the site must be formally handed over to the principle contractor by Project Manager. During this meeting all occupational health and safety requirements applicable are to be defined, confirmed and signed off.

24. The identification of occupational health and safety hazards

a) The principal contractor shall, before proceeding with work, visit and inspect the site and shall establish whether there are any additional hazards to the health and safety of persons involved, in any work, which is to be performed there. The principal contractor shall report any additional hazards identified to the Project Management Clerk of Works.

b) Each person working on a site or visiting a site, and the surrounding community shall be made aware of the dangers likely to arise from operations at the site and the precautions to be observed to avoid or minimize those dangers. The necessary signage shall be posted at all times.

25. Reporting for duty

The principal contractor and/or its' designated person appointed in terms of Section 16 (2) of the Occupational Health and Safety Act shall report to the designated Eskom Distribution representative prior to commencing work at the premises.

26. On site risk assessments

a) A risk assessment shall be conducted in accordance with section 7 of the Construction Regulations.

b) An on site toolbox talk including a risk assessment shall be conducted prior to the commencement of work. The team leader, after conducting pre-task planning and after facilitating the on site risk assessment shall share all the tasks at hand, the identified risks and control measures with all his team members before commencing a specific task. This shall be done to ensure common understanding of the tasks, risks and control measures required.

27. Supervision of contractor employees

a) The supervision of contractor employees performing construction work shall be executed in terms of section 6 of the Construction Regulations.

b) The principal contractor shall ensure that the work is performed under the close supervision of a contractor's employee.

c) The principal contractor shall ensure that the supervisor has been trained to identify and understand the hazards associated with the work and have the authority to ensure that precautionary measures prescribed by the OHS Act and Eskom Distribution are implemented.

d) The principal contractor shall strictly enforce discipline against any of it's' staff regarding non-compliance by such staff with any health and safety requirements.

e) The principal contractor shall not permit the use of any unsafe machinery, plant, equipment, vehicle (including cranes, hoists and forklifts), substances, article, material, tool, protective equipment, ladder or scaffolding on Eskom Distribution premises.

f) The principal contractor shall not permit any of it's' staff to use any material, machinery or equipment of Eskom Distrbution unless the prior written consent of the company has been obtained.

28. Fall protection

The principal contractor shall designate a competent person to prepare a fall protection plan, which will include a risk assessment of all work carried out from an elevated position. In accordance with section 8 of the Construction Regulations.

29. Structures

a) The designer shall before the contract is put out to tender, make available to the client (the requestor) all relevant information about the design which may affect the pricing of the construction.

b) The designer shall also be required to inform the principle contractor in writing of any known or anticipated dangers or hazards related to the construction work. The following information should be made available:

- a geo-science technical report where appropriate;
- the loading the structure is designed to withstand ;
- the methods and sequence of construction.

In accordance with section 9 of the Construction Regulations.

30. Vehicles and mobile equipment

a) All vehicles and earth-moving or materials-handling equipment should:

1) be of good design and construction taking into account as far as possible ergonomic principles particularly with reference to the seat;

2) be maintained in good working order;

3) be properly used with due regard to health and safety;

4) be operated by workers who have received appropriate training, by their employers, in accordance with legislative requirements.

5) All drivers have the relevant valid licences.

b) The employer of all drivers and operators of vehicles and earthmoving or materials handling equipment shall ensure that the employees are medically fit, trained and tested in accordance with legislative requirements.

c) On all construction sites on which vehicles, earthmoving or material handling equipment are used:

1) safe and suitable access ways should be provided for them;

2) traffic should be organised and controlled as to secure their safe operation.

d) Adequate signalling or other control arrangements or devices should be provided to guard against danger from the movement of vehicles and earth moving or material-handling equipment. Special safety precautions should be taken for vehicles and equipment when manoeuvring backwards.

e) The assistance of a trained and authorised signaller should be available when the view of the driver or operator is restricted. All involved should understand the signalling code.

f) The principal contractor shall see to it that all his employees obey road traffic signs and speed limits at all times.

g) Any person ignoring or violating traffic rules on site may be prevented from driving on the site or even prevented from entering the premises.

h) When earth-moving or material-handling equipment is required to operate in dangerous proximity to live electrical conductors, adequate precautions should be taken, such as isolating the electrical supply or erecting overhead barriers of a safe height.

i) Preventive measures should be taken to avoid the fall of vehicles and earth-moving or materials-handling equipment into excavations or into water.

j) Contractor owned construction vehicles and mobile equipment shall be in a roadworthy condition at all times in accordance with the National Road Traffic Act. (Refer to section 21 of the Construction Regulations for details of all requirements under the heading of Construction vehicles and mobile plant.)

k) Contractor owned vehicles shall display their own company logo on their vehicles used during the duration of the Eskom Distribution contract.

31. Cranes

Notwithstanding the provisions of the Driven Machinery Regulations promulgated by Government Notice No.R.533 of 16 March 1990, as amended, a principle contractor shall ensure that where tower cranes are used:

(a) account is taken of the effects of wind forces on the structure;

(b) account is taken of the bearing capacity of the ground on which the tower crane is to stand;

(c) the bases for the tower cranes and tracks for rail-mounted tower cranes are firm and level;

(d) the tower cranes are erected at a safe distance from excavations;

(e) there is sufficient clear space available for erection, operation and dismantling;

(f) the tower crane operators are competent to carry out the work safely; and

(g) the tower crane operators are physically and psychologically fit to work in such an environment by being in possession of a medical certificate of fitness in accordance with section 20 of the Construction Regulations.

32. Excavations

a) The principal contractor shall conform to the requirements as prescribed under the Construction Regulation 11 when carrying out any excavation work.

b) Adequate precautions should be taken in any excavation, shaft, earthworks, underground works or tunnel:

1) By suitable shoring or otherwise, to guard against danger to workers from a fall or dislodgement of earth, rock or other material.

2) To guard against dangers arising from the fall of persons, materials or objects or the inrush of water into the excavation, shaft, earthworks, underground works or tunnel.

3) To secure adequate ventilation at every workplace so as to maintain an atmosphere fit for respiration and to limit any fumes, vapour, dust or other impurities to levels which are not dangerous or injurious to health and are within limits laid down in legislative requirements.

4) To enable the workers to reach safety in the event of fire, or an inrush or water or material.

33. Demolition work

a) The principal contractor shall conform to the requirements as prescribed under the Construction Regulation 12 when carrying out any demolition work.

b) When the demolition of any building or structure might present danger to workers or to the public:

1) Appropriate precautions, methods and procedures should be adopted, including those for the disposal of waste or residues, in accordance with legislative requirements.

2) The work should be planned and undertaken only under the supervision of a competent person.

34. Tunneling

Any contractor performing tunnelling activities shall comply with the Tunnelling Regulation as published under the Mine Health and Safety Act 1996 (Act No. 29 of 1996) as amended and section 13 of the Construction Regulations.

35. Entering confined spaces

a) When contractor employees have to enter a confined space or pipe, the contractor must ensure that there is sufficient ventilation before entering the confined space.

b) Measurements must be taken to see if it is safe to enter and a person must be on standby to supervise the process.

36. Lock out procedure

The principal contractor must ensure that his/her employees working in substations are trained to do so. If required they must get a competent person who is authorized to do lock outs.

37. Scaffolding

All scaffolding work operations are carried out under the supervision of a competent person who has been appointed in writing and that all scaffold erectors, team leaders and inspectors are competent.

38. Suspended platforms

The principal contractor shall ensure that all suspended platform work operations are carried out under the supervision of a competent person who has been appointed in writing and that all suspended platform erectors, operators and inspectors are competent to carry out their work. The principal contractor shall ensure that proof of their training is kept on site. (In accordance with the requirements of the Constriction Regulation 15)

39. Boatswain's chairs

The principal contractor shall ensure that the boatswain's chair is securely suspended and constructed in such a manner to prevent any occupant from falling there from. Ensure inspections are carried out prior to use and performance tests are carried out immediately after erection and a visual inspection daily.

40. Material hoists

A principal contractor shall ensure that every material hoist and its tower have been constructed of sound material in accordance with the generally accepted technical standards and are strong enough and free from defects.

41. Welding and flame cutting

The principal contractor shall ensure that no welding or flame cutting is undertaken unless:

a) The person has been fully instructed in the safe use of the equipment and in the hazards that may arise.

b) He must ensure that all electrodes are effectively insulated.

c) Area adequately ventilated.

d) The workplace is effectively partitioned off and the relevant warning signs displayed.

e) The principal contractor must ensure that when welding or flame cutting is undertaken, all flammable materials are removed or properly covered and that sufficient and suitable fire extinguishing equipment is placed at strategic locations.

42. Hand tools and safeguarding of machinery

a) Machinery and equipment, including hand tools, should:

1) be of a good design and construction, taking into account, as far as possible, health and safety and ergonomic principles;

2) be maintained in good working order;

3) be used only for the work for which they have been designed unless a use outside the initial design purpose has been assessed by a competent person who has concluded that such use is safe;

4) be operated only by workers who have been authorised and given appropriate training;

5) be provided with protective safety devices including guards, shields, earths, tools, barricades, vehicles, chains, ropes, and all relevant safety signs.

b) As far as practicable, safe operating procedures should be established and used for all machinery and equipment.

c) Operators of machinery and equipment should not be distracted while work is in progress.

d) Machinery and equipment should be switched off when not in use and isolated before any major adjustment, cleaning or maintenance is done.

e) Where trailing cables or hose pipes are used they should be kept as short as practicable and not allowed to create a safety hazard.

f) A maintenance programme shall be implemented on all items of equipment and proper records shall to be kept of inspections, testings and work performed on these items, as required by the Occupational Health and Safety Act.

g) The principal contractor shall be responsible for inspecting and maintaining all his own tools, equipment and personal protective equipment.

h) The principal contractor shall enforce the correct application, maintenance and use of the equipment and tools.

43. Explosive powered tools

a) The use of explosive power tools shall be executed in accordance with section 19 of the Construction Regulations.

b) No principal contractor shall use or permit any person to use an explosive powered tool, unless:

(1) it is provided with a protective guard around the muzzle end, which effectively confines any flying fragments or particles; and

(2) the firing mechanism is so designed that the explosive powered tool will not function unless—

(i) it is held against the surface with a force of at least twice its' weight; and

(ii) the angle of inclination of the barrel to the work surface is not more then 15 degrees from a right angle:

Provided that the provisions of this sub-regulation shall not apply to explosive powered tools in which the energy of the cartridge is transmitted to the bolts, nails or similar relevant objects by means of an intermediate piston which has a limited distance of travel.

44. Electrical installations and machinery on construction sites

a) In terms of electrical installations and machinery on construction sites section 22 of the Construction Regulations will apply.

b) All electrical equipment and installations shall be constructed, installed and maintained by a competent person, and so used as to guard against danger.

c) Before construction is commences and during the progress thereof adequate steps shall be taken to ascertain the presence of and to guard against danger to workers from any live electrical cables or apparatus which is under, over or on site.

d) All parts of electrical installations should be constructed, installed and maintained so as to prevent danger of electrical shock, fire and external explosion.

e) All electrical appliances and outlets should be clearly marked to indicate their purpose and voltage.

f) A notice or notices should be kept exhibited at suitable places:

1) Prohibiting unauthorised persons from entering electrical equipment rooms or from handling or interfering with electrical apparatus.

2) Containing direction as to procedures in the case of fire, rescue of persons in contact with live conductors and the restoration of persons suffering from electrical shock.

3) Specifying the person to be notified in case of electrical accident or dangerous occurrence, and indicating how to communicate with him.

g) Persons having to operate electrical equipment shall be fully instructed as to any possible dangers of the equipment concerned.

h) All electrical equipment should be inspected before it is taken into use to ensure that it is suitable for its proposed use.

i) After the work has been completed on conductors and equipment, the current should only be switched on again on the orders of a competent person after the earthing and short-circuiting have been removed and the workplace reported safe.

45. Stacking and storage of articles

a) The stacking and storage of articles on construction sites shall be undertaken in terms of section 26 of the Construction Regulations.

b) The principle contractor shall ensure that stacks are safe.

c) Stacking is to be executed by a person with specific knowledge and experience of this type of work.

46. Vessels under pressure

The principal contractor shall ensure that an Approved Inspection Authority tests all compressors and other pressure vessels the contractor intends to use on the specific site. Gas cylinders must always be stored in an upright position and properly chained. (Vessels Under Pressure Regulations 15, 16 and 17)

47. Water environments

A principal contractor shall ensure that where construction work is done over or in close proximity to water he or she shall ensure that measures are taken to prevent employees from falling into the water and ensure that rescue equipment is available, in accordance with section 24 of the Construction Regulations.

48. Record keeping

It is recommended as a result of, the onerous requirements stemming from the Construction Regulations that Line Management (the client requesting the service) keep copies of all contractor health and safety plans indefinitely depending on the nature of the risks that were identified in the required risk assessments.

Annex C
(informative)

Energy Control Unit (ECU) installations contract guidelines

These are the requirements that Eskom Distribution should include in its' contracts with principal contractors, who will install or replace energy control units (ECU's) on its' behalf, to ensure that the practices of the principal contractors comply with the applicable Eskom Distribution requirements in terms of compliance to the relevant Eskom exemption.

1. Occupational Health and Safety Act Requirements

The following clauses based on the Occupational Health and Safety Act must be included in the contract.

1.1 Undertakings

a) The principal contractor must undertake, warrant and assume responsibility for compliance with the provisions of the Occupational Health and Safety Act in terms of section 37(2).

b) The contract, drawn up by the Procurement Department, must in writing set out the arrangement and procedure to ensure compliance by the principal contractor with the provisions of the Occupational Health and Safety Act.

1.2 In practical terms this will entail a checklist:

a) Agreed control measures to administer Eskom's exposure.

b) Checklist of compliance and submission of a certificate of appointment of 16(1) and (2) delegated senior persons, competent persons, accredited persons, training and supervision, written work procedures, adequate first aid facilities and PPE.

c) The contractor must assume responsibility in terms of OHS Act section 16(1) and if the contractor delegates any duty in terms of OHS Act section 16(2) a copy of such written delegation must immediately be handed over to the Eskom Distribution Project Manager.

d) The contractor must be barred from signing any undertaking in terms of OHS Act section 10(4) without the written approval of Eskom Distribution.

e) The contractor must irrevocably declare that Eskom Distribution shall have an interest in any inquiry in terms of section 31 and 32 into any incident involving the contractor, its employees and/or his sub-contractors.

2. General Requirements

2.1 Principal Contractor

The criteria to be used in determining who a principal contractor is, is as follows, “It is any person or registered business doing work on behalf of Eskom Distribution”. It is important to clarify this, because it would be of no use to Eskom Distribution to conclude a contract with a contractor who in turn will enter into a contract with a sub-contractor because the sub-contractor will not be a party in the original contract between Eskom Distribution and the principle contractor.

The principal contractor must, therefore, agree that he will not sub-contract without Eskom Distribution’s written approval. The policy should, therefore, be that a written contract in terms of OHS Act section 37(2) be entered into between Eskom Distribution and each principle contractor and they in turn with their sub-contractors.

2.2 Insurance

a) The contractor must warrant that his employees are covered in terms of the Compensation for Occupational Injuries and Diseases Act, 1993, and that those employees earning in excess of the amounts defined in the Act also have adequate cover.

b) It may also be necessary to look at public liability cover.

2.3 Other Terms

The rest of the terms will be those standard in a contract and or its annexes, and it is preferable that the person who signs the contract must be the OHS Act 16(2) delegated person. This will ensure that Eskom Distribution will at all material times deal with the person who is operational and carries responsibility in terms of the Occupational Health and Safety Act.

Annex D
(informative)

Electricity Dispenser (ED) installations – contract guidelines

In the case where a principal contractor is contracted in to install an Electricity Dispenser (ED) on Eskom Distribution's behalf, the same contractor may also, for example, accept a contact from the customer to connect his electrical installation to the electricity supply and issue the customer with a certificate of compliance (CoC).

Eskom Distribution and a principal contractor are free to conclude any contract between them. See the minimum requirements as set out in - Energy Control Unit installations contract guidelines.

The principal contractor is not an employee of Eskom Distribution and, therefore is entitled to participate in any economic activity of his choice insofar as that does not contravene the agreement with Eskom.

If there is a clause on time management in the contract between Eskom Distribution and the contractor, there is no reason why the contractor should not accept other work.

The South African courts have traditionally relied on the so-called "control test" to determine whether the relationship between two persons is that of a "master and servant" or that of an "employer and independent contractor."

In *Smith v. Workmen's Compensation Commissioner* 1979(2) SA 51(A) the position was set out as follows:

The legal characteristics of a location conduction operarum (dienstcontract) in Roman-Dutch Law is the duty of the employee (locator operatum) to obey the lawful commands, orders or instructions of his employer (conductor operarum) has concomitant right under (location conduction operarum) to supervise and control the manner in which the employee (location operarum) is to perform his services.

Control is a wide concept. It includes inter alia the right to decide what work is to be done, the manner in which it is to be done, the means to be employed in doing it, the time and place where it is to be done.

The above text must guide Eskom Distribution not to conduct an employer/employee relationship in a contractual relationship with an independent contractor. The "dominant impression" test of the relationship is important. If the relationship is seen as defined in the above case, then and in that event, the contractor is an employee and this means Eskom Distribution will be vicariously liable for the contractor's acts and omissions.

It is therefore advisable to contract with the contractor in such a manner that he retains his independence subject to the arrangement and procedure in terms of section 37(2) of the Occupational Health and Safety Act.

Annex E

(normative)

ACKNOWLEDGEMENT OF RECEIPT FORM

OHS ACT REQUIREMENTS TO BE MET BY PRINCIPAL CONTRACTORS EMPLOYED BY ESKOM DISTRIBUTION

We ……..…….... have been engaged by ……..... to perform work under a contract.

We declare that we have familiarized ourselves with the requirements of the Occupational Health and Safety Act and related legislation. We have also read and understand the health and safety rules governing our work at the above mentioned company and agree to abide by them while on the premises.

I,……do hereby acknowledge having received the Distribution Procedure DISPVABF3, OHS Act requirements to be met by Principle Contractors employed by Eskom Distribution. I undertake to study and abide by these requirements at all times.

Furthermore, we undertake to explain the various rules and regulations to all our employees.

Signed at: …….. on the …… day of ……..…… 20…….

_____

Principal Contractor's signature

_____

Eskom Distribution – Project Manager

(The Project Manager shall keep the original on file and a copy shall remain with the Principal Contractor)

Annex F
(informative)

LEGAL COMPLIANCE GUIDE WHEN APPOINTING PRINCIPAL CONTRACTORS CONDUCTING WORK ON BEHALF OF ESKOM DISTRIBUTION

GENERAL MATTERS

Responsible Eskom Distribution Manager dealing with principal contractor:

Name: …….. Designation ……..

Department: ……

Details of principal contractor:

Name of Principal Contractor: ……..

Contact Person: …… Tel: ……..……..

Nature of work performed: ……

Duration of Contract: ……..

Commencing date: …… Completion date: ……

IMPORTANT ISSUES THAT MUST BE IN PLACE

(Please indicate with a (√) in the yes or no box to the following questions)

		Yes	No
1.	Section 37(2) OHS Act written agreement in place? (Reference- DISPVABF3)		
2.	Is Annexure E "Acknowledgement of Receipt" of DISPVABF3, signed by Contractor?		
3.	Is the Contractor Registered with Compensation Commissioner (CC)?		
4.	Has the Contractor paid his/her assessment to CC? (Goodwill certificates) (Annual Payment)		
5.	Have the names of the persons charged with the responsibilities of the Act been submitted to the Distribution Project Manager. (Section 16(2) OHS Act)		
6.	Have Health and Safety Reps. been appointed? (If employing more than 20 employees)		
7.	Is there a person with a valid first aid certificate? (Provide name to Distribution Project Manager if more than 5 employees are employed). (Are names submitted to Distribution Project Manager- GSR 3)?		

Annex F
(Continue

		Yes	No
8.	Is high-risk work being performed as per the Distribution critical task list or as identified by the Contractor? (Contractor to provide a list of critical tasks that will be undertaken)		
9.	Are all the employees of the contractor or sub-contractors trained? (Obtain proof of training records)		
10.	Eskom Distribution will provide Eskom Distribution specialized training where applicable (See SCSPVABN2)		
11.	Does contractor or sub-contractor understand their duties in terms of this agreement?		
12.	Does the contractor or sub-contractor have a Health and Safety programme in place?		
13.	If working in close proximity of live apparatus, is SCSASAAW8 issued to the contractor?		
14.	Is contractor registered with UIF?		

…….. ……

Signed Date

Annex G
(informative)

List of Eskom Distribution Critical Tasks

Task Analyses – Most Critical Tasks

No	TASK
1	Replace a pole mounted transformer
2	Work with/on extension/single ladders
3	Work with/on pedestal mounted ladders
4	Operate a vehicle mounted crane
5	Operate a vehicle mounted crane with a bucket attached
6	High voltage operating
7	Work in live chambers and prohibited areas
8	Operate metal clad switch gear
9	Replace a rotten/broker pole (intermediate single pole structure) manually A. Scenario 1 – Damaged pole still standing in position – Able to climb against with ladder (when pole is supported) B. Scenario 2 – Damaged pole still standing in position – Unable to climb against with ladder (partially burnt off, broken off, etc.)
10	Replace a rotten/broken pole (intermediate single pole structure) with a vehicle mounted crane
11	Build/maintain overhead lines (LV) under energized/dead lines (11/22 kV)
11a (i)	Build overhead lines (LV) under energized lines (11/22 kV)
11a (ii)	Maintain overhead lines (LV) under energized lines (11/22 kV)
11b (i)	Build overhead lines (LV) under dead lines (11/22 kV)
11b (ii)	Maintain overhead lines (LV) under dead lines (11/22 kV)
12	Work in an energized pillar box – Replace a circuit breaker
13	Cut a newly constructed line into an energized line (live tapping)
14	Work with chainsaws (petrol driven) and high cutters (mechanical)
15	Physical material handling
16	Vehicle risk management
17	Install pre-paid meters – Electricity dispenser (ED) and energy control unit (ECU)

Annex H
(informative)

Example of a Principal Contractor's monthly incident/accident statistical report

(The frequency of submission to be determined and agreed upon contractually)

Company name:……

Physical address:……

Name of the Principal Contractor's Responsible Person……..

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
a) Injury types 1. Fatal incidents												
2. Occupational Diseases												
3. Disabling injuries												
4. Medical incidents												
5. First aid incidents												
b) Incident types 1. Vehicle incidents												
2. Environmental incidents												
3. Damage to property incident												
4. Public incidents												
5. Electrical contact incidents												
6. Near-miss incidents												

Note: This information should be kept on site.

Annex I
(informative)

Health and Safety File

1. Contract appointing contractor.

2. Company Health and Safety Policy.

3. Organizational organogram (detailing all statutory appointments). List all possible appointments.

OSH Act, Section 17 – Appointment of the Health and Safety Representatives

Specific Construction Regulation Appointments:

Regulation 4 (1) (c) – Appointment of the Principal Contractor
Regulation 4 (5) – Appointment of the Client Agent
Regulation 5 (3) (b) – Appointment of the Contractor
Regulation 6 (1) – Appointment of the Construction Supervisor
Regulation 6 (6) – Appointment of the Construction Site Health and Safety Officer
Regulation 7 (1) – Appointment of the Construction Site Risk Assessor
Regulation 8 (1) (a) – Appointment of the Fall Protection Plan Developer
Regulation 10 (a) – Appointment of the Formwork and Support Work Supervisor
Regulation 11 (1) – Appointment of the Excavation Work Supervisor
Regulation 12 (1) – Appointment of the Demolition Work Supervisor
Regulation 14 (2) – Appointment of the Scaffolding Supervisor
Regulation 15 (1) – Appointment of the Suspended Platform Supervisor
Regulation 17 (1) – Appointment of the Material Hoist Inspector
Regulation 18 (1) – Appointment of the Batch Plant Supervisor
Regulation 19 (2) (g) (i) – Appointment of the Explosive Powered Tools Issuer
Regulation 21 (1) (j) – Appointment of the Construction Vehicles and Mobile Plant Inspector
Regulation 22 (e) – Appointment of the Temporary Electrical Installation controller
Regulation 26 (a) – Appointment of the Stacking and Storage Supervisor
Regulation 27 (h) – Appointment of the Fire Extinguisher Inspector

4. Copies of relevant appointment letters.

5. Exemptions and/or notifications.

6. COID Registration
- Registration number
- Letter of good standing

Annex I (Concluded)

7. Risk assessments and analysis
- Task analysis
- Risk assessments
- Safety work procedures
- Fall protection plan
- Fall protection risk assessment

8. PPE – Personal Protective Equipment
- List of PPE
- Issue list,
- Inspection of PPE

9. Training records
- The relevant training records of all employees
- Health and safety induction
- Risk assessment training
- Responsible persons (ORHVS)

10. Medical Records
- Proof of medical surveillance plan

11. Minutes of all site and statutory meetings
- Agenda
- Minutes

12. Incident reporting and investigation reports
- Report of incident to the Department of Labour
- Report of incident to Eskom Distribution (The Project Manager)
- Report to COID
- OHS Act Annexure 1
- Proof of follow-up and close out of incident recommendations

Annex J

(informative)

Health and Safety Plan

1. Copy of the Health and Safety Plan
- It must be available on site
- It must contain a copy of the organizational organogram specifically depicting the appointment of the Construction Supervisor

2. OHS Act Appointments
- Copies of the relevant OHS Act appointments for that specific work site

3. List of names of persons working under the supervision of the Construction Supervisor

4. Design and work specifications
- Technical drawings
- Technical specifications
- Relevant Eskom Policies, Standards and Procedures

5. Risk analysis, Risk profiling and Job Observations
- Relevant task analysis
- On-site risk assessments
- Specific written safe work procedures
- Personal protective equipment (PPE)
- Proof of job observations conducted

6. Sub-Contractors
- List sub-contractors and contract details (where applicable)
- Proof of sub-contractor competencies

7. Site hand over
- Site hand over certificate on file
- Relevant authorizations
- Relevant permits e.g.

a) ORHVS authorizations
b) Confined spaces
c) Hot work

8. Inspections (site specific)
- Record of relevant / required inspections (site specific)

9. Occupational Health and Hygiene Surveys
- Proof of survey reports (where applicable)

Annex J

(concluded)

10. Incident investigations
- Copies of the incident report to the Department of Labour
- Copies of the incident reporting to Eskom Distribution (Project Manager)
- Copies of report to COID (where applicable)
- Copies of OHS Act Annexure 1's

Annex K
(informative)

Typical health and safety inspections to cover the following (where applicable)

Note: This list is not in any order of priority

1. Fire
2. First aid box and equipment
3. Housekeeping
4. Scaffolding
5. Dangerous goods
6. Demolition
7. Earth leakage control inspection
8. Electrical hazards
9. Electrical installations
10. Ergonomics
11. Formwork and concreting
12. Hand tools and equipment
13. Hazardous substances
14. Ladders
15. Portable electrical lights tools and appliances
16. Powered mobile plan
17. PPE issue
18. The use of PPE
19. Public safety
20. Roofing
21. Site establishment
22. Trenching and excavation

Annex L
(informative)

BIBLIOGRAPHY

1. Labour Relations Act, Act 66 of 1995 (as amended).
2. Mines Health and Safety Act, Act 29 of 1996.
3. Occupational Health and Safety Act, Act 85 of 1993 (OHS ACT) (as amended).
4. Compensation for Occupational Injuries and Diseases Act, Act 130 of 1993 (COID).
5. National Environmental Management Act, Act 107 of 1998.
6. Public Finance Management Act, Act 1 of 1999 (PFMA).
7. King II Report.
8. Energy Control Unit (ECU) Report
9. Eskom contract works maintenance and overhaul and public liability insurance.
   (Policy Number – MS ENG 426 5174)

Annex M
(informative)

Revision Information

DATE	REV. NO.	NOTES
1997	0	Original issue – Stemmed from the Safety Department
April 1999	1	Document revised - at this point the Safety and Field Services documents were combined.
May 2001	2	1. Document revised and improved from a legal liability point of view.
April 2004	3	Document title amended Eskom logo updated Document reference number amended to bring it in line with organizational requirements – SCS to DIS Text revised: Section 3 Section 4.1 Section 5 Section 7 Annexes included or revised: Annex B – New Annex C – New Annex D – New Annex E – Amended Annex F – New Annex G – New Annex H – Amended Annex I - New Annex J - New Annex K - New