

PART 2:

Section VII -Employers Requirements and Technical Specifications

E. Schedules of Technical Information

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
1.0 Minimum factors of safety to be applied to assumed maximum simultaneous maximum loadings			
1.1 Line and earth conductors, based on ultimate strength		2.5	
1.2 Line and earth conductors at everyday temperature, still air, based on ultimate strength		5	
1.3 Complete insulators and fittings, based on SML		2.5	
1.4 Steel supports, foundation structures, based on elastic limit of members in tension and on crippling loads of compression members, or on tests on complete supports (but not tests on the foundations):			
1.4.1 Suspension supports			
a. Normal conditions		2.0	
b. Unbalanced conditions (except cascade)		1.5	
c. Cascading condition		1.0	
1.4.2 Tension supports			
a. Normal conditions		2.0	
d. Unbalanced conditions (except cascade)		1.5	
b. Cascading condition		1	
c. Temporary Terminal Condition		1.5	
1.4.3 Foundations			
a. Normal conditions		2.5	
b. Unbalanced conditions		1.75	
1.4.4 Maintenance and Erection		2.0	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
2.0 Assumed loading conditions			
2.1 Minimum temperature of line and earth conductors	°C	1	
2.2 "Everyday" temperature	°C	25	
2.3 Maximum operating temperature of line conductor	°C	80	
2.4 Maximum ambient temperature and earth conductors	°C	40	
2.5 Wind speed and pressure			
2.5.1 Kabarnet-Rumuruti Transmission line			
- Basic Wind speed (3 sec Gust)	m/s	45	
- Basic Wind pressure	N/m ²		
- Wind pressure on conductors	N/m ²		
- Wind pressure on earthwires	N/m ²		
- Wind pressure on insulators	N/m ²		
- Dynamic reference wind pressure on tower based on IEC standard	N/m ²		
2.6 Site altitude above sea level	metres	2210	
3.0 Span lengths			

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
3.1	Basic span	m	300	
3.2	Wind spans for tower S,T10,T30,T90/Trm For T60	m	350 500	
3.3	Maximum single span for tower S,T10,T30,T90/Trm For T60	m	340 430	
3.4	Tower design spans:			
3.4.1	Wind span			
a.	Suspension towers	m	350	
b.	Tension towers/T60	m	350/500	
3.4.2	Maximum weight spans:			
a.	Suspension towers	m		
b.	Tension towers	m		
c.	T10			
d.	T30			
e.	T60			
f.	T90/Trm			
3.4.3	Minimum weight spans :			
a.	Suspension towers	m	0	
b.	Tension towers (uplift net)	m		
c.	T10			
d.	T30			
e.	T60			
f.	T90/Trm			
3.4.4	Span at broken condition		0.75* normal	
3.4.5	Span for Trm tower design		0.75* normal	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
4.0 Line conductor and fittings		ACSR	
4.1 Complete line conductor:			
4.1.1 Nominal area per phase	mm ²	226.2	
4.1.2 Number of conductors per phase	No	1	
4.2 Each single conductor:			
4.2.1 Code name		Lynx	
4.2.2 International Standard		EN 50182/IEC 61089	
4.2.3 National standard		ASTM B 232	
4.2.4 Material of conductor		Aluminium/ Galvanised Steel	
4.2.5 Number and diameter of wires	No/mm	Al 30/2.79 St 7/2.79	
4.2.6 Total area of conductor	mm ²	226.2	
4.2.7 Overall diameter of stranded conductor	mm	19.53	
4.2.8 Aluminium Cross sectional area	mm ²	183.4	
4.2.9 Resistance of conductor (dc) at 20°C	ohm/km	0.1576	
4.2.10 Mass of conductor (without grease)	kg/km	842.1	
4.2.11 Total mass of greased conductor (greased to Case 2 of IEC 61089)	kg/km	864.44	
4.2.12 Ultimate rated strength of conductor	Newton	79800	
4.2.13 Maximum tension of conductor in still air at "everyday" temperature	Newton	15960	
4.2.14 Assumed equivalent modulus of elasticity of conductor	N/mm ²	81000	
4.2.15 Assumed equivalent coefficient of linear expansion of conductor	per °C	1.78 x 10 ⁻⁵	
4.3 Minimum length of conductor on drum	km	5	
4.3.1 Conductor grease:			

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
4.3.2 Type			
4.3.3 Minimum drop-point temperature	°C	120	
Mass of grease per kilometre of conductor (all inner layers greased – Case 2 to IEC 61089)	Kg/km	22.34	
4.4 Vibration damping system:			
4.4.1 Type of system (vibration damper)	type		
4.4.2 Vibration damper			
4.4.2.1 Type of vibration damper	type	Stockbridge	
4.4.2.2 National / International standard		IEC 61897	
4.4.2.3 Number of wires in messenger cable	No	19	
4.4.2.4 Conductor diameter range	mm	19.53	
4.4.2.5 Mass of damper	kg		
4.4.2.6 Maximum span for:			
a. One vibration damper at each end of span	m		
b. Two vibration dampers at each end of span	m		
c. Three vibration dampers at each end of span	m		
4.4.2.7 Dimensions from clamp mouth to vibration damper attachment:			
a. First damper	mm		
b. Second damper when required	mm		
c. Third damper when required	mm		

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
5.0 Earth Conductor and fittings			OPGW	
5.1 Complete optical earth conductor system				
5.1.1 Number of OPGW earth conductors	No		1	
5.2 Each single optical earth conductor (OPGW)				
5.2.1 International Standard No			IEE 1138 IEC 60794-4-1	
5.2.2 Material of conductor			Aluminium Alloy/ Aluminium-clad steel	
5.2.3 Total area of conductor	mm ²			
5.2.4 Overall diameter of conductor	mm		19.8	
5.2.5 Mass of conductor	kg/km		<800	
5.2.6 Ultimate strength of conductor	Newton		≥ 93,700	
5.2.7 Maximum tension of conductor in still air at “everyday” temperature	Newton		≤20%UTS	
5.2.8 Assumed equivalent modulus of elasticity of conductor	N/mm ²		≥ 80,000	
5.2.9 Assumed equivalent coefficient of linear expansion of conductor	per °C		≤1.95 x 10-5	
5.2.10 Minimum bending radius	mm			
5.2.11 Short circuit current rating	kA ² s		≥ 496	
5.2.12 Minimum length of conductor on drum	km		5	
5.3 Individual wires before stranding				
5.3.1 Aluminium alloy Standard Minimum conductivity at 20°C	%IACS		IEC 60104 52.5	
5.3.2 Aluminium-clad steel Standard Grade of Steel			IEC 60232 20SA	
5.4 Vibration damping system				
5.4.1 Maximum span for:				
a. One vibration damper at each end of span	m			

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
b. Two vibration dampers at each end of span	m		
c. Three vibration dampers at each end of span	m		
6.0 FIBRE OPTIC TRANSMISSION SYSTEM			
6.1 Fibre optic data			
6.1.1 Type		NZDSF (as specified in ITU – T G.655)	
6.1.2 Wavelength	nm	1550/1625	
6.1.3 Number of fibres		48	
6.1.4 The number of tubes		4	
6.1.5 Transmission attenuation:			
a. at 1550 nm	dB/km	< 0.22	
b. at 1625 nm	dB/km	< 0.24	
6.1.6 Transmission bandwidth	MHz/km	> 10 000	
6.1.7 Fibre identification	colour code		
6.1.8 Chromatic dispersion			
a. at 1550 nm	ps/nm.km	< 2	
b. at 1625 nm	ps/nm.km	< 12.4	
6.1.9 Splicing loss	dB	< 0.05	
6.1.10 Polarisation Mode Dispersion (PMD)	ps/√km	< 0.2	
6.1.11 Minimum bending radius	mm		
7.0 Insulator and fittings			
7.1 Insulator units: Long Rod			
7.1.1 Suspension units			
7.1.1.1 Shed profile		aerodynamic	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
7.1.1.2 Appropriate IEC Number		IEC 61109	
7.1.1.3 Material		Silicone rubber	
7.1.1.4 Coupling			
a. Standard		IEC 60120	
b. Type (recommended only)		Ball/Socket	
c. Size (recommended only)		16	
7.1.1.5 Minimum failing load	kN	120	
7.1.1.6 Outside diameter:	mm		
7.1.1.7 Mass of unit	kg		
7.1.1.8 Minimum dry lightning impulse withstand	kV	750	
7.1.1.9 Minimum wet power frequency withstand	kV	325	
7.1.1.10 Creepage distance	mm	4495	
7.1.2 Tension units			
7.1.2.1 Shed profile		aerodynamic	
7.1.2.2 Appropriate IEC Number		IEC 61109	
7.1.2.3 Material		Silicone rubber	
7.1.2.4 Coupling			
a. Standard		IEC 60120	
b. Type (recommended only)		Ball/Socket	
c. Size (recommended only)		16	
7.1.2.5 Minimum failing load	kN	120	
7.1.2.6 Outside diameter:			
7.1.2.7 Mass of unit	kg		
7.1.2.8 Minimum dry lightning impulse withstand	kV	750	
7.1.2.9 Minimum wet power frequency withstand	kV	325	
7.1.2.10 Creepage distance	mm	4495	
7.2 Insulator sets complete			
7.2.1 Suspension sets			
7.2.1.1 Number of insulator strings in parallel		1	
7.2.1.2 Minimum failing load, complete set	kN	120	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
7.2.1.3 Overall length of set including clamps and all fittings	mm	≤ 2500	
7.2.1.4 Arcing Gap	mm	1480	
7.2.1.5 Mass of set, complete with all fittings	kg		
7.2.1.6 Overall length of creepage path per string:	Mm	4495	
7.2.1.7 50 Hz voltage tests: #			
a. Dry withstand voltage of complete set:	kV		
b. One minute wet withstand voltage of complete set:	kV	325	
7.2.1.8 50% Impulse withstand: #			
a. 1.2/50 μs negative wave:	kV	750	
b. 1.2/50 μs positive wave:	kV	750	
7.2.1.9 Corona test voltage	kV	145	
7.2.1.10 Set RI test voltage	kV	145	
7.2.1.11 Set radio noise level	dB	45	
7.2.1.12 Short circuit current withstand for 1 second (any part of set)	kA	31.5	
7.2.2 Tension sets			
7.2.2.1 Number of insulator strings in parallel		1	
7.2.2.2 Minimum failing load, complete set	kN	160	
7.2.2.3 Overall length of set including clamps and all fittings	mm		
7.2.2.4 Arcing Gap	mm	1480	
7.2.2.5 Mass of set, complete with all fittings	kg		
7.2.2.6 Overall length of creepage path per string:	mm	4495	
7.2.2.7 50 Hz voltage tests: #			
a. Dry withstand voltage of complete set:	kV		
b. One minute wet withstand voltage of complete set:	kV	325	

All flashover and withstand voltage levels are minimum and to be validated to normal temperature and pressure in accordance with IEC 60071-2 and IEC 60060

All flashover and withstand voltage levels are minimum and to be validated to normal temperature and pressure in accordance with IEC 60071-2 and IEC 60060.

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
7.2.2.9 50% Impulse withstand: #			
a. 1.2/50 μ s negative wave:	kV	750	
b. 1.2/50 μ s positive wave:	kV	750	
7.2.2.10 Corona test voltage	kV	145	
7.2.2.11 Set RI test voltage	kV	145	
7.2.2.12 Set radio noise level	dB	45	
7.2.2.13 Short circuit current withstand for 1 second (any part of set)	kA	31.5	
7.3 Earth conductor sets			
7.3.1 Minimum failing load			
a. Suspension set	kN	120	
b. Tension set	kN	120	
7.3.2 Short circuit current withstand for 1 second (any part of set)	kA	31.5	

**KABARNET-RUMURUTI Transmission lines Tower and Foundation Data (132kV Towers- for
45m/s wind zone)**

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
8.0 TOWER DESIGN PARTICULARS			
8.1 Maximum tension per phase, for purposes of tower design			
a. Suspension towers	Newton		
b. Tension towers	Newton		
c. Downloads per conductor bundle	Newton		
8.2.1 Maximum tension per earth conductor for purpose of tower design and application: ACS Earthwire			
a. Suspension towers	Newton		
b. Tension towers	Newton		
c. Earth conductor downloads	Newton		
8.2.2 Maximum tension per earth conductor for purpose of tower design and application: OPGW			
a. Suspension towers	Newton		
b. Tension towers	Newton		
c. OPGW downloads	Newton		
8.3 Minimum clearance between live metal and tower steelwork:			
a. with suspension insulator set swing, at 70°	mm	1100	
b. with suspension insulator set swing, at 60°	mm	1480	
8.4 Minimum Clearance to steelwork - crossarm length	m	3.6	
8.5 Minimum vertical phase to phase clearance in still air	m	5.0	
8.6 Earth conductor suspension clamps, unobstructed transverse swing angle from vertical-min	degrees	0 – 50	
8.7 Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors	degrees	30	
8.8 Design standard for tower members		ASCE 10-97	

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
8.9	Maximum ratio of unsupported length of steel compression member to their least radius of gyration:			
a.	Main members		120	
b.	Stressed bracings		200	
c.	Unstressed bracings		250	
8.10	Maximum design ratio of tower members, for checking tower designs not subjected to test (unless otherwise approved):		0.9	
	Minimum thickness of stub and leg members	mm	6	
	Minimum thickness of other members	mm	4	
	Minimum thickness of gusset plate	mm	6	
8.11	Material standard for tower members		EN 10025-2	
8.11.1	Mild Steel (S275JR):			
	Minimum yield strength (Fy)	N/mm ²	275	
	Minimum tensile strength (Fu)	N/mm ²	410	
8.11.2	High Tensile Steel (S355J0):			
	Minimum yield strength (Fy)	N/mm ²	355	
	Minimum tensile strength (Fu)	N/mm ²	470	
8.11.3	Bolts & nuts standards		ISO 898 (Part I & II), DIN 7990	
	Bolt & nut size		M16 - M20	
	Bolt & nut grade			
	Minimum Shear stress (0.62Fu)	N/mm ²	5.8	
	Minimum Bearing Stress (1.5xFu) (Connected to mild steel)	N/mm ²	310	
	Minimum Bearing Stress (1.5xFu) (Connected to high tensile steel)	N/mm ²	615	
			705	
8.11.5	Spring washer standard		DIN 127	
8.11.6	Plain washer standard		DIN 7989	
8.11.7	Galvanizing standard for tower members and bolts & nuts		ISO 1461, BS 7371 part 6	
	Minimum galvanized thickness of tower members	Micron		
	Minimum galvanized thickness of bolt & nut	Micron		

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
10.0	APPLIED LOADS – CONSTRUCTION AND MAINTENANCE LOADING CONDITIONS – LONGITUDINAL LOADS			
10.1	Straight line towers (suspension insulators)			
10.1.1	Maintenance condition:			
a.	phase	Newton		
b.	earth	Newton		
10.2	Angle and terminal towers (tension insulators)			
10.2.1	Temporary terminal condition:			
a.	phase	Newton		
b.	earth	Newton		
10.2.2	Maintenance condition:			
a.	phase	Newton		
b.	earth	Newton		

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
11.0 PARTICULARS OF DOUBLE CIRCUIT TOWERS			
11.1 Type of Tower		132S	
11.1.1 Type of insulator sets		Suspension	
11.1.2 Angles of deviation	degree	0 – 2	
11.1.3 Basic span length	m	300	
11.1.4 Minimum ground clearance of line conductor at 80°C, normal ground	m	6.7	
11.1.5 Sag of line conductor in span length at 80°C	m		
11.1.6 Minimum standard tower height above ground of bottom conductor	m		
11.1.7 Minimum height of earth conductors above upper line conductor at tower	m	7	
11.1.8 Minimum vertical spacing between line conductors at tower	m	5.0	
11.1.9 Minimum overall tower height (with maximum leg and body extension: +9 body extension and +4 metre leg extension)	m		
11.1.10 Maximum differential, foundation movement permitted under ultimate loads	mm		
11.1.11 Minimum horizontal distance, from tower to insulator attachments- crossarm length	m	3.6	
11.1.12 Overall tower base dimensions at ground line (transverse x longitudinal):	m x m	---	
11.1.13 Mass of complete towers above ground line:			
a. - 3 body extension + 4 metre leg extension	kg	---	
b. Basic body + 4 metre leg extension	kg	---	
c. + 3 body extension + 4 metre leg extension	kg	---	
d. + 6 body extension + 4 metre leg extension	kg	---	
e. + 9 body extension + 4 metre leg extension	kg	---	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
11.2 Type of Tower		132T10	
11.2.1 Type of insulator set		Tension	
11.2.2 Angles of deviation	degree	0 – 10	
11.2.3 Basic span length	m	300	
11.2.4 Minimum ground clearance of line conductor at 80°C, normal ground	m	6.7	
11.2.5 Sag of line conductor in span length at 80°C	m		
11.2.6 Minimum standard tower height above ground of bottom conductor	m		
11.2.7 Minimum height of earth conductors above upper line conductor at tower	m	7	
11.2.8 Minimum vertical spacing between line conductors at tower	m	5.0	
11.2.9 Minimum overall tower height (with maximum leg and body extension: +9 body extension and +4 metre leg extension)	m		
11.2.10 Maximum differential, foundation movement permitted under ultimate loads	mm		
11.2.11 Minimum horizontal distance, from tower to insulator attachments- crossarm length	m	3.6	
11.2.12 Overall tower base dimensions at ground line (transverse x longitudinal):	m x m	---	
11.2.13 Mass of complete towers above ground line:			
a. - 3 body extension + 4 metre leg extension	kg	---	
b. Basic body + 4 metre leg extension	kg	---	
c. + 3 body extension + 4 metre leg extension	kg	---	
d. + 6 body extension + 4 metre leg extension	kg	---	
e. + 9 body extension + 4 metre leg extension	kg	---	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
11.3 Type of tower		132T30	
11.3.1 Type of insulator set		Tension	
11.3.2 Angles of deviation	degree	10 – 30	
11.3.3 Basic span length	m	300	
11.3.4 Minimum ground clearance of line conductor at 80°C, normal ground	m	6.7	
11.3.5 Sag of line conductor in span length at 80°C	m		
11.3.6 Minimum standard tower height above ground of bottom conductor	m		
11.3.7 Minimum height of earth conductors above upper line conductor at tower	m	7	
11.3.8 Minimum vertical spacing between line conductors at tower	m	5.0	
11.3.9 Minimum overall tower height (with maximum leg and body extension: + 12 body extension and +4 metre leg extension)	m		
11.3.10 Maximum differential, foundation movement permitted under ultimate loads	mm		
11.3.11 Minimum horizontal distance, from tower to insulator attachments- crossarm length	m	3.6	
11.3.12 Overall tower base dimensions at ground line (transverse x longitudinal):	m x m	---	
11.3.13 Mass of complete towers above ground line:			
a. - 3 body extension + 4 metre leg extension	kg	---	
b. Basic body + 4 metre leg extension	kg	---	
c. + 3 body extension + 4 metre leg extension	kg	---	
d. + 6 body extension + 4 metre leg extension	kg	---	
e. + 9 body extension + 4 metre leg extension	kg	---	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
11.4 Type of tower		132T60	
11.4.1 Type of insulator set		Tension	
11.4.2 Angles of deviation	degree	30 – 60	
11.4.3 Basic span length	m	300	
11.4.4 Minimum ground clearance of line conductor at 80°C, normal ground	m	6.7	
11.4.5 Sag of line conductor in span length at 80°C	m		
11.4.6 Minimum standard tower height above ground of bottom conductor	m		
11.4.7 Minimum height of earth conductors above upper line conductor at tower	m	7	
11.4.8 Minimum vertical spacing between line conductors at tower	m	5.0	
11.4.9 Minimum overall tower height (with maximum leg and body extension: + 9 body extension + 4 metre leg extension)	m		
11.4.10 Maximum differential, foundation movement permitted under ultimate loads	mm		
11.4.11 Minimum horizontal distance, from tower to insulator attachments- crossarm length	m	4.0	
11.4.12 Overall tower base dimensions at ground line (transverse x longitudinal):	m x m	---	
11.4.13 Mass of complete towers above ground line:			
a. - 3 body extension + 4 metre leg extension	kg	---	
b. Basic body + 4 metre leg extension	kg	---	
c. + 3 body extension + 4 metre leg extension	kg	---	
d. + 6 body extension + 4 metre leg extension	kg	---	
e. + 9 body extension + 4 metre leg extension	kg	---	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
11.5 Type of tower		132T90	
11.5.1 Type of insulator set		Tension	
11.5.2 Angles of deviation	degree	60 – 90	
11.5.3 Basic span length	m	300	
11.5.4 Minimum ground clearance of line conductor at 80°C, normal ground	m	6.7	
11.5.5 Sag of line conductor in span length at 80°C	m		
11.5.6 Minimum standard tower height above ground of bottom conductor	m		
11.5.7 Minimum height of earth conductors above upper line conductor at tower	m	7	
11.5.8 Minimum vertical spacing between line conductors at tower	m	5.0	
11.5.9 Minimum overall tower height (with maximum leg and body extension: + 9 body extension and +4 metre leg extension)	m		
11.5.10 Maximum differential, foundation movement permitted under ultimate loads	mm		
11.5.11 Minimum horizontal distance, from tower to insulator attachments- crossarm length	m	3.6	
11.5.12 Overall tower base dimensions at ground line (transverse x longitudinal):	m x m	---	
11.5.13 Mass of complete towers above ground line:			
a. - 3 body extension + 4 metre leg extension	kg	---	
b. Basic body + 4 metre leg extension	kg	---	
c. + 3 body extension + 4 metre leg extension	kg	---	
d. + 6 body extension + 4 metre leg extension	kg	---	
e. + 9 body extension + 4 metre leg extension	kg	---	
f.			

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
11.6 Type of tower		132Trm	
11.6.1 Type of insulator set		Terminal	
11.6.2 Angles of deviation	degree	0 – 45	
11.6.3 Basic span length	m	300	
11.6.4 Minimum ground clearance of line conductor at 80°C, normal ground	m	6.7	
11.6.5 Sag of line conductor in span length at 80°C	m		
11.6.6 Minimum standard tower height above ground of bottom conductor	m		
11.6.7 Minimum height of earth conductors above upper line conductor at tower	m	7	
11.6.8 Minimum vertical spacing between line conductors at tower	m	5.0	
11.6.9 Minimum overall tower height (with maximum leg and body extension: + 9 body extension and +4 metre leg extension)	m		
11.6.10 Maximum differential, foundation movement permitted under ultimate loads	mm		
11.6.11 Minimum horizontal distance, from tower to insulator attachments- crossarm length	m	3.6	
11.6.12 Overall tower base dimensions at ground line (transverse x longitudinal):	m x m	---	
11.6.13 Mass of complete towers above ground line:			
a. - 3 body extension + 4 metre leg extension	kg	---	
b. Basic body + 4 metre leg extension	kg	---	
c. + 3 body extension + 4 metre leg extension	kg	---	
d. + 6 body extension + 4 metre leg extension	kg	---	
e. + 9 body extension + 4 metre leg extension	kg	---	

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
12.0	FOUNDATION DESIGN PARTICULARS			
12.1	Assumed density of Plain concrete for foundation dry	kg/m3	2240	
12.2	Assumed density of Reinforced concrete for foundation dry	kg/m3	2400	
12.3	Assumed density of concrete for foundation submerged	kg/m3	1400	
12.4	Maximum angle between base and side of concrete foundation for uplift "frustum" to be taken from base of foundation	degree	30 (based on soil type)	
12.5	Maximum allowable design stresses in standard concrete foundation design, under ultimate conditions, shall be in accordance with BS 8110 or BS 5328, with the following requirement:			
a.	28 day concrete cube strength (characteristic strength)	N/mm2	35	
b.	Minimum proportion of stub load to be allowed for in the design of stub cleats	%	100	
12.6	Minimum rebar yield point (Fy)	N/mm2	400	

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
18.0 Grounding Material				
18.1	Ground Wire			
	a. Material		galvanised steel	
	b. Cross Section	mm	11.5	
18.2	Ground Rod			
	a. Material		galvanised steel	
	b. length	m	3/6	
	c. Diameter	mm	20	
18.3	Connectors			
	a. Material		Bronze/Brass	
	b. Diameter	mm		
18.4	Fence grounding			
	a. Rod Material		galvanised steel	
	b. Rod length	m	2	
	c. Rod Diameter	mm	20	
19.0 Warning Sphere (Aircraft Warning Markers)				
19.1	Material		Fiberglass	
19.2	Diameter	mm	600	
19.3	colour		Orange	
20.0 Birds flight Diverter				
20.1	Type			
20.2	Disc Material		UV stabilized plastic	
20.3	Clamp Material		UV stabilized composite plastic (polymer)/ metal	
20.4	Size			

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
20.5	weight	m		
20.6	Installation intervals		5-20	
20.7	colour		combination of any two colours from Red, Yellow, Orange, White	
21.0 GPS				
21.1	display size		Min.1.4"W x 1.7"H	
21.2	Battery	hour	Min. 24	
21.3	Memory	GB	Min. 3.7	
21.4	Water-resistant	Points	Min. 2000	
			yes	
22.0 Operation and Maintenance Tools and Equipment				
22.1	Earth Resistance Testing unit			
22.1.1	Measurement range	Ω	0-2000	
22.1.2	Measurement accuracy	%	± 2	
22.1.3	Ground resistance measurement/Test			
	2-Pole measurement		Yes	
	3-Pole measurement		Yes	
22.1.4	Ground resistivity measurement/Test		Yes	
22.2	Torque wrench	Nm	60-120	
22.3	Torque wrench	Nm	140-310	
22.4	Motor operated Hydraulic press & Die Kit			
	Applied conductor		ACSR Lynx	
22.5	Tirfor for steel wire rope	Ton	3.5	
22.6	Tirfor for steel wire rope	Ton	7	
22.7	Steel wire rope			
	Diameter	mm	14	
	Length	m	50	
22.8	Wire clip (Crosby type)	mm	14	
22.9	Wire connector rotating swivel type	mm	14	
22.10	Stringing stocking/tension type grips			
	Applied conductor		ACSR Lynx	

132 kV OVERHEAD LINE	UNIT	DATA	
		Required	Offered
22.11 Stringing stocking/tension type Applied conductor		OPGW	
22.12 Chain pulley block	Ton	3	
22.13 Chain pulley block	Ton	6	
22.14 Total Station			
22.14.1 Accuracy Reflectorless (ISO 17123-4:2001)	mm	(2 + 2ppm*D)	
22.14.2 Telescope Magnification / Resolving power		30x / 2.5"	
22.14.3 Laser output		Reflectorless mode: Class 3R / Prism/sheet mode: Class 1	
22.14.4 Measuring range, Reflectorless	m	0.3 to 2000 / Under good conditions: 3,000	
22.14.5 Measuring time			
Fine	s	0.9 (initial 1.5)	
Coarse	s	0.6 (initial 1.3)	
Tracking	s	0.4 (initial 1.3)	
22.14.6 Levels			
Graphic		6' (Inner Circle)	
Circular level (on tribrach)		10' / 2mm	
22.15 Thermo-Vision Scanner			
22.15.1 Resolution	Pixels		
22.15.2 Focus Distance	cm		
22.15.3 Temperature			
Operating	°C	-10 to 50	
Measurement Range	°C	-10 to 150	
Measurement Accuracy	°C	±2	
22.15.4 Waterproof		Yes	