132KV NANYUKI ISIOLO TRANSMISSION LINE

PREAMBLE

The details in the following technical data sheets should be used to augment the Employer's Requirements and as such the previously approved designs, unless otherwise advised, takes precedence in case of omissions and/ or inconsistency.

TECHNICAL DATASHEETS

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TECHNICAL DATASHEETS FOR 132KV OVERHEAD LINE CONDUCTOR

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			
	Normal conditions		2.5	
	Unbalanced conditions (except cascade) Cascade collapse condition		1.25 1.0	
1.4.2	Tension supports			
	Normal conditions		2.5	
	Unbalanced conditions		1.25	
1.4.3	Foundations			
	Normal conditions		2.5	
	Unbalanced conditions		1.5	
1.4.4	Maintenance and Erection		1.5	

132 kV OVERHEAD LINE		UNIT	DATA	
			Required	Offered
2.0	**ASSUMED LOADING CONDITIONS**			
2.1	**Minimum temperature of line and earth conductors**	°C	0	
2.2	**"Everyday" temperature**	°C	25	
2.3	**Maximum operating temperature of line conductor**	°C	75	
2.4	**Basic Wind Speed (36m/s zone)**			
	- Wind pressure on projected area of insulators	N/m^2	834	
	- Wind pressure on projected area of conductors	N/m^2	598	
	- Wind pressure on projected area of earth wires	N/m^2	667	
	- Wind pressure on the projected area of members of one face of the towers	N/m^2	1896	
2.5	**Site altitude above sea level (maximum)**	metres	2000	
3.0	**SPAN LENGTHS**			
3.1	**Basic span**	m	350	
3.2	**Maximum sum of adjacent spans**	m	700	
3.3	**Maximum single span**	m	380	
3.4	**Tower design spans:**			
3.4.1	Wind span	m		
	Suspension towers	m	350	
	Tension towers	m	350	
3.4.2	Maximum weight spans:			
	Suspension towers	m	700	
	Tension towers	m	1200	
3.4.3	Minimum weight spans (for design purposes):			
	Suspension towers	m	0	
	Tension towers (uplift)	m	-300	

132 kV OVERHEAD LINE		UNIT	DATA	
Technical Details			**Required**	**Offered**
4	**LINE CONDUCTOR AND FITTINGS**		**ACSR**	
4.1	**Complete line conductor:**			

4.1.1	Nominal area per phase	mm^2	175	
4.1.2	Number of conductors per phase	No	1	
4.1.3	Tolerance of diameter: Aluminium Steel	% %	±1.0 ±2.0	
4.2	**Each single conductor:**			
4.2.1	Code name		Lynx	
4.2.2	International Standard		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 (Stranding Configuration of aluminium and steel wires)	No/mm	Al 30/2.79 St 7/2.79	
4.2.6	Lay direction of outer layer		Z-Lay	
4.2.7	Total area of conductor	mm^2	226.2	
4.2.8	**Overall diameter of stranded conductor**	Mm	19.53	
4.2.9	Resistance of conductor (dc) at 20˚C	ohm/km	0.1576	
4.2.10	Approximate current carrying capacity	A	480	
4.2.11	Mass of conductor (without grease)	kg/km	842	
4.2.12	Total mass of greased conductor (greased to Case 2 of IEC 61089)	kg/km	864	
4.2.13	**Minimum Tensile Strength after Stranding: Aluminium** Steel	kg/mm^2 kg/mm^2	17.2 128.5	
4.2.14	Minimum Coating weight of Zinc	g/m^2	240	
4.2.15	Ultimate rated strength of conductor	Newton	81400	
4.2.16	Maximum tension of conductor in still air at “everyday” temperature	Newton	≥18500	
4.2.17	Assumed equivalent modulus of elasticity of conductor	kg/mm^2	7870	
4.2.18	Assumed equivalent coefficient of linear expansion of conductor	per ˚C	1.78×10^{-5}	
4.2.19	Maximum length of conductor per drum	km	3.3	
4.2.20	Mass per drum	Kg	2430	
4.2.21	**Conductor grease:**			
4.3.1	Type			

4.3.2	Minimum drop-point temperature	deg ˚C	120	
4.3.3	Mass of grease per kilometre of conductor (all inner layers greased – Case 2 to IEC 61089)	kg/km	22	
4.4	**Vibration damping system:**			
4.4.1	Type of system (vibration damper + spacer or spacer damper)	type		
4.4.2	Type of vibration damper	type	Stockbridge	
4.4.2.1	National / International standard		IEC 61897,61284,61854	
4.4.2.2	Number of wires in messenger cable	No	19	
4.4.2.3	Conductor diameter range	mm	27.74	
4.4.2.4	Mass of damper	Kg		

TECHNICAL DATASHEETS FOR OPGW EARTH CONDUCTOR & FITTINGS

220 kV OVERHEAD LINE EARTH CONDUCTOR		**UNIT**	**DATA**	
			Required	Offered
1	**Earth Conductor and fittings**		**Aluminium Clad Steel GW**	
1.1	**Complete earth conductor system**			
1.1.1	Number of ACS earth conductors	No	1	
1.2	**Each single earth conductor**			
1.2.1	International Standard No		ASTM B416	
1.2.2	Material of conductor		Aluminium-clad steel	
1.2.3	Number and diameter of wires	No/mm	7/3.26	
1.2.4	Total area of conductor	mm^2	58.6	
1.2.5	Overall diameter of conductor	mm	9.78	
1.2.6	Mass of conductor	kg/km	390	
1.2.7	Ultimate strength of conductor	Newton	71,000	
1.2.8	Maximum tension of conductor in still air at “everyday” temperature	Newton		
1.2.9	Assumed equivalent modulus of elasticity of conductor	N/mm^2	162,000	
1.2.10	Assumed equivalent coefficient of linear expansion of conductor	per °C	12.96×10^{-6}	
1.2.11	Minimum bending radius	mm		

1.2.12	Minimum length of conductor on drum	km	4	
1.3	**Individual wires before stranding**			
1.3.1	Aluminium-clad steel		ASTM B415	
	a. Grade of steel		20SA	
1.4	**Vibration damping system**			
1.4.1	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		
220 kV OVERHEAD LINE		**UNIT**	**DATA**	
OPGW EARTH CONDUCTOR AND FITTINGS			Required	Offered
2	**Earth Conductor and fittings**		**OPGW**	
2.1	**Complete optical earth conductor system**			
2.1.1	Number of OPGW earth conductors	No	1	
2.2	**Each single optical earth conductor (OPGW)**			
2.2.1	International Standard No		IEE 1138 IEC 60794-4-1	
2.2.2	Material of conductor		Aluminium Alloy/ Aluminium-clad steel	
2.2.3	Number and diameter of wires	No/mm		
2.2.4	Total area of conductor	mm^2	134	
2.2.5	Overall diameter of conductor	mm	15.3	
2.2.6	Mass of conductor	kg/km	<850	
2.2.7	Ultimate strength of conductor	Newton	≥ 93,000	
2.2.8	Maximum tension of conductor in still air at “everyday” temperature	Newton	> 18,500	
2.2.9	Assumed equivalent modulus of elasticity of conductor	N/mm^2	≥ 70,000	
2.2.10	Assumed equivalent coefficient of linear expansion of conductor	per °C	$\leq 1.98 \times 10^{-5}$	
2.2.11	Minimum bending radius	mm		
2.2.12	Short circuit current rating	kA^2s	496	
2.2.13	Minimum length of conductor on drum	km	5	
2.3	**Individual wires before stranding**			
2.3.1	Aluminium alloy Standard		IEC 60104	
	Minimum conductivity at 20ºC	%IACS	20.3	
2.3.2	Aluminium-clad steel Standard		IEC 60232	
	Grade of Steel		20SA	
2.4	**Vibration damping system**			
2.4.1	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		
132kV OVERHEAD LINE		**UNIT**	**DATA**	

OPGW EARTH CONDUCTOR			Required	Offered
3	**FIBRE OPTIC TRANSMISSION SYSTEM**			
3.1	**Fibre optic data**			
3.1.1	Type		Non-Zero Dispersion-Shifted Single-Mode acc. to ITU G.655.	
3.1.2	Wavelength	nm	1550/1625	
3.1.3	Number of fibres		24	
3.1.4	Transmission attenuation:			
	a. at 1550 nm	dB/km	< 0.22	
	b. at 1625 nm	dB/km	< 0.24	
3.1.5	Transmission bandwidth	MHz/km	> 10 000	
3.1.6	Fibre identification	colour code		
3.1.7	Chromatic dispersion			
	a. at 1550 nm	ps/nm.km	< 2	
	b. at 1625 nm	ps/nm.km	< 12.4	
3.1.8	Splicing loss	dB	< 0.1	
3.1.9	Polarisation Mode Dispersion (PMD)	ps/√km	< 20	
3.1.10	Minimum bending radius	mm		

TECHNICAL DATASHEETS FOR INSULATORS & FITTINGS

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX : INSULATORS & FITTINGS			**Required**	**Offered**
1.0	**INSULATOR AND FITTINGS**			
1.1	**Insulator units: Long Rod**			
1.1.1	Suspension units			
1.1.1.1	Shed profile		Aerodynamic	
1.1.1.2	Appropriate IEC Number		IEC 61109	
1.1.1.3	Material		E-CR glass	
1.1.1.4	Coupling Standard Type (recommended only) Size (recommended only)		 IEC 60120/16 Ball/Socket 16	
1.1.1.5	Minimum failing load	kN	120	
1.1.1.6	Outside diameter:	mm		

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX : INSULATORS & FITTINGS			**Required**	**Offered**
1.1.1.7	Mass of unit	kg		
1.1.1.8	Minimum dry lightning impulse withstand	kV		
1.1.1.9	Minimum wet power frequency withstand	kV		
1.1.1.10	Creepage distance	mm/kV	25	
1.1.2	**Tension units**		kNm	
1.1.2.1	Shed profile		Aerodynamic	
1.1.2.2	Appropriate IEC Number		IEC 61109	
1.1.2.3	Material		Silicone rubber	
1.1.2.4	Coupling Standard Type (recommended only) Size (recommended only)		 IEC 61120 Ball/Socket 20	
1.1.2.5	Minimum failing load	kN	120	
1.1.2.6	Outside diameter:			
1.1.2.7	Mass of unit	kg		
1.1.2.8	Minimum dry lightning impulse withstand	kV		
1.1.2.9	Minimum wet power frequency withstand	kV		
1.1.2.10	Creepage distance	mm/kV	25	
1.2	**Insulator sets complete**			
1.2.1	Suspension sets			
1.2.1.1	Number of insulator strings in parallel		2	
1.2.1.2	Minimum failing load, complete set	kN	70/100	
1.2.1.3	Overall length of set including clamps and all fittings	mm	≤ 4400	
1.2.1.4	Arcing Gap	mm	1250	
1.2.1.5	Mass of set, complete with all fittings	kg		
1.2.1.6	Overall length of creepage path per string:	mm	3700	
1.2.1.7	50 Hz voltage tests: [#]			

[#] All flashover and withstand voltage levels corrected to normal temperature and pressure in accordance with IEC 60383

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX : INSULATORS & FITTINGS			Required	Offered
	Dry withstand voltage of complete set:	kV	145	
	One minute wet withstand voltage of complete set :	kV	275	
1.2.1.8	50% Impulse withstand: #			
	1.2/50 μs negative wave:	kV	650	
	1.2/50 μs positive wave:	kV	650	
1.2.1.9	Corona test voltage	-	-	
1.2.1.10	Set RI test voltage	kV	275	
1.2.1.11	Set radio noise level	dB	45	
1.2.2.12	Short circuit current withstand for 1 second (any part of set)	kA	31.5	
1.2.2	**Tension sets**			
1.2.2.1	Number of insulator strings in parallel		2	
1.2.2.2	Elastic limit load of set fittings:			
	Common to each string	kN		
	Common to conductor	kN		
	Separate for each sub-conductor	kN		
1.2.2.3	Minimum failing load, complete set	kN	2 x 120	
1.2.2.4	Overall length of set including clamps and all fittings	mm		
1.2.2.5	Arcing Gap	mm	1250	
1.2.2.6	Mass of set, complete with all fittings	kg		
1.2.2.7	Overall length of creepage path per string:	mm	3700	
1.2.2.8	50 Hz voltage tests: #			
	Dry withstand voltage of complete set:	kV	650	
	One minute wet withstand voltage of complete set:	kV	650	
1.2.2.9	50% Impulse withstand: #			
	1.2/50 μs negative wave:	kV	650	

All flashover and withstand voltage levels corrected to normal temperature and pressure in accordance with IEC 60383

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX : INSULATORS & FITTINGS			Required	Offered
	1.2/50 μs positive wave:	kV	650	
1.2.2.10	Corona test voltage	kV	-	
1.2.2.11	Set RI test voltage	kV	275	
1.2.2.12	Set radio noise level	dB	45	
1.2.2.13	Short circuit current withstand for 1 second (any part of set)	kA	31.5	
1.3	**Earth conductor sets**			
1.3.1	Minimum failing load			
	Suspension set	kN		
	Tension set	kN		
1.3.2	Short circuit current withstand for 1 second (any part of set)	kA	31.5	

TECHNICAL DATASHEETS FOR STEEL TOWER DESIGN

1.0	132kV TOWER DESIGN PARTICULARS	Unit	Required	Offered
1.1	**Maximum tension per phase, for purposes of tower design**			
	a. Suspension towers	Newton		
	b. Tension towers	Newton		
	c. Downleads per conductor bundle	Newton		
1.1.1	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 downleads	Newton		
1.1.2	Maximum tension per earth conductor for purpose of tower design and application: OPGW			
	a. Suspension towers	Newton		
	b. Tension towers	Newton		
	c. OPGW downleads	Newton		

1.2	**Minimum clearance between live metal and tower steelwork:-**			
	a. with suspension insulator set swing, at 65º	mm		
	b. with suspension insulator set swing, 0 - 10º	mm		
	c. with suspension insulator set swing 10 - 35º	mm		
1.3	**Minimum clearance to steelwork on which a man may stand for live line maintenance (cross arm floor)**	m		
1.4	**Downleads – minimum clearances:**			
	phase to phase clearance in still air	mm		
	phase to phase clearance under conditions of maximum (opposing) swing and sag	mm		
1.5	**Earth conductor suspension clamps, unobstructed transverse swing angle from vertical**	degrees		
1.6	**Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors**	degrees		
1.7	**Maximum ratio of unsupported length of steel compression member to their least radius of gyration:**			
	a. Main members			
	b. Stressed bracings			
	c. Unstressed bracings			
	d. Tension only members			
1.8	**Maximum ultimate stresses, for checking tower designs not subjected to test (unless otherwise approved):-**			
1.8.1	Mild Steel:			
	a. Compression members, Tenderer to indicate his design assumptions		ASCE 10-97	
	b. Tension members (elastic limit)	N/mm^2		
	c. Shear on bolts Bolt Grade 5.6	N/mm^2		
	d. Material Bearing	N/mm^2		
1.8.2	High Yield Steel:			
	a. Compression members, Tenderer to indicate his design assumptions		ASCE 10-97	
	b. Tension members (elastic limit)	N/mm^2		
	c. Shear on bolts Bolt Grade 8.8	N/mm^2		

	d. Material Bearing	N/mm^2		

132 kV OVERHEAD LINE		**UNIT**	**DATA**	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
2.0	**SIMULTANEOUS UNBALANCED LOADING CONDITIONS – LONGITUDINAL LOADS** • Factors of safety to be applied: see the Technical Parameters. • For transverse and vertical loads: see the Technical Specification.			
2.1	**Straight line towers (suspension insulators)**			
2.1.1	At any one attachment:			
	a. phase or	Newton		
	b. earth	Newton		
2.1.2	Cascade collapse conditions at all attachments:			
	a. phase	Newton		
	b. earth	Newton		
2.2	**Angle towers (tension insulators)**			
2.2.1	At any two attachments:			
	a. either phase or	Newton		
	b. earth	Newton		
2.2.2	Cascade collapse conditions at all attachments:			
	a. phase	Newton		
	b. earth	Newton		
2.3	**Terminal towers (tension insulators)**			
2.3.1	At any two attachments:			
	a. either phase or	Newton		
	b. earth	Newton		
3.0	**APPLIED LOADS – CONSTRUCTION AND MAINTENANCE LOADING CONDITIONS – LONGITUDINAL LOADS** Factors of safety to be applied: see the Technical Parameters. For transverse and vertical loads: see the Technical Specification.			

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
3.1	**Straight line towers (suspension insulators)**			
3.1.1	Maintenance condition:			
	a. phase	Newton		
	b. earth	Newton		
3.2	**Angle and terminal towers (tension insulators)**			
3.2.1	Temporary terminal condition:			
	a. phase	Newton		
	b. earth	Newton		
3.2.2	Maintenance condition:			
	a. phase	Newton		
	b. earth	Newton		
4.0	**PARTICULARS OF TOWERS**			
4.1	**Type of Tower**		**S**	
4.1.1	Type of insulator sets		Suspension	
4.1.2	Angles of deviation	degree	0 – 2	
4.1.3	Basic span length	m	350	
4.1.4	Minimum ground clearance of line conductor at 80˚C, normal ground	m	7.1	
4.1.5	Sag of line conductor in span length at 80˚C	m		
4.1.6	Maximum distance of line conductor below cross arm	m		
4.1.7	Height above ground of bottom conductor cross arm (Standard height tower)	m		
4.1.8	Minimum height of earth conductors above upper line conductor at tower	m		
4.1.9	Minimum horizontal spacing between adjacent conductors	m	2.75	
4.1.10	Vertical spacing between line conductors at tower:	m		
4.1.11	Overall tower height (Standard height tower)	m		
4.1.12	Maximum differential, foundation movement permitted under ultimate loads	mm		

132 kV OVERHEAD LINE		**UNIT**	**DATA**	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
4.1.13	Clearance between conductors of one circuit and tower climbing leg of the other circuit:	m		
4.1.14	Horizontal distance, from tower centre line of insulator attachments	m		
4.1.15	Horizontal distance, from tower centre line of earth conductors	m		
4.1.16	Tower body dimensions at bottom cross arm level (transverse x longitudinal)	m x m		
4.1.17	Overall tower base dimensions at ground line (transverse x longitudinal):	m x m		
4.1.18	Total transverse overturning moment at ground line of standard height tower, load case 1 with factor of safety	kN m		
4.1.19	Mass of complete towers above ground line:			
	a. 3 metre reduced height tower	kg		
	b. Standard height tower:	kg		
	c. 3 metre extended tower	kg		
	d. 6 metre extended tower	kg		
	e. 9 metre extended tower	kg		
	f. 12 metre extended tower	kg		
4.2	**Type of Tower**		**L**	
4.2.1	Type of insulator set		Tension	
4.2.2	Angles of deviation	degree	2 – 15	
4.2.3	Basic span length	m	350	
4.2.4	Minimum ground clearance of line conductor at 80˚C, normal ground	m	7.1	
4.2.5	Sag of line conductor in span length at 80˚C	m		
4.2.6	Maximum distance of line conductor below cross arm	m		
4.2.7	Height above ground of bottom conductor cross arm	m		
4.2.8	Minimum height of earth conductors above upper line conductor at tower	m		
4.2.9	Minimum horizontal spacing between adjacent conductors	m		

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
4.2.10	Vertical spacing between line conductors at tower:	m		
4.2.11	Overall tower height	m		
4.2.12	Maximum differential, foundation movement permitted under ultimate loads	mm		
4.2.13	Clearance between conductors of one circuit and tower climbing leg of the other circuit:	m		
4.2.14	Horizontal distance, from tower centre line of insulator attachments	m		
4.2.15	Horizontal distance, from tower centre line of earth conductors	m		
4.2.16	Tower body dimensions at bottom cross arm level (transverse x longitudinal)	m x m		
4.2.17	Overall tower base dimensions at ground line (transverse x longitudinal):	m x m		
4.2.18	Total transverse overturning moment at ground line of standard height tower, load case 1 with factor of safety	kN m		
4.2.19	Mass of complete towers above ground line:			
	a. 3 metre reduced height tower	kg		
	b. Standard height tower:	kg		
	c. 3 metre extended tower	kg		
	d. 6 metre extended tower	kg		
	e. 9 metre extended tower	kg		
	f. 12 metre extended tower	kg		
4.3	**Type of tower**		**M**	
4.3.1	Type of insulator set		Tension	
4.3.2	Angles of deviation	degree	15 – 30	
4.3.3	Basic span length	m	350	
4.3.4	Minimum ground clearance of line conductor at 80˚C, normal ground	m	7.1	
4.3.5	Sag of line conductor in span length at 80˚C	m		

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
4.3.6	Maximum distance of line conductor below crossarm	m	-	
4.3.7	Height above ground of bottom conductor crossarm	m		
4.3.8	Minimum height of earth conductors above upper line conductor at tower	m		
4.3.9	Minimum horizontal spacing between adjacent conductors	m		
4.3.10	Vertical spacing between line conductors at tower:	m		
4.3.11	Overall tower height	m		
4.3.12	Maximum differential, foundation movement permitted under ultimate loads	mm		
4.3.13	Clearance between conductors of one circuit and tower climbing leg of the other circuit:	m		
4.3.14	Horizontal distance, from tower centre line of insulator attachments	m		
4.3.15	Horizontal distance, from tower centre line of earth conductors	m		
4.3.16	Tower body dimensions at bottom cross arm level (transverse x longitudinal)	m x m		
4.3.17	Overall tower base dimensions at ground line (transverse x longitudinal):	m x m		
4.3.18	Total transverse overturning moment at ground line of standard height tower, load case 1 with factor of safety	kN m		
4.3.19	Mass of complete towers above ground line:			
	a. 3 metre reduced height tower	kg		
	b. Standard height tower:	kg		
	c. 3 metre extended tower	kg		
	d. 6 metre extended tower	kg		
	e. 9 metre extended tower	kg		
	f. 12 metre extended tower	kg		
4.4	**Type of tower**		**H**	
4.4.1	Type of insulator set		Tension	
4.4.2	Angles of deviation	degree	30 – 60	

132 kV OVERHEAD LINE		**UNIT**	**DATA**	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
4.4.3	Basic span length	m	350	
4.4.4	Minimum ground clearance of line conductor at 80˚C, normal ground	m	7.1	
4.4.5	Sag of line conductor in span length at 80˚C	m		
4.4.6	Maximum distance of line conductor below cross arm	m	-	
4.4.7	Height above ground of bottom conductor cross arm	m		
4.4.8	Minimum height of earth conductors above upper line conductor at tower	m		
4.4.9	Minimum horizontal spacing between adjacent conductors	m		
4.4.10	Vertical spacing between line conductors at tower:	m		
4.4.11	Overall tower height	m		
4.4.12	Maximum differential, foundation movement permitted under ultimate loads	mm		
4.4.13	Clearance between conductors of one circuit and tower climbing leg of the other circuit:	m		
4.4.14	Horizontal distance, from tower centre line of insulator attachments	m		
4.4.15	Horizontal distance, from tower centre line of earth conductors	m		
4.4.16	Tower body dimensions at bottom cross arm level (transverse x longitudinal)	m x m		
4.4.17	Overall tower base dimensions at ground line (transverse x longitudinal):	m x m		
4.4.18	Total transverse overturning moment at ground line of standard height tower, load case 1 with factor of safety	kN m		
4.4.19	Mass of complete towers above ground line:			
	a. 3 metre reduced height tower	kg		
	b. Standard height tower:	kg		
	c. 3 metre extended tower	kg		
	d. 6 metre extended tower	kg		
	e. 9 metre extended tower	kg		
	f. 12 metre extended tower	kg		
4.5	**Type of tower**		**HS**	
4.5.1	Type of insulator set		Tension	
4.5.2	Angles of deviation	degree	60 – 75	
4.5.3	Basic span length	m	350	

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
4.5.4	Minimum ground clearance of line conductor at 80˚C, normal ground	m	7.1	
4.5.5	Sag of line conductor in span length at 80˚C	m		
4.5.6	Maximum distance of line conductor below cross arm	m	-	
4.5.7	Height above ground of bottom conductor cross arm	m		
4.5.8	Minimum height of earth conductors above upper line conductor at tower	m		
4.5.9	Minimum horizontal spacing between adjacent conductors	m		
4.5.10	Vertical spacing between line conductors at tower:	m		
4.5.11	Overall tower height	m		
4.5.12	Maximum differential, foundation movement permitted under ultimate loads	mm		
4.5.13	Clearance between conductors of one circuit and tower climbing leg of the other circuit:	m		
4.5.14	Horizontal distance, from tower centre line of insulator attachments	m		
4.5.15	Horizontal distance, from tower centre line of earth conductors	m		
4.5.16	Tower body dimensions at bottom crossarm level (transverse x longitudinal)	m x m		
4.5.17	Overall tower base dimensions at ground line (transverse x longitudinal):	m x m		
4.5.18	Total transverse overturning moment at ground line of standard height tower, load case 1 with factor of safety	kN m		
4.5.19	Mass of complete towers above ground line:			
	a. 3 metre reduced height tower	kg		
	b. Standard height tower:	kg		
	c. 3 metre extended tower	kg		
	d. 6 metre extended tower	kg		
	e. 9 metre extended tower	kg		
	f. 12 metre extended tower	kg		
4.6	**Type of tower**		**T**	
4.6.1	Type of insulator set		Terminal	

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
4.6.2	Angles of deviation	degree	0 – 60	
4.6.3	Basic span length	m	350	
4.6.4	Minimum ground clearance of line conductor at 80˚C, normal ground	m	7.1	
4.6.5	Sag of line conductor in span length at 80˚C	m		
4.6.6	Maximum distance of line conductor below crossarm	m	-	
4.6.7	Height above ground of bottom conductor crossarm	m		
4.6.8	Minimum height of earth conductors above upper line conductor at tower	m		
4.6.9	Minimum horizontal spacing between adjacent conductors	m		
4.6.10	Vertical spacing between line conductors at tower:	m		
4.6.11	Overall tower height	m		
4.6.12	Maximum differential, foundation movement permitted under ultimate loads	mm		
4.6.13	Clearance between conductors of one circuit and tower climbing leg of the other circuit:	m		
4.6.14	Horizontal distance, from tower centre line of insulator attachments	m		
4.6.15	Horizontal distance, from tower centre line of earth conductors	m		
4.6.16	Tower body dimensions at bottom cross-arm level (transverse x longitudinal)	m x m		
4.6.17	Overall tower base dimensions at ground line (transverse x longitudinal):	m x m		
4.6.18	Total transverse overturning moment at ground line of standard height tower, load case 1 with factor of safety	kN m		
4.6.19	Mass of complete towers above ground line:			
	a. 3 metre reduced height tower	kg		
	b. Standard height tower:	kg		
	c. 3 metre extended tower	kg		
	d. 6 metre extended tower	kg		
	e. 9 metre extended tower	kg		

132 kV OVERHEAD LINE		UNIT	DATA	
LINE CONDUCTOR: 1 X LYNX			Required	Offered
	f. 12 metre extended tower	kg		
5.0	**QUALITY OF CABLE RISER STRUCTURES**			
5.1	**Steel members**			
5.1.1	Grade/standard:		EN10025 or Equivalent	
	a. Mild steel		S275	
	b. High tensile steel		S355	
5.1.2	Tensile breaking stress:			
	a. Mild steel	N/mm^2	275	
	b. High tensile steel	N/mm^2	355	
5.1.3	Elongation on breaking:			
	a. Mild steel	%		
	b. High tensile steel	%		
5.1.4	Yield point as percentage of breaking stress:			
	a. Mild steel	%		
	b. High tensile steel	%		
5.2	**Steel nuts and bolts**			
5.2.1	Grade/standard:			
	a. Mild steel		5.6	
	b. High tensile steel		8.8	
5.2.2	Tensile breaking stress:			
	a. Mild steel	N/mm^2		
	b. High tensile steel	N/mm^2		
5.2.3	Elongation on breaking:			
	a. Mild steel	%		
	b. High tensile steel	%		

TECHNICAL DATASHEETS FOR FOUNDATION DESIGN

1.0	132kV OHL FOUNDATION DESIGN PARTICULARS	Unit	Required	Offered
1.1	Assumed density of concrete for foundation dry	kg/m^3	2240	
1.2	Assumed density of concrete for foundation submerged	kg/m^3	1200	
1.3	Maximum angle between base and side of concrete foundation for uplift "frustum" to be taken from base of foundation	degree		
1.4	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:			
1.5	28 day concrete cube strength (characteristic strength)	N/mm^2	30	
	Minimum proportion of stub load to be allowed for in the design of stub cleats	%	100	

TECHNICAL DATASHEETS FOR ADSS /APPROACH CABLE

Data about offered equipment to be filled in by the bidder.

Name of Manufacturer: _____
Model: _____
Type: _____

DESCRIPTION	UNIT	REQUIRED	OFFERED
GENERAL			
Reference Standards	Yes	IEC9001, ISO14001, IEC60793-1, IEC60793-2, ITU-TG.655, IEC60794-3-10. IEC60794-3-20 standards	
Double jacket outer diameter	No*mm		
Type tests	Yes	Yes	
Maximum pulling Tension	N		
Cable offered has been in operation for more than 5 years.	YES	YES. Provide Completion certificate	
Minimum bending radius	mm		
Standard weight			
Weight of grease			
OPTICAL CHARACTERISTICS			
Total number of Optical Fibers	Number	48 or 96 as per project spec	
Number of Fibers per buffer tube (max)	Number	12	
Fiber Type/Mode		G.655/Single Mode	
Operating wavelengths	nm	1550, 1625	
Cladding diameter	µm/µm	1251	
Maximum Transmission Rate	Gbps	40	
Mode field Diameter at 1550nm	µm	(8-11)±0.6	
Core concentricity error	µm	<0.8	
Cladding Non-circularity	%	<1.0	
Cable cut off wavelength	nm	<1450	
Macrobend loss Loss Number of turns Maximum at 0.1dB	 mm Number dB	 30 100 0.1dB	
Attenuation Coefficient At 1550nm At 1625nm	 dB/km dB/km	 0.22 0.24	
PMD Coefficient	$ps/\sqrt{km}$	<0.2	

TECHNICAL DATASHEETS FOR JOINT BOXES

JOINT BOXES

Data about offered equipment to be filled in by the bidder.

Name of Manufacturer: _____
Model: _____
Type: _____

DESCRIPTION	UNIT	REQUIRED	OFFERED
GENERAL			
Capacity of Fibers spliced	number	24 or 48 or 96 as per project spec	
Entrance Ports 2 way 3 way	 YES YES	 YES YES	
Material		Metal and Aluminium Alloy	
Colour		Silver	
Weight			
TECHNICAL			
Fiber radius of curvature	mm	≥43	
Fiber length of the plate to stay	mm	≥1500mm	
Additional Attenuation of optical discs to stay	dB	≤0.01dB	
Maximum capacity of fiber optic			
Operational Temperature range	℃	-40°C to 80°C	
Flattening performance	N/100mm	2000N/100mm	
IP Rating		IP65	
Atmospheric Pressure	Kpa	62-106Kpa	
Working Temperature	℃	-40°C to 65°C	
Insulation Resistance	MΩ	2*104MΩ	