

### 1. 132/33kV POWER TRANSFORMER (AIS-AIS)

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
1	Substation name		RUMURUTI/KABARNET SUBSTATION	
2	Manufacture name & country		Should be Proposed By Tenderer	
3	Type designation		Should be Proposed By Tenderer	
4	Type of transformers		Two Windings	
4.1	Auto or separate windings		Separate	
4.2	Shell or core		Core	
4.3	Indoor or outdoor		Outdoor	
4.4	Three phases or single phases units		Three phase	
5	Type of cooling acc. to IEC			
5.1	First stage		ONAN	
5.2	Second stage		ONAF	
5.3	Third stage		-	
6	Rated frequency	Hz	50	
7	Rated voltage			
7.1	HV	kVrms	132	

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
7.2	LV	kVrms	33	
8	Continuous power rating at principle tap			
8.1	Type		ONAN/ONAF	
8.2	Nominal power rating at site conditions	MVA	23	
8.3	At first stage of cooling:			
8.3.1	HV winding	MVA	18	
8.3.2	LV winding	MVA	18	
8.4	At second stage of cooling:			
8.4.1	HV winding	MVA	23	
8.4.2	LV winding	MVA	23	
9	Maximum temperature rise at rated power outputs corrected for altitude & ambient temperature of site			
9.1	Top oil	°C	56	
9.2	Winding	°C	61	
9.3	Hottest spot	°C	74	
10	Off load tap changer		N.A	

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			REQUIRED	OFFERED
10.1	Type		-----	
10.2	Manufacture		-----	
10.3	Rated current	Arms	-----	
10.4	Total range	%	-----	
10.5	Total number of steps		-----	
10.6	Variation per step	%	-----	
10.7	Position to tapings (winding)		-----	
11	On load tap changer			
11.1	Type		On-load	
11.1.1	Resistor/reactor		Resistor	
11.1.2	In tank/ out of tank		In Tank	
11.1.3	Vacuum or oil		Vacuum	
11.2	Manufacturer		MR	
11.3	Country of manufacturer		Should be Proposed By Tenderer	
11.4	Standards		IEC 60214	
11.5	Number of phases		3	

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11.6	Arrangement of tapping (linear, coarse/fine, reversing)		Should be Proposed By Manufacturer	
11.7	Rated current	Arms	Min (140)	
11.8	Rated step voltage	Vrms	Should be Proposed By Manufacturer	
11.9	Rated switching capacity	kVA	Should be Proposed By Manufacturer	
11.10	Rated short circuit withstand current	kArms	Should be Proposed By Manufacturer	
11.11	Rated short circuit duration	sec	Should be Proposed By Manufacturer	
11.12	Total range	%	±13.36	
11.13	Total number of steps		±8(1.67%) steps	
11.14	Variation per step	V	2200	
11.15	Principle Tap Position		9	
11.16	Insulation level		Should be Proposed By Manufacturer	
11.16.1	Voltage class	kVrms	Should be Proposed By Manufacturer	
11.16.2	Highest voltage for equipment	kVrms	Should be Proposed By Manufacturer	
11.16.3	BIL to ground	kVpeak	Should be Proposed By Manufacturer	

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11.16.4	BIL between diverter switch contacts	kVpeak	Should be Proposed By Manufacturer	
11.16.5	BIL across regulating winding	kVpeak	Should be Proposed By Manufacturer	
11.17	OLTC protection system		Should be Proposed By Manufacturer	
11.17.1	Is oil flow relay required? If so, type and manufacturer		Required	
11.17.2	Is pressure relief device required? If so, type and manufacturer		Required	
11.17.3	Over pressure relay type and manufacturer		Should be Proposed By Manufacturer	
11.17.4	Other protection device type & manufacturer		Should be Proposed By Manufacturer	
11.18	Rated voltage of drive system	V	415/240	
11.19	Rated voltage of control circuit	V	110	
11.20	All features, controls, alarms and interlocks as called for provide	Yes/No	Yes	
11.21	Whether remote control cubicle included in scope of work	Yes/No	Yes	

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11.22	Whether AVR required?	Yes/ No	Yes	
11.23	Type of AVR		Should be Proposed By Manufacturer	
11.24	Full description of remote OLTC control included	Yes/ No	Yes	
11.25	Parallel operation control required for number of transformers		4	
11.26	Method of parallel control		Acc. to Specifications	
11.26 .1	Master /follower			
11.26 .2	Min circulating current			
11.26 .3	Reverse reactance method			
11.27	Is line drop compensation required?	Yes/ No	Yes	
11.28	Tap position output type		BCD/mA/Ohm/Contact	
12	Vector group		Dyn1 (Rumuruti)/ Dyn11(Kabarnet)	
13	Impedance			

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	On the base of rated power of main windings	MVA	23	
13.1	Positive sequence impedance at 75 °C, on principal tapping and on:		This parameter should be identical with the existing 23MVA Power transformer at respective substations for parallel operation	
13.1.1	Between HV & LV winding	%	9.58 (Rumuruti) / 9.59 (Kabarnet)  This parameter should be identical with the existing 23MVA Power transformer at respective substations for parallel operation	
13.1.2	Between HV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.1.3	Between LV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.2	Positive sequence impedance at 75 °C, on max. raise voltage and on:			
13.2.1	Between HV & LV windings	%	Should be Filled By Manufacturer	
13.2.2	Between HV & TV winding (if applicable)	%	Should be Filled By Manufacturer	

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13.2.3	Between LV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.3	Positive sequence impedance at 75 °C, on max. lower voltage and on:			
13.3.1	Between HV & LV windings	%	Should be Filled By Manufacturer	
13.3.2	Between HV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.3.3	Between LV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.4	Zero sequence impedance at 75 °C:			
13.4.1	Between HV & LV windings (LV open)	Ohm /ph.	Should be Filled By Manufacturer	
13.4.2	Between HV & LV windings (LV short)	Ohm /ph.	Should be Filled By Manufacturer	
13.4.3	Between LV & HV windings (HV open)	Ohm /ph.	Should be Filled By Manufacturer	
13.4.4	Between LV & HV windings (HV short)	Ohm /ph.	Should be Filled By Manufacturer	
13.5	Resistance of windings at 75 °C on principal tapping:			
13.5.1	HV	Ohm /ph.	Should be Filled By Manufacturer	



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			REQUIRED	OFFERED
13.5.2	LV	Ohm /ph.	Should be Filled By Manufacturer	
13.6	Estimated winding capacitance's with:		Should be Filled By Manufacturer	
13.6.1	Series capacitance of HV phase winding	PF		
13.6.2	Series capacitance of LV phase winding	PF		
13.6.3	Shunt capacitance to earth of each HV phase winding with LV unearthed	PF		
13.6.4	Shunt capacitance to earth of each LV phase winding with HV unearthed	PF		
13.6.5	Capacitance of HV-LV phase winding with LV unearthed	PF		
14	Rated short circuit strength of windings (symmetrical values)		Should be Filled By Manufacturer	
14.1	HV system Indicate 1 and 3 phase	kA/kA	31.5	
14.2	LV system Indicate 1 and 3 phase	kA/kA	25	
14.3	Short circuit duration	sec	2	

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			REQUIRED	OFFERED
14.4	Short circuit calculation will be submitted after award of contract	Yes/ No	Yes	
15	Insulation levels			
15.1	Lightning impulse withstand voltages:			
15.1.1	HV winding/bushing	kVpeak / kVpeak	750	
15.1.2	LV winding/bushing	kVpeak / kVpeak	250	
15.1.3	Neutral end winding/bushing	kVpeak / kVpeak	145	
15.2	Switching impulse withstand voltages:			
15.2.1	HV winding/bushing	kVpeak / kVpeak	N.A	
15.2.2	LV winding/bushing	kVpeak / kVpeak	N.A	

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			REQUIRED	OFFERED
15.2.3	Neutral end winding/bushing	kVpeak / kVpeak	N.A	
15.3	One minute power frequency withstand voltages:			
15.3.1	HV winding/bushing	kVrms / kVrms	325	
15.3.2	LV winding/bushing	kVrms / kVrms	95	
15.3.3	Neutral end winding/bushing	kVrms / kVrms	50	
15.4	Partial discharge measurement:			
15.4.1	Standard		IEC 60270	
15.4.2	Test method		IVPD	
15.4.3	Long duration induced voltage	kVrms	Acc. to IEC 60076-3	
15.4.4	Enhancement voltage level	kVrms	Acc. to IEC 60076-3	

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			REQUIRED				OFFERED			
15.4.5	Maximum allowable partial discharge	pC	Acc. to IEC 60076-3							
16	Bushing data		HV	LV	TV	N	HV	LV	TV	N
16.1	Manufacturer & country									
16.2	Type (OIP/RIP/RBP/...)		OIP	OIP	-	OIP				
16.3	Rated service voltage	kV	132	33	-	24				
16.4	Nominal current rating	A	140	560	-	2000				
16.5	Rated short circuit current	kA	31.5	25	-	25				
16.6	Rated thermal short time current duration	sec	2	2	-	2				
16.7	Power frequency withstand voltage (complete with all fittings)	kV	315	95	-	50				
16.8	Radio influence voltage level measured at 1.1 rated system voltage at 1MHz	microV	2500							
16.9	Is test tap required?	Yes/No	Yes	No	-	No				
16.10	Quantity of oil per bushing	liters	Acc. to Manufacturer	Acc. to Manufacturer	-	Acc. to Manufacturer				

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			REQUIRED				OFFERED			
			ure r Dat a	ure r Dat a		r Data				
16.11	Type of internal insulation (oil impregnated/resin type)		Oil Imp reg nat ed	Oil Imp reg nat ed	-	Acc. to Man ufac ture r Data				
16.12	Equipped with magnetic oil indicator (in case of oil type)	Yes/ No	Yes	No	-	No				
16.13	Creepage distance	mm	449 5	111 6	-	>90 0				
16.14	Protected creepage distance	mm	Acc . to Ma nuf act ure r Dat a	Acc . to Ma nuf act ure r Dat a	-	Acc. to Man ufac ture r Data				
16.15	Loss angle (insulation power factor) at working Voltage		Acc . to Ma nuf act ure r	Acc . to Ma nuf act ure r	-	Acc. to Man ufac ture				

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data							
			REQUIRED				OFFERED			
			Data	Data		r Data				
16.16	Electrostatic capacity of complete bushing	PF	Acc. to Manufacturer Data	Acc. to Manufacturer Data	-	Acc. to Manufacturer Data				
16.17	Cantilever load class (Acc to IEC 60137)		Level II	Level II	-	Level II				
16.18	Max. mechanical forces		Acc. to Buswork Calc.	Acc. to Buswork Calc.	-	Acc. to Buswork Calc.				
	Static, horizontal	N								
	Static, vertical	N								
	Dynamic, horizontal	N								
	Dynamic, vertical	N								
16.19	Min. corona inception voltage	kV								

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data							
			REQUIRED				OFFERED			
16.20	Washable in service	Yes/No	Yes	Yes	-	Yes				
16.21	Terminal leads full insulated at factory	Yes/No	Yes	Yes	-	Yes				
16.22	Bushing can be removed/ installed	Yes/No	Yes	Yes	-	Yes				
16.23	Bushing can be interchanged with spares	Yes/No	Yes	Yes	-	Yes				
16.24	Maximum external diameter of ring type current transformer which can be accommodated	mm	Acc. to Manufacturer Data	Acc. to Manufacturer Data	-	Acc. to Manufacturer Data				
16.25	Minimum external diameter of ring type current transformer which can be accommodated	mm	Acc. to Manufacturer Data	Acc. to Manufacturer Data	-	Acc. to Manufacturer Data				
17	Bushing type current transformer									

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17.1	Fully complies with requirement	Yes/ No	Yes	
17.2	Number of cores (HV, LV, HV-N, LV-N, TV)		Acc to SLD	
17.3	Specification		Acc to SLD	
17.4	Ratio accuracy class and burdens will be selected acc to owner request during design review	Yes/ No	Yes	
17.5	Test conductor (winding) will be provided	Yes/ No	Yes	
18	Losses			
18.1	No load losses at 75 °C, rated frequency and rated voltage on principal tapping	kW	Max. 12 (Tolerance 0%)	
18.2	Load losses at rated frequency, 75 °C And rated current on principal tapping:	kW	(Tolerance 0%)	
18.2.1	At first stage of cooling		Should be Filled By Tenderer	
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		



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18.2. 2	At second stage of cooling		Should be Filled By Tenderer	
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		
18.2. 3	At third stage of cooling			
a	HV/LV	kW	Max. 60 kW (RI2 Losses: 50 kW, Stray Losses: 10 kW)	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.3	Load losses at 75 °C and max. raise Voltage tapping:		Should be Filled By Tenderer	
18.3. 1	At first stage of cooling			
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		
18.3. 2	At second stage of cooling		Should be Filled By Tenderer	

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			REQUIRED	OFFERED
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		
18.3.3	At third stage of cooling		Should be Filled By Tenderer	
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		
18.4	Load losses at 75 °C and max. lower voltage tapping:		Should be Filled By Tenderer	
18.4.1	At first stage of cooling			
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		
18.4.2	At second stage of cooling			
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		

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			REQUIRED	OFFERED
18.4.3	At third stage of cooling			
a	HV/LV	kW		
b	HV/TV (if applicable)	kW		
c	LV/TV (if applicable)	kW		
18.5	Cooling plant losses at ONAF/OFAF rating	kW	Max. 2	
19	Efficiency at winding temperature of 75 °C & PF=1			
19.1	At ONAN rating, full load, ¾ full load, ½ full load	%		
19.2	At ONAF rating, full load, ¾ full load, ½ full load (ONAF1)	%		
19.3	At OFAF rating, full load, ¾ full load, ½ full load (ONAF2)	%	Should be Filled By Tenderer	
19.4	No load losses capitalized value	US\$/KW	9000	
19.5	load losses capitalized value	US\$/KW	4000	
20	Cooling system data			
20.1	ONAF system		Should be Filled By Tenderer	

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			REQUIRED	OFFERED
20.1.1	Number of coolers or cooler banks		Should be Filled By Tenderer	
20.1.2	Number of radiator units in each bank		Should be Filled By Tenderer	
20.1.3	Manufacturer and type of radiators		painted	
20.1.4	Number of fans		Should be Filled By Tenderer	
20.1.5	Make and type of fans		Should be Filled By Tenderer	
20.1.6	Capacity of each fan	kW	Should be Filled By Tenderer	
20.1.7	Rated operating voltage	Vrms	Should be Filled By Tenderer	
20.1.8	Three phase or single phase		Should be Filled By Tenderer	
20.1.9	Starting current of each	Arms	Should be Filled By Tenderer	
20.1.10	Efficiency of each fan	%	Should be Filled By Tenderer	
20.2	OFAF system		Should be Filled By Tenderer	
20.2.1	Number of pumps		Should be Filled By Tenderer	
20.2.2	Manufacturer and type of pumps		Should be Filled By Tenderer	

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			REQUIRED	OFFERED
20.2.3	Capacity of each pumps	HP	Should be Filled By Tenderer	
20.2.4	Rated operating voltage of pumps	Vrms	Should be Filled By Tenderer	
20.2.5	Three phase or single phase		Should be Filled By Tenderer	
20.2.6	Starting current of each	Arms	Should be Filled By Tenderer	
20.2.7	Efficiency of each pump	%	Should be Filled By Tenderer	
21	Capability of transformer to remain in operation from hot condition without Injurious heating at rated full load in case of failure of:		Should be Filled By Tenderer	
21.1	50% of air forced cooling	Minute		
21.2	100% of air forced cooling	Minute		
21.3	All of air and oil forced cooling	Minute		
21.4	Condition of injurious heating (hot spot temp.)	°C		
22	Exciting current		Should be Filled By Tenderer	

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22.1	At rated voltage when excited from HV side	Arms		
22.2	At 110% rated voltage when excited from HV side	Arms		
23	Core and winding data		Should be Filled By Tenderer	
23.1	Three limb/ five limb			
23.2	Type of core stacking		Step Lap	
23.3	Type of steel core lamination		Should be Filled By Tenderer	
23.4	Manufactures of steel core material			
23.5	Thickness of steel core lamination	mm	<0.3	
23.6	Flux density of core on principal tap			
23.6.1	At rated HV voltage	Wb/m <sup>2</sup>		
23.6.2	At 110% rated HV voltage	Wb/m <sup>2</sup>		
23.7	Main limb/yoke cross section	cm <sup>2</sup> /cm <sup>2</sup>		

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23.8.	Types and arrangement of winding			
23.8.1	HV winding			
23.8.2	LV winding			
23.8.3	TV winding			
23.9	Winding arrangement			
23.10	Current density at rated power and voltage			
23.10.1	HV winding	A/m m2		
23.10.2	LV winding	A/m m2		
23.10.3	TV winding	A/m m2		
23.10.4	Tap winding	A/m m2		
23.11	Insulation of core			
23.11.1	Lamination			
23.11.2	Core bolts			

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			REQUIRED	OFFERED
23.11 .3	Strapping			
23.12	Type of Insulation of winding (uniform/graded)			
23.12 .1	HV		Graded	
23.12 .2	LV		Uniform	
23.12 .3	TV		Uniform	
23.13	Insulation material			
23.13 .1	Turn insulation HV/LV			
23.13 .2	Between windings HV/LV			
23.13 .3	Between core and LV side			
23.13 .4	Between laminations			
23.13 .5	Core bolts			
23.13 .6	Core bolts washers			
23.13 .7	Side plates			



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23.13.8	Core lamination			
23.13.9	Tapping			
23.13.10	Tapping connections			
24	Calculated thermal time constant		Should be Filled By Tenderer	
24.1	Natural cooling	sec		
24.2	Forced cooling	sec		
25	Tank		Should be Filled By Tenderer	
25.1	Tank design conventional/bell shaped		Conventional	
25.2	Thickness of transformer plates:			
25.2.1	Cover of tank	mm		
25.2.2	Sides	mm		
25.2.3	Bottom	mm		
25.2.4	Conservator	mm		

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25.2.5	Radiator plates	mm		
26	Vacuum withstand capability		Should be Filled By Tenderer	
26.1	Tank	mm Hg		
26.2	Radiators	mm Hg		
26.3	Conservator	mm Hg		
26.4	Positive pressure withstand capability for complete Transformer	mm Hg		
27	Oil			
27.1	Manufacture		Shell	
27.2	Type designation		Diala S4 ZX-I	
27.3	Oil preservation system		Air-bag	
27.4	Country of manufacture			
27.5	Naphthenic or Paraphenic based oil		Naphthenic	
27.6	Type – inhibited/ trace inhibited/ non-inhibited		non-inhibited	

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27.7	Details of inhibitor		By manufacturer	
27.8	Details of passivators		By manufacturer	
27.9	Viscosity at 40 °C (Acc. to ISO 3104)	mm <sup>2</sup> /s	Max. 12	
27.10	Viscosity at –30 °C (Acc. to ISO 3104)	mm <sup>2</sup> /s	Max. 1800	
27.11	Pour point (Acc. To ISO 3016)	°C	Max. -40	
27.12	Water content (Acc. To IEC 60814)	mg/k g	Max. 40 for delivery in drums (IBC)	
27.13	Breakdown voltage (Acc. To IEC 60156)			
27.13.1	As delivered	kV	Min. 30	
27.13.2	After laboratory treatment	kV	Min. 70	
27.14	Density at 20 °C (Acc. To ISO3675 or ISO12185)	g/ml	Max. 0.895	
27.15	DDF at 90 °C (Acc. To IEC 60247 / IEC 61620)		Max. 0.005	
27.16	Appearance		Clear, free from sediment and suspended matter	
27.17	Acidity (Acc. To IEC 62021-1 / IEC 62021-2)	mg KOH/ g	Max. 0.01	

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27.18	Interfacial tension (Acc. To EN 14210/ASTM D971)	mN/ m	Min. 40	
27.19	Total Sulphur content (Acc. To IP 373 / ISO 14596)	%	Max. 0.05	
27.20	Corrosive Sulphur (Acc. To DIN 51353)		Not corrosive	
27.21	Copper Corrosion (Acc. To IEC 62535)		Not corrosive	
27.22	Potentially corrosive Sulphur (Acc. To IEC 62535)		Not corrosive	
27.23	DBDS (Acc. To IEC 62697-1)	mg/k g	Not detectable ( <5 )	
27.24	Inhibitors of IEC 60666 (Acc. To IEC 60666)	%	(U) uninhibited oil (Max. 0.01)	
27.25	Metal passivator additives of IEC 60666	mg/k g	Max. 5	
27.26	2-Furfural and related compounds content (Acc. To IEC 61198)	mg/k g	Max. 0.05 (for each individual compound)	
27.27	Oxidation stability (Acc. To IEC 61125:1992 (Method C))			
27.27 .1	Test duration (for uninhibited oil)	h	164	

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27.27.2	Total acidity (Acc. To 1.9.4 of IEC 61125:1992)	mg KOH/g	Max. 1.2	
27.27.3	Sludge (Acc. To 1.9.1 of IEC 61125:1992)	%	Max. 0.80	
27.27.4	DDF at 90 °C (Acc. To 1.9.6 of IEC 61125, Amendment 1 (2004) +IEC 60247)		Max. 0.50	
27.28	Flash point (Acc. To ISO 2719)	°C	Min. 135	
27.29	PCA content (Acc. To IP 346)	%	Max. 3	
27.30	PCB content (Acc. To IEC 61619)	mg/kg	Not detectable (Max. 2)	
27.31	Quantity of oil			
27.31.1	Main tank	Liters	By manufacturer	
27.31.2	Conservator	Liters	By manufacturer	
27.31.3	Radiator	Liters	By manufacturer	
27.32	Total oil required for commissioning	Liters	By manufacturer	
27.33	Total oil provided (including 5% extra)	Liters	By manufacturer	
27.34	Way of shipping		By drums	

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
27.35	Total number of drums provided		By manufacturer	
28	Maximum sound pressure level (NEMA TR1 – 5dB(A))	dB(A)	74	
29	Max. RIV at 1 MHz for complete transformer acc. to NEMA 107	Micro V	500	
30	Applicable standard for overload capacity of transformer with cooling system in operation		IEC 60076-3	
31	Vibration at rated frequency, voltage and 75 °C	Micro n	<=100	
32	Physical data		Should be Filled By Tenderer	
32.1	Overall height, including bushings	mm		
32.2	Overall width, including mounted accessories	mm		
32.3	Overall length, including mounted accessories	mm		
32.4	Height over cover for lifting core and coils	mm		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
32.5	Dimensions of transformer arranged for transport			
32.6	Length	m		
32.7	Height	m		
32.8	Width	m		
32.9	Weight of oil	kg		
32.10	Weight of on load tap changer	kg		
32.11	Total weight of core and coils	kg		
32.12	Total weight of tank/cooler and fittings	kg		
32.13	Total weight of windings	kg		
32.14	Total weight of core (steel lamination)	kg		
32.15	Total weight steel (tank, fittings, conservator, etc)	kg		
32.16	Total weight of complete transformer	kg		
32.17	Max. shipping weight (heaviest item)	kg		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
33	Provisions for tank mounting lightning arresters			
33.1	HV	Yes/ No	No	
33.2	LV	Yes/ No	No	
33.3	TV	Yes/ No	No	
33.3. 1	Type			
33.3. 2	Type designation			
33.3. 3	Standard			
33.3. 4	Rated/system voltage	kV		
33.3. 5	Maximum overvoltage factor on the system due to any switching duty	pu		
33.3. 6	Rated system frequency	Hz		
33.3. 7	Condition of system neutral			
33.3. 8	Nominal Discharge current	kAcrest		



132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
33.3.9	Energy capability as per IEC 60099-4	kJ/kV		
33.3.10	Rated Voltage – MOA	kV		
33.3.11	Long duration discharge class as per IEC 99-1	Class		
33.3.12	Maximum Continuous Operating Voltage (COV)	kV		
33.3.13	TOV capability for			
	1sec	kV		
	10sec	kV		
33.3.14	Maximum residual voltage with current wave			
	Switching Surges – 1kA/2kA	kV		
	8/20 $\mu$ s – 5kA	kV		
	8/20 $\mu$ s – 20kA	kV		
33.3.15	Discharge current withstand strength			
	High current 4/10 $\mu$ s	KAp		
	Low current 2000 $\mu$ s	KAp		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
34	Anti-vibrations pads	Yes/ No	Yes	
35	Radiators mounted separate	Yes/ No	No	
36	Wheels	Yes/ No	Acc. to Project Requirements	
36.1	Plain/ Flanged		Plain	
36.2	Unidirectional/ bi-directional		bi-directional (If Needed)	
36.3	Gauge	mm		
37	All accessories supplied as specified	Yes/ No	Yes	
38	All drawings and documents enclosed	Yes/ No	Yes	
39	Schedule of deviations filled	Yes/ No		
40	Fire protection scheme	Yes/ No	Acc. to Project Requirements	
41	All additional equipment specified provided	Yes/ No	Yes	
42	Accessories make and type			
42.1	Buchholz relay with sampling device			

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
42.1.1	For conservator main compartment		Yes	
42.1.2	For conservator OLTC		Yes	
42.2	Pressure relief Relay		Yes	
42.3	Oil level indicator:			
42.3.1	For conservator main compartment		Yes	
42.3.2	For conservator OLTC		Yes	
42.4	Temperature indicators:			
42.4.1	Oil		Yes	
42.4.2	HV winding		Yes	
42.4.3	LV winding		Yes	
42.4.4	TV winding		Yes	
42.5	Conservator type:			
42.5.1	Normal/air bag (diaphragm)		Air bag	
42.5.2	Air detector relay (for air bag)	Yes/No	Yes	

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
42.6	breather		Maintenance free type	
42.7	Cables		By Contractor	
42.8	Control cabinets		By Contractor	
42.9	Fire extinguishing system:		Acc. to Project Requirements	
42.9.1	Drainage and mixing			
42.9.2	Water sprinkler system			
42.9.3	Whether full information are attached	Yes/ No	Should be confirmed by Tenderer	
42.10	Whether all catalogues of accessories are enclosed	Yes/ No	Should be confirmed by Tenderer	
43	Fault currents and mechanical forces and stresses.		Should be Filled by Tenderer	
43.1	Max. fault current in windings on which mechanical stresses are based.			
43.1.1	HV winding			
a	Symmetrical component current	Arms		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
b	Asymmetrical crest current	Amp Peak		
43.1.2	LV winding			
a	Symmetrical component current	Arms		
b	Asymmetrical crest current	Amp Peak		
43.1.3	Tapped winding			
a	Symmetrical component current	Arms		
b	Asymmetrical crest current	Amp Peak		
43.2	Max. fault current on which mechanical stresses are based for OLTC (main+arcing contacts):			
43.2.1	Symmetrical short circuit current	kArms		
43.2.2	Dynamic short circuit current value			
43.2.2	Asymmetrical crest current	Amp crest		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
43.3	Max. fault current on which mechanical stresses are based for leads to OLTC are:			
43.3.1	Symmetrical short circuit current	Arms		
43.3.2	Asymmetrical crest current	Amp crest		
43.4	Max. fault current on which mechanical Stresses are based for various bushings of:			
43.4.1	HV side	kArms		
43.4.2	LV side	kArms		
43.4.3	Neutral HV/LV	kArms		
43.5	Current density in windings on principal tapping under the most onerous fault condition			
43.5.1	HV winding	A/m <sup>2</sup>		
43.5.2	LV winding	A/m <sup>2</sup>		
43.5.3	Tapped windings	A/m <sup>2</sup>		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
43.5.4	Tapping lead connections	A/m m2		
43.5.5	Neutral	A/m m2		
43.5.6	HV bushings	A/m m2		
43.5.7	LV bushings	A/m m2		
43.5.8	Neutral bushings	A/m m2		
43.6	Hoop stress in winding conductors:			
43.6.1	HV winding	N/m2		
43.6.2	LV winding	N/m2		
43.6.3	Tapping	N/m2		
43.7	Total axial compressive force in windings:			
43.7.1	HV winding	N		
43.7.2	LV winding	N		
43.7.3	Tapped winding	N		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
43.7.4	Tertiary winding	N		
43.8	Max. stress to flexion of conductor between two adjacent spacers:			
43.8.1	HV winding	N/m2		
43.8.2	LV winding	N/m2		
43.8.3	Tapping	N/m2		
43.9	Total axial and thrust in windings:			
43.9.1	HV winding	N		
43.9.2	LV winding	N		
43.9.3	Tapping	N		
43.10	Max. stresses in end insulation and supports:			
43.10.1	HV winding	N/m2		
43.10.2	LV winding	N/m2		
43.10.3	Tapped winding	N/m2		



132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
43.11	Relative axial displacement at the windings assumed in items 43.9, 43.10 Above			
43.12	Cross sectional area of conductor for each windings:	%		
43.12 .1	HV winding	mm2		
43.12 .2	LV winding	mm2		
43.12 .3	Tapped winding	mm2		
43.13	Cross section area of insulation for:			
43.13 .1	HV winding	mm2		
43.13 .2	LV winding	mm2		
43.13 .3	Tapped winding	mm2		
43.14	Specific heat in watt-seconds per degree Celsius per pound of conductor Material for:			
43.14 .1	HV winding	mm2		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
43.14.2	LV winding	mm2		
43.14.3	Tapped winding	mm2		
43.15	Position and magnitude of max. axial stress on inter turn insulation in:			
43.15.1	HV winding	N/m2		
43.15.2	LV winding	N/m2		
43.15.3	Tapped winding	N/m2		
44	On-line gas monitoring		Should be Filled by Tenderer	
44.1	Manufacturer			
44.2	Country of manufacturer			
44.3	Model/Type			
44.4	Detectable key gases			
44.5	Moisture detection	Yes/No	Yes	
44.6	Lower detection limit (LDL)	ppm	Should be confirmed by Tenderer	

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
44.7	Accuracy of sensor	%	Should be confirmed by Tenderer	
44.8	Response time	Minute	Should be confirmed by Tenderer	
44.9	Operating range			
44.9.1	Operating temperature	°C		
44.9.2	Operating oil temperature	°C		
44.9.3	Operating oil pressure	PSI		
44.9.4	Operating humidity	% RH		
44.9.5	Storage temperature	°C		
44.9.6	Storage humidity	% RH		
44.9.7	Altitude	m		
44.10	Input power requirement			
44.10.1	Voltage	V AC		
44.10.2	Frequency	Hz		
44.10.3	Current or power	A or kW		

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
44.11	Communication option			
44.11 .1	Display			
44.11 .2	Communication protocols			
44.11 .3	Communication ports and analog I/O			
44.11 .4	Measurement alarms			
44.11 .5	Alarm contacts			
44.11 .6	Data storage	Year		
44.12	Software			
44.13	Dimensions			
44.14	Weight	kg		
44.15	Whether all catalogues and description of the system attached	Yes/ No		
45	Minimum Clearances (IEC 60076-3)- (Should be according to Altitude of Substation)		Should be confirmed by Tenderer	
45.1	Line to earth			

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
45.1.1	HV side	mm	1300	
45.1.2	LV side	mm	320	
45.2	Phase to phase			
45.2.1	HV side	mm	1500	
45.2.2	LV side	mm	320	
45	System Grounding			
45.1	HV system		Non-Effective	
45.2	LV system		Effective	
45.3	TV system		N.A.	
45	Winding and oil temp. (Dial type or temp. monitoring)		Dial type	
46	Size of copper ground conductor		240	
47	Type of terminals			
	HV		Air bushing	
	LV		Air bushing	
	TV		N.A.	
	Neutral		Air bushing	

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
48	Pre-stressed non-return valve (PNRV)	Yes/ No	Yes	
49	Buchholz relay test pump	Yes/ No	Yes	
50	Color of exterior/finishing paint		Will be Finalized During Detail Design	
51	Manufacturer quality assurance		Yes	
52	According to ISO 9000, 9001, 9002, 9003 and 9004	Validity	Yes	
52.1	Certificate attached to the offer	Yes/ No	Yes	
52.2	Type test certificate to be issued by:		Yes	
53	Independent laboratory or independently witnessed type test certificate	Yes/ No		
53.1	Certificate attached to the offer	Yes/ No	Yes	
53.2	Special Tests to be performed: As Type test = T As Routine test = R		Yes	
54	Chopped Wave Lightning Impulse Test		Yes (*)	

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
	(*)Type or routine test as appropriate to transformer HV Um			
54.1	Measurement of zero-sequence impedance		Yes (T)	
54.2	Determination of sound levels		Yes (T)	
54.3	Measurement of harmonics of no-load current		Yes (T)	
54.4	Frequency response analysis (FRA)		Yes (R)	
54.5	Measurement of the power by the fan motors and oil pumps		Yes (T)	
54.6	Check of external coating		Yes (R)	
54.7	Determination of capacitance, windings to earth and between windings		Yes (R)	
54.8	Measurement of insulation resistance to earth and loss angle of insulation system capacitances		Yes (R)	
54.9	Short circuit withstand test/calculations		Yes (Calculation)	

132/33KV POWER TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED	OFFERED
54.10	Wheel locking capability on Transformer rails	Yes/ No	Yes	