

7.0 Technical Guarantee Specification of 60MVA, 132/33kV Mobile Substation

TECHNICAL DATA SCHEDULE				
60MVA, 132/33 kV MOBILE SUBSTATION				
ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
A	<i>POWER TRANSFORMER</i>			
1	<i>Manufacturer</i>			
1.1	<i>Country of Origin</i>		Specify	
1.2	Type	-	Oil immersed	
1.3	No. of phase / winding	-	Three-phase with 2 windings	
2.0	<i>Rated data and characteristics</i>			
2.1	Rated power:			
	- primary/secondary	MVA	60	
2.2	Cooling	-	ONAN/ONAF	
2.3	Rated voltage			
	-HV winding	kV	132	
	- LV winding	kV	33	
2.4	Tap changer:		OLTC	
	- manufacturer	-	Specify	
	- Country of Origin	-	Specify	
	- model		CFVV	
	- type		HV neutral	
	- on-load tap changer location		132 kV	
	- regulating range	%	+8 x 1.25%	
			-8 x 1.25%	
	- rating	-	Rated power on all taps	
2.5	Frequency	Hz	50	
2.6	Connection of the three-phase windings (group of vectors IEC 76)	-	YNd11	
2.7	Rated current at ONAF rated power and rated voltage tap:			
	- HV winding	A	262	
	- LV winding	A	1050	
2.8	No-load current through:			
	- HV winding	A	specify	
	- LV winding	A	Specify	
2.9	- Short circuit capacity HV system		7000 MVA	
	- Short circuit capacity LV system		1000MVA	
2.9.1	Direct impedance at nominal voltage tap:		10.2	
	- HV/LV	%		
2.9.2	Direct impedance at minimum voltage tap:		10.6	

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	- HV/LV	%		
2.9.3	- Direct impedance at maximum voltage tap	%	10.1	
2.9.4	Zero sequence impedance at nominal voltage tap		Specify	
	- HV / LV	%	Specify	
2.10	Tolerance to be applied to the short circuit impedance, in terms of % of the guaranteed value on:			
	- nominal voltage tap	%	±7.5	
	- other taps	%	±10	
2.11	Short circuit data			
2.11.1	Short circuit symmetrical current duration	Sec	2	
2.11.2	Symmetrical short circuit current withstand during the indicated period and asymmetrical short circuit withstand:			
	- HV winding	kA RMS kA (peak)	Specify Specify	
	- LV winding	kA RMS kA (peak)	Specify	
	- Altitude	M	1000	
	- pre-fault voltage	p.u.	1.05	
2.12	Guaranteed losses			
2.12.1	No-load losses at rated voltage and frequency at 75 degree centigrade	kW	Specify	
2.12.2	No-load current at rated voltage, frequency and power	%	0.2	
2.12.3	No-load losses capitalized value	US \$/kW	3000	
2.12.4	Tolerance to be applied to no-load and on load losses (in % of the guaranteed value)	%	10	
2.12.5	On-load losses at rated voltage and frequency, with rated voltage tap and ONAN rating:			
	- HV winding	kW	Specify	
	- LV winding	kW	Specify	Specify
	- tertiary winding	kW		
2.12.6	On-load losses capitalized value	US \$/kW	1080	
2.12.7	Load loss at 75 degrees centigrade, 60MVA, 132/33kV	kW	Specify	
2.12.8	Auxiliaries consumption at second stage of cooling (ONAF)	kW	Specify	

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2.13	Highest voltage for equipment:			
	- HV winding	kV	145	
	- LV winding	kV	36	
2.14	Rated insulation level:			
2.14.1	Short time low frequency applied voltage withstand:			
	- HV winding - line terminal	kV RMS	275	
	- LV winding - line terminal	kV RMS	70	
	- H.V neutral-graded insulation	kV RMS	70	
	- control wiring	kV RMS	2.0	
2.14.2	Full Wave Impulse - Basic impulse level:			
	- HV winding - line terminal	kV (peak)	650	
	- LV winding - line terminal	kV (peak)	170	
	- HV neutral graded insulation	kV (peak)	170	
2.15	Temperature rise limits at maximum power output at ONAN and ONAF ratings and at lowest voltage tap and corresponding voltage:			
	- Ambient temperature	°C	45	
	- Top oil temperature rise	°C	55	
	- Average winding temperature rise	°C	65	
	- Temperature class	-	A	
2.16	Permissible overload in emergency cases:			
	- permanent permissible overload based on highest winding temperature which exceeds by 5°C the guaranteed limit	MVA	Specify	
	- permanent permissible overvoltage based on the maximum top oil temperature which exceeds by 5°C the guaranteed limit at rated power (in % of the rated voltage)	%	Specify	
2.17	Oil:		PCB prohibited	
	- manufacturer	-	Specify	
	- type	-	NYNAS	
	- data sheet attached	-	Yes	
2.18	Bushings			
2.18.1	HV bushings:			
	- class	kV	145	
	- manufacturer	-	Specify	
	- type designation	-	Specify	
	- rated current	A	Specify	
	- short circuit withstand	kA RMS	Specify	
	- basic insulation level	kV (peak)	650	
	- power frequency withstand for 1 minute	kV RMS	275	
	- creepage distance	mm	31mm/kV	
2.18.2	LV bushings:			
	- class	kV	36	
	- manufacturer	-	Specify	
	- type designation	-	Specify	
	- rated current	A	Specify	

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2.18.3	- short circuit withstand	kA	RMS	Specify
	- basic insulation level	kV	(peak)	170
	- power frequency withstand for 1 minute	kV	RMS	70
	- creepage distance	mm		31mm/kV
	Neutral bushings:			
	- class	kV		36
	- manufacturer	-		Specify
	- type designation	-		Specify
	- rated current	A		Specify
	- short circuit withstand	kA	RMS	Specify
2.19	- basic insulation level	kV	(peak)	125
	- power frequency withstand for 1 minute	kV	RMS	50
2.19.1	- Creepage distance	mm		31mm/kV
	Design data:			
2.19.1	Maximum flux density in the columns at:			
	- rated voltage	tesla		Specify
2.19.2	- 105% of the rated voltage	tesla		Specify
	Maximum flux density in the yokes at:			
2.19.2	- rated voltage	tesla		Specify
	- 105% of the rated voltage	tesla		Specify
2.19.3	Maximum current density at ONAN rated power and rated voltage tap:			
	- HV winding	A/mm ²		Specify
2.19.4	- LV winding	A/mm ²		Specify
	Winding resistance:			
2.19.4	- HV winding	ohms		Specify
	- LV winding	ohms		Specify
2.19.5	Voltage regulation at ONAN rating and rated voltage tap (in % of the rated voltage):			
	- with unity power factor:			
	. HV side	%		Specify
	. LV side	%		Specify
	- with 0.9 power factor (lagging):			
	. HV side	%		Specify
	. LV side	%		Specify
	- with 0.8 power factor (lagging):			
	. HV side	%		Specify
	. LV side	%		Specify
2.19.6	Primary exciting current, LV side:			
	- at 0.01 second	kA		Specify
2.19.7	- at 0.1 second	kA		Specify
	Core type (core or shell)	-		Specify
2.19.8	Winding conductor	-		Copper
2.20	Audible noise level			
	- Voltage in percent of rated value	%		105
	- ONAN rating	dB(A)		75max

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ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
2.21	- ONAF maximum rating Radio Interference Voltage at 0.5 MHz as per IEC 694	dB(A) μ V	78 max 2500 max	
3.0	<i>Weights and dimensions</i>			
3.1	Total weight of transformer, equipped for service	Kg	-	
3.2	Weight:			
	- oil	kg	Specify	
	- core and coil assembling	kg	Specify	
	- tank and accessories	kg	Specify	
	- net copper	kg	Specify	
	- net core steel	kg	Specify	
3.3	Maximum shipping weight (heaviest item)	Kg	Specify	
3.4	Height from foundation to:			
	- highest point of HV bushing	mm	Specify	
	- highest point of tank	mm	Specify	
	- highest point of conservator tank	mm	Specify	
	- highest point of lifting hook to remove core and coil assembly	mm	Specify	
3.5	Outline dimensions:			
	- length	mm	Specify	
	- width	mm	specify	
3.6	Layout drawing	-	To be enclosed with bid	
3.7	Maximum shipping dimensions of tank:			
	- outside height	mm	Specify	
	- outside width	mm	Specify	
	- outside length	mm	Specify	
3.8	Transportation drawing	-	To be enclosed with bid	
4.0	<i>On-load tap changer</i>			
4.1	Manufacturer	-	Specify	
4.2	Type	-	Specify	
4.3	Rated current	A	Specify	
4.4	Number of steps	-	17	
4.5	Short circuit withstand	kA RMS	Specify	
4.6	BIL to ground through the regulating coil	kV (peak)	Specify	
4.7	Power frequency withstand voltage for 1 minute through the regulating coil	kV RMS	Specify	
4.8	Tap transition device	-	Resistance type	
4.9	Parallel automatic controller	-	Master-follower	

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ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
5.0	<i>Current transformer incorporated into the power transformer</i>			
5.1	CT in HV phase bushings:			
5.1.1	Number of cores per bushing	-	4	
5.1.2	Primary rated current	A	300	
5.1.3	Secondary rated current	A	1	
5.1.4	Accuracy class and Burden:			
	- protection	-	(3) 5P20, 20VA	
	- metering	-	(1) CL0.2, 20VA	
5.1.5	Ratio	-	300:1:1:1:1	
5.1.6	Short circuit withstand	A	Specify	
5.1.7	Continuous secondary current thermal limit	A	Specify	
5.2	CT in LV phase bushings:			
5.2.1	Number of cores per bushing	-	4	
5.2.2	Primary rated current	A	1200	
5.2.3	Secondary rated current	A	1	
5.2.4	Accuracy class and Burden:			
	- protection	-	(3) 5P20, 20VA	
	- metering	-	(1) CL0.2, 20VA	
5.2.5	Ratio	-	600 - 1200:1:1:1:1	
5.2.6	Short-circuit withstand	A	Specify	
5.2.7	Continuous secondary current (thermal limit)	A	Specify	
5.3	CT in HV neutral bushing:			
5.3.1	Number of cores per bushing	-	2	
5.3.2	Primary rated current	A	300	
5.3.3	Secondary rated current	A	1	
5.3.4	Accuracy class - protection	-	5P20, 20 VA	
5.3.5	Ratio	-	300:1	
5.3.6	Short circuit withstand	A	Specify	
5.3.7	Continuous secondary current (thermal limit)	A	Specify	
6.0	<i>Layout</i>			
6.1	Primary winding bushings	-	(3) Long. Axis	
6.2	Secondary winding bushings	-	(3) Long. Axis (opposite to HV)	
6.3	Conservator tank	-	Transv. Axis	

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ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
6.4	Tap changer	-	Transv. Axis	
6.5	Control cabinet	-	Specify	
6.6	Radiators	-	Specify	
6.7	Terminal block connection drawing	-	drawings to be enclosed	
7.0	<i>Standards</i>			
7.1	Manufacturing	-	IEC 60044 IEC 60076 IEC 60137 IEC 60214 IEC 60529 IEC 60815 IEC 60947 NEMA TR-1	
7.2	Quality assurance	-	ISO 9001	
8	<i>Auxiliary supply voltages</i>			
8.1	<i>OLTC motor and fans, at 50Hz</i>	Vac	415	
8.2	<i>OLTC & cooling control circuits</i>	Vac	240	
8.3	<i>Heaters and lights</i>	Vac	240	
8.4	<i>Relays & instruments</i>	Vdc	110	
9	<i>High voltage switchgear – 132kV</i>			
9.1	<i>Insulation Type</i>		Air or Gas	
9.2	<i>Rated voltage / maximum voltage</i>	kV	132 / 145	
9.3	<i>Power frequency withstand voltage(1/ min</i>	kV (rms)	275	
9.4	<i>Lightening impulse withstand voltage</i>	kV(peak)	650	
9.6	<i>Rated current</i>	A	2500	
9.7	<i>Rated short - time withstand current (1sec)</i>	kA	40	
9.8	<i>Current transformer ratio</i>	A	300-600-1200/1	
	<i>-Metering class (core 1)</i>		0.2	
	<i>-burden</i>		20	
	<i>-Security factor</i>		<10	
	<i>-Protection class (core 2)</i>		5p	
	<i>-burden</i>		20	
	<i>-Accuracy limit factor</i>		20	
9.9	<i>Design pressure of circuit breaker enclosure</i>	kPa	800	
	<i>-Rated circuit breaker operating sequence</i>		O-0.3s-CO-1min-CO	
	<i>- Stored switching sequence</i>		O - CO	
	<i>-Rated current of circuit breaker</i>	A	3150	
	<i>-Rated short time withstand current</i>	kA	40	
	<i>-Rated DC voltage</i>	V	110	
	<i>-Rated making current</i>	kA	100	
9.10	<i>Routine test pressure</i>	kPa	1200	

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ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
9.11	<i>Bursting disc release pressure</i>	kPa	950	
9.12	<i>Combined disconnecter & earthing switch - 132kV</i>			
	- <i>Manufacturer</i>	-	Specify	
	- <i>Country of origin</i>	-	Specify	
	- <i>Type</i>	-	3 pole double break for outdoor	
	- <i>Rated voltage</i>	kV	145	
	- <i>Rated current</i>	A	2500	
	- <i>Rated short time withstand current</i>	kA, 1sec	31.5	
	- <i>Rated peak current</i>	kA	108	
	- <i>Disconnector motor operating time</i>	sec	<4	
	- <i>Auxiliary contacts</i>		4NO + 4NC	
	- <i>Disconnector dc voltage</i>	V	110	
	- <i>Power frequency</i>	kV	275	
	- <i>Impulse</i>	kV	650	
	- <i>Operated mechanism</i>	-	Motor operated with manually operated earthing blade	
10	<i>145kV Surge Arrester (with counter)</i>			
	- <i>Manufacturer</i>	-	Specify	
	- <i>Country of origin</i>	-	Specify	
	- <i>Type</i>	-	Metal oxide, Gapless	
	- <i>Rated voltage</i>	kV	120	
	- <i>Nominal discharge current</i>	kAcrest	10	
	- <i>TOV capability 1.0s</i>	kVrms	138	
	- <i>Short-circuit capability high current 0.2s</i>	kA	50	
	- <i>Line discharge class, IEC60099-1</i>		2	
	- <i>Energy capability</i>	Class	7.4	
	- <i>Insulator colour / material</i>	Ur	Gray / Silicon	
	- <i>Creepage distance (nominal)</i>	mm	3625	
	- <i>Maximum usable bending moment</i>	Nm	2500	
11.1	<i>Medium Voltage Switchgear</i>			
	- <i>Manufacturer</i>		Specify	
	- <i>Country of origin</i>		Specify	
	- <i>Type</i>		SF6 for outdoor	
	- <i>Type of insulation</i>		Air	
	- <i>Rated / maximum voltage</i>	kV	36	
	- <i>Power frequency withstand voltage(1/min)</i>	kVrms	70	
	- <i>Rated normal current</i>	A	1250	
	- <i>Rated short time withstand current of circuit breaker (3sec)</i>	kA	31.5	
	- <i>Rated breaking current</i>	kA	25	
	- <i>Rated making current</i>	kA	80	

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ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
11.2	<i>-Rated operating sequence acc to IEC</i>		O-0.3s-CO-15s-CO	
	<i>-Rated DC voltage</i>	V	110	
	<i>-Auxiliary contacts</i>	-	4NO + 6 NC	
	<i>-Power frequency</i>	kV	70	
	<i>-Impulse</i>	kV	170	
	36kV Disconnecter			
	<i>-Manufacturer</i>	-	Specify	
	<i>-Country of origin</i>	-	Specify	
	<i>-Type</i>	-	Outdoor/Indoor	
	<i>-Rated current</i>	A	1250	
	<i>-Power frequency withstand across isolating distance</i>	kV	75	
11.3	<i>-Lightning impulse withstand voltage (1sec)</i>	kV	170	
	<i>-Rated peak current</i>	kA	78	
	<i>-Short circuit withstand at 1sec</i>	kA	31.5	
	36kV voltage transformer			
	<i>-Manufacturer</i>	-	Specify	
	<i>-Country of origin</i>	-	Specify	
	<i>-Type</i>	-	Outdoor/Indoor	
	<i>-Thermal capacity</i>	VA	1500	
	<i>-Rated output</i>	VA	20	
	<i>-accuracy class</i>	Class	3p	
	<i>-Voltage factor/time</i>		1.5 / 30s	
<i>- Voltage ratio</i>		33000/ $\sqrt{3}$:110/ $\sqrt{3}$: 110/ $\sqrt{3}$		
11.4	<i>One minute power frequency withstand voltage on:</i>			
	<i>- Primary winding</i>	kV	70	
	<i>- Secondary winding</i>	kV	2.5	
	<i>- Rated voltage</i>	kV	33	
	<i>- insulation material / color</i>	-	Porcelain / brown	
	300kVA Grounding Transformer			
	<i>- Rated power</i>	kVA	300	
	<i>- Primary Rated voltage</i>	kV	33, 2x2.5%	
	<i>- Primary connection</i>		Zigzag	
	<i>- Vector group</i>		Znyn	
	<i>-Rated insulation level HV side</i>	kV	36/70/170	
<i>-Rated insulation level LV side</i>	kV	3		
<i>-Secondary connection</i>		Star + neutral		
<i>-Secondary rated voltage, no load</i>	V	415/240		
<i>-Insulation class</i>		Specify		

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ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
11.5	-No-load losses	W	715	
	-Short circuit losses	W	1020	
	-short circuit impedance	%	5	
	36kV Surge Arresters			
	- Type	-	Metal-oxide, gapless	
	-Rated voltage (U_r)	kVrms	33.8	
	-Maximum continuous operating voltage (U_c)	KVrms	27	
	-Short -circuit capability, high current, 0.2s	kA	20	
	Discharge current withstand strength:			
	-High current, 4/10microsecond	kA (crest)	100	
	-Low current, 2000micro second	A (crest)	550	
	- Line discharge class, IEC 60099-4	Class	2	
	-Energy capability (U_r)		5.5	
	TOV Capability (after rated energy):			
	-1sec	kVrms	36.7	
	-10sec	kVrms	35.3	
	- cantilever strength	Nm	350	
- Torsion strength	Nm	68		
- Vertical load	N	1200		
- Insulation colour / material		Gray / Silicon		
-Energy at one high current impulse 100kA 4/10microsecond	kJ/kVuc	3.6		
11.6	Expulsion fuse cutout			
	-Rated voltage	kV	36	
	Rated frequency withstand voltage:			
	-To ground	kV	70	
	-Across insulated distance	kV	80	
	-Rated current	A	100	
	-Rated short time withstand current	kA	11.2	
	-Rated current of fuse	A	2	
12.0	Trailer	Qty	1	
12.1	- Type		Low-bed	

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ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
12.2	- <i>Load on King Pin (approx)</i>	Ton	18	
	- <i>Axels</i>	Qty	6 (3 steerable)	
	- <i>Dimensions (approx)</i>	m	(LxWxH) 17x3.5x4.5	
12.3	Auxiliary			
	- <i>24VDC connection to 24VDC system of prime mover</i>			
	- <i>spirit level on trailer</i>			
12.4	- <i>Brakes</i>	Qty	Specify 2 pneumatic brake systems	
13.0	Control Cubicle:	No.	1	
13.1	General Consists of two compartments, one contains relays, control equipment, AC/DC panel and the other one contains the batteries. The floor of the building shall be covered with rubber sheet.			
13.2	Walls and roof: This shall be of sandwich construction using plastic coated aluzink sheet on both sides of an polyurethane insulation layer. Total thickness not less than 60mm. The roof shall be covered with rubber sheet.			
13.3	Lighting: Both compartments shall be illuminated with compact fluorescent lamps (CFL).			
13.4	Heating: The rooms shall be installed with panel type, adjustable temperature regulator.			
13.5	Ventilation: The cubicle shall be equipped with an air-conditioning unit with adequate cooling capacity for ambient temperature of 45°C. The cubicle shall be installed with ventilators capable of keeping dust outside the room.			

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14	<i>Control, protection and metering panel.</i> <i>Make</i> <i>County of origin</i> <i>-Type of cubicle</i> <i>-Surface treatment with acrylic paint</i> <i>-Dimension</i> <i>-Type of Energy meter</i> <i>Type of Battery charging system:</i> <i>-Type of battery</i> <i>-Number of cells</i> <i>-Nominal capacity</i> <i>Numerical transformer protection with over current & distance protection functions but programmable for temperature and buchholz etc)</i> <i>- Make</i> <i>Feeder terminal relay for protection, measurement, control, communication and monitoring functions. Earth fault and under voltage</i> <i>- Make</i> <i>Voltage regulator, with three phase over current & under voltage blocking</i> <i>-Make</i>		Specify Specify Specify RAL 7030 800x2200x800 Specify Specify 104 90/5h Yes Specify Yes Specify Yes Specify	
14.0	<i>Installation</i>		Outdoor	
15.0	<i>Mandatory Spares</i>			
	<i>SF6 gas</i>	kg	40	
	<i>Gas refilling unit</i>	No.	1	