Schedule D: Schedules of Technical Data (STD)

The Schedule of Technical Data (STD) shall be filled-in and dully signed and stamped by the Tenderer.

Any deviation from the required value shall be show clearly in the schedule L. and statement of compliance.

Schedule of Technical Data (STD) 33 kV reactor

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
1	SHUNT REACTOR 25 MVAr, 33 kV			
1.1	General Data			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Three- phase, single-winding, oil immersed shunt reactor	
	Type designation by the Manufacturer			
	Standards		IEC 60076-6	
	Installation		Outdoor, without wheels	
	Type of Reactor		fixed reactance, linear	
	Type of core		Radially stacked, air-gapped	
	Type of tank		With conservator	
	Reactor purpose in system		Compensation purpose	
	Method of earthing:			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	-system earthing		Earthing transformer	
	- The reactor		Solidly earthed	
	Reactor painting colour (RAL)		RAL 7001	
4.2	**Site/Design Conditions**			
	Altitude above sea level	m	≥1000	
	Minimum ambient temperature	°C	-10	
	Maximum ambient temperature	°C	50	
	Design maximum ambient temperature	°C	50	
4.3	**Rated Data and Characteristics**			
	Number of phases		Three	
	Rated frequency	Hz	50	
	Type of cooling (acc to IEC 60076)		ONAN	
	Rated voltage (Ur)	kV	33	
	Maximum operating voltage (U_{max})	kV	36	
	Highest voltage for equipment as per IEC 60076-3 (U_m)	kV	36	
	Rated power at site conditions:			
	- At maximum operating voltage	MVAr	29.75	
	- At rated voltage	MVAr	25	
	Reactance at rated voltage and frequency	Ω	43.56	
	Efficiency at 100% of rated power and with ONAN cooling	%		
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min):	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs):	kV	≥170	
	Connection symbol (Vector group)		YN	
	Maximum temperature rises at rated power at:			
	- average winding	K	55	
	- hot spot of winding	K	68	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- top oil	K	50	
	- oil at inlet of cooler	K		
	- oil at outlet of cooler	K		
	- core	K		
	Hot-spot factor (H)		1.3	
	The total losses at rated current, rated frequency at 75°C	kW	The losses shall provide in financial part The detailed losses table in ANNEX C	
	Noise level measured in accordance with IEC 60076-10	dB	≤70	
4.4	**Structural Characteristics**			
	Type (graded/non-graded) of windings:			
	Star connected winding		Fully insulated	
	Winding conductor material		enamelled copper	
	Winding conductor cross section	mm^2		
	Winding conductor insulation		thermally upgraded paper	
	Insulation system thermal class of the winding		105	
	Maximum current density in the windings at rated power and at rated voltage	A/mm^2		
	Winding resistance at 75°C:	Ω/phase		
	Magnetic core construction:			
	- Type of magnetic core material			
	- taped/banded/bolted limbs			
	- taped/banded/bolted yokes			
	- taping/banding material			
	- number of limbs			
	- type of joints in magnetic core			
	- type of core laminations			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	-Thickness of core laminations			
	- maximum specific loss in core laminations at 1.7 T	W/kg	Max. 0.95	
	Maximum flux density in the core at rated voltage and at rated frequency:			
	- limbs	T	1.6	
	- yokes	T	1.6	
	- cores	T	1.6	
	- shields	T	1.6	
	Insulation of magnetic core:			
	- core laminations			
	- core screws			
	- washers for core screws			
	- end plates			
	Material of reactor tank			
	Thickness of reactor tank:			
	- sides	mm		
	- bottom	mm		
	- top	mm		
	Tank anticorrosion protection			
	Thickness of radiator plates	mm		
	Thickness of final paint	µm		
	Conservator vessel, radiators, control cabinets or boxes and pipework anticorrosion protection		Hot dip galvanized and painted	
4.5	**Reactor Protective Devices & Accessories**			
	Standards		IEC 60076-22-1 IEC 60076-22-7	
	Location of reactor control cabinet		Mounted on reactor	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Control cabinet painting colour (RAL)		7001	
	Heater inside reactor control cabinet		Yes	
	winding temperature indicator		Yes	
	Oil temperature indicator		Yes	
	Buchholz relay		Yes	
	Pressure relief device		Yes	
	Reactor conservator		Yes	
	- Total volume of conservator	litres		
	- Volume of oil in conservator between the highest and lowest visible levels	litres		
	- Minimum capacity of conservator between highest and lowest visible levels, as percentage of total cold oil volume of the reactor	%	7.5	
	Dehydrating breather		Yes	
	Type of dehydrating breather		Air bag + Dehydrating agent, Maintenance free	
	Type of oil level gauge			
	Transformer wheels		No	
	Supply voltage for reactor auxiliaries	V	400/230 AC	
	Control & Protection voltage	V	110 DC	
	Impact recorder		Yes	
	Designed and manufactured constant acceleration in all directions	m/s^2	min. 20	
4.6	**Reactor Mineral Insulating Oil**	**As IEC 60296:2020 - table 3 ANNEX D**		
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Type		Fully inhibited high grade mineral naphthenic oil	
	Type designation by the manufacturer			
	Standards		IEC 60296 IEC 62535	
	Note: if passivator is detected, supplied oil shall be rejected.			
	Insulation oil meeting special applications		Yes	
	Free of corrosive sulphur (as per IEC 62535), PCB, DBDS (dibenzyl disulphide), Antioxidant, passivator, metal deactivator and other additives		Yes	
	Additional test method for corrosive sulphur according to ASTM D1275 B		Yes	
	Function:			
	Appearance		Clear, free from sediment	
	Viscosity: ISO 3104[a] or ASTM D7042			
	- at 40 °C	mm^2/s	Max. 12	
	- at -30 °C [b]	mm^2/s	Max. 1800	
	Pour point ISO 3016	°C	Max -40	
	Water content IEC 60814	mg/kg	Max. 30[d]/40[e]	
	Breakdown voltage: IEC 60156			
	- before treatment	kV	Min. 30	
	- after treatment	kV	Min. 70	
	Density at 20 °C ISO 12185 [a] or ISO 3675 or ASTM D7042	kg/m^3	Max. 895	
	DDF at 90 °C IEC 60247 [a] or IEC 61620		Max. 0.005	
	Refining and Stability			
	Colour ISO 2049		L0.5	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
			less than 0.5	
	Appearance		Clear, free from sediment and suspended matter	
	Acidity IEC 62021-2[a] or 62021-1	mgKOH/g	Max. 0.01	
	Interfacial Tension IEC 62961 [a] or ASTM D971	mN/m	Min. 43	
	Total sulphur content ISO 14596 [a] or ISO 8754	%	Max. 0.05	
	Corrosive sulphur DIN 51353		non-corrosive	
	Potentially corrosive sulphur IEC 62535		non-corrosive	
	DBDS IEC 62697-1	mg/kg	non-detectable	
	Inhibitor content IEC 60666	%	(I) Inhibited oil: 0.08 to0.40	
	Metal Passivator additives IEC 60666	mg/kg	non-detectable	
	Other additives		See [g]	
	2-Furfural and related compounds content IEC 61198	mg/kg	non-detectable[h]	
	Stray gassing under thermo-oxidative stress Procedure in Clause A.4 (oil saturated with air) in the presence of copper		Non stray gassing: < 50 µl/l of hydrogen (H2) < 50 µl/l methane(CH4) < 50 µl/l ethane (C2H6)	
	Performance			
	Oxidation stability 500 h according to IEC 61125 C			
	- total acidity [h] 4.8.4 of IEC 61125:2018	mg KOH/g	Max. 0.3	
	- sludge [h] 4.8.4 of IEC 61125:2018	wt%	Max. 0.05	
	- DDF at 90 °C [h] 4.8.4 of IEC 61125:2018		Max. 0.050	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Health, Safety and environment (HSE) [K]			
	Flash point ISO 2719	° C	Min 135	
	Polycyclo Aromatic Content (PCA) [j] IP 346	%	< 3	
	Polychlorinated Biphenyl Content (PBC) IEC 61619	mg/kg	not detectable	
	Other tests as per IEC and ISO standards		Yes	
	a Reference method. b This is the standard LCSET for a transformer oil (see 6.1) and can be modified depending on the climatic condition of each country. Pour point should be minimum 10 °C below LCSET. c Standard LCSET for low temperature switchgear oil. d For bulk supply. e For delivery in drums and IBC. f After laboratory treatment (see 6.4). g The supplier shall declare the chemical family and function of all additives (3.3), and the concentrations in the cases of inhibitors, antioxidants and passivators (3.4). h At the end of oxidation stability tests. i In some countries there can be additional requirements, e.g. REACH in the EU. j Some individual PAH compounds can be determined by EN 16143.			
4.7	Cooling System			
	Total number of coolers (radiators) per reactor	pcs		
	Number of stand-by coolers (radiators)	pcs		
4.8	Reactor Bushings			
	Bushings			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type			
	- Line terminals		Cable box	
	- neutral end terminal		Bushing	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Rating current	A		
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Insulator material and color			
	Insulator type			
	Pitch circle diameter drilling flange			
	Overall length of bushing insulator	mm		
	Mass of bushing insulator	kg		
	Material of fitting			
	Dry withstand power frequency voltage	kV		
	Wet withstand power frequency voltage	kV		
	Routine power frequency test voltage (1 min)	kV		
	Voltage at which corona is not visible	mm/kV		
	Maximum diameter of bushing passing through current transformer chamber	mm		
	Minimum gap setting	mm		
	Arcing horns or rings		As per IEC standard	
	Radio influence voltage measured at 110% of the maximum line to ground operating voltage and at 1000kHz shall be less than	µV		
	Maximum symmetrical fault current	kA		
	Penetration of bushing into tank measured from bottom of fixing flange			
	All outdoor equipment must be suitable for live washing			
4.9	**Current Transformers**			
	Current Transformer in Line Bushing			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Number of current transformers per line terminals	pcs	N/A	
	Number of secondary cores	Pcs		
	Rated transformation ratio	A/A		
	Accuracy class			
	Rated output	VA		
	Current Transformer in Neutral end terminal			
	Number of current transformers per phase	pcs	1	
	Number of secondary cores	pcs	1	
	Rated transformer ratio	A/A	600/1	
	Accuracy class		Class X	
	Rated output	VA		
4.10	**Dimensions and Masses**			
	Overall dimensions of the assembled reactor in operation:			
	- length	mm		
	- width	mm		
	- height	mm		
	Total mass of the assembled reactor in operation	kg		
	Individual masses of reactor:			
	- core	kg		
	- windings	kg		
	- total mass excluding oil	kg		
	- oil mass in tank	kg		
	- oil mass in radiators	kg		
	- total oil required	kg		
		Litres		
	Dimensions of reactor arranged for transport:			
	- length	mm		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- width	mm		
	- height	mm		
	Mass of reactor arranged for transport	kg		
	Filling medium of reactor tank for transport		Oil	

Annex A: Equipment's suppliers (shall specify one supplier only according to qualification requirements)

Item	Manufacturer	Place of Manufacture	Place of testing and Inspection
25 MVAr Reactors			
Core plates			
Tanks			
Radiators			
Marshalling kiosk and/or cabinets			
Bushings			
Cable Box			
Oil			
Oil Valves			
Alarms			
Gas And Oil Actuated Relays			
Oil Temperature Indicators			
Winding Temperature Indicators			
Digital Meters			
MCBs			
Silicagel Breather			
Valves			
Pressure Relief Device			
Buchholz Relays			
CTs			
Terminal blocks			
Fuses			
Oil level indicator			

ANNEX B: NEPCO PROPERTY PLATE DETAILS (WILL PROVIDE AT ENG STAGE)

SHUNT REACTORS 25MVAR

SERIAL NO.	**NEPCO SERIAL NO.**	**S/S NAME**	**RATING VAR**	**RATIO K.V**

All NEPCO serial number shall mounted on separate plate.

ANNEX C

(Information to be supplied with Financial Bid)

SHUNT REACTORS

For the purposes of Bid evaluation, these losses are capitalized in accordance with the following formula:

Total Cost = IC + 2603.5 Pk

where:

- IC: Reactor initial cost, in JOD
- Pk: Total losses in kW

(Reactors) shall be evaluated based on the reactor Total Cost.

Description	unit	
1*25 MVAR SHUNT REACTORS (three phase) Total losses **"**The total losses at rated current, rated frequency at 75°C"	**kW**	

- **Rate of losses and price Schedules should be included with the financial envelope which should be closed and separated from the technical envelope.**

Annex D: Transformer oil specification

Table 3 – General specifications, Type A (fully inhibited high grade oils)

Property	Test method	Limits	
		Transformer oil	Low temperature switchgear oils
1 – Function			
Viscosity at 40 °C	ISO 3104[a] or ASTM D7042	Max. 12 mm^2/s	Max. 3,5 mm^2/s
Viscosity at –30 °C [b]	ISO 3104[a] or ASTM D7042	Max. 1 800 mm^2/s	–
Viscosity at –40 °C [c]	IEC 61868	–	Max. 400 mm^2/s
Pour point	ISO 3016	Max. –40 °C	Max. –60 °C
Water content	IEC 60814	Max. 30 mg/kg [d] / 40 mg/kg [e]	
Breakdown voltage	IEC 60156	Min. 30 kV / 70 kV [f]	
Density at 20 °C	ISO 12185 [a] or ISO 3675 or ASTM D7042	Max. 895 kg/m^3	
DDF at 90 °C	IEC 60247 [a] or IEC 61620	Max. 0,005	
2 – Refining/stability			
Colour	ISO 2049	L0,5 (less than 0,5)	
Appearance	–	Clear, free from sediment and suspended matter	
Acidity	IEC 62021-2[a] or 62021-1	Max. 0,01 mg KOH/g	
Interfacial tension	IEC 62961 [a] or ASTM D971	Min. 43 mN/m	
Total sulphur content	ISO 14596 [a] or ISO 8754	Max. 0,05 %	
Corrosive sulphur	DIN 51353	Not corrosive	
Potentially corrosive sulphur	IEC 62535	Not corrosive	
DBDS	IEC 62697-1	Not detectable (< 5 mg/kg)	
Inhibitors of IEC 60666	IEC 60666	(I) Inhibited oil: 0,08 % to 0,40 % (see 3.7)	
Metal passivator additives of IEC 60666	IEC 60666	Not detectable (< 5 mg/kg), or as agreed upon with the purchaser	
Other additives		See [g]	
2-furfural and related compounds content	IEC 61198	Not detectable (< 0,05 mg/kg) for each individual compound	
Stray gassing under thermo-oxidative stress	Procedure in Clause A.4 (oil saturated with air) in the presence of copper	Non stray gassing: < 50 µl/l of hydrogen (H_2) and < 50 µl/l methane (CH_4) and < 50 µl/l ethane (C_2H_6)	
3 – Performance			
Oxidation stability	IEC 61125: Test duration (I) Inhibited oil: 500 h	For oils with other antioxidant additives and metal passivator additives, see 6.12.2	
– Total acidity [h]	4.8.4 of IEC 61125:2018	Max. 0,3 mg KOH/g	
– Sludge [h]	4.8.1 of IEC 61125:2018	Max. 0,05 %	
– DDF at 90 °C [h]	4.8.5 of IEC 61125:2018	Max. 0,050	
4 – Health, safety and environment (HSE)[i]			
Flash point	ISO 2719	Min. 135 °C	Min. 100 °C
PCA content[j]	IP 346	< 3 %	
PCB content	IEC 61619	Not detectable (< 2 mg/kg)	

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a	Reference method.
b	This is the standard LCSET for a transformer oil (see 6.1) and can be modified depending on the climatic condition of each country. Pour point should be minimum 10 °C below LCSET.
c	Standard LCSET for low temperature switchgear oil.
d	For bulk supply.
e	For delivery in drums and IBC.
f	After laboratory treatment (see 6.4).
g	The supplier shall declare the chemical family and function of all additives (3.3), and the concentrations in the cases of inhibitors, antioxidants and passivators (3.4).
h	At the end of oxidation stability tests.
i	In some countries there can be additional requirements, e.g. REACH in the EU.
j	Some individual PAH compounds can be determined by EN 16143.

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