

Procurement of Transformers for Heo Hydro Electric Project (240 MW), Arunachal Pradesh.		Technical Data Sheets
		Volume II Section-IV
		Generator Transformer

Generator Transformers (Guaranteed Technical Particulars)				
Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
1	Generator Transformers			
1	Name of Manufacturer			
2	Applicable standards			
3	Application (Indoor/Outdoor)			
4	Type of construction			
4.A	(I)Reference ambient temperature			
	a) Maximum (°C)			
	b) Minimum (°C)			
4.B	a) Winding Hot Spot Temperature (°C)			
	b) Temperature rise in core by calculation (°C)			
5	Temp. gradient between windings and oil (°C)			
6.A	Rated Power, MVA (OFWF)			
6.B	i) Rated Voltage (HV)			
	ii) Rated Voltage (LV)			
	iii) Rated Frequency (Hz)			
	iv) Rated Load Current (A)			
7	Phases (Single/Three)			
8	Type of Cooling			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
9	No load current at rated frequency			
	a) At 90% rated voltage (A)			
	b) At 100% rated voltage (A)			
	c) At 110% rated voltage (A)			
10	Magnetizing in-rush current (A)			
11	Power factor of No-load current at normal voltage, ratio and frequency			
12	Losses			
12.1	i) No-load losses at rated voltage and frequency at principal tap			
	ii) No-load losses at the voltage corresponding to the highest tap			
	ii) Tolerance, if any, on the above values:			
12.2	Load losses at rated output, rated frequency and corrected for 75 deg. C Winding temperature at: (I^2R +Stray losses)			
	Principal tap			
	Highest tap			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	Lowest tap			
	Tolerance, if any, on the above values:			
12.3	Auxiliary losses at rated output, normal ratio, rated voltage, rated frequency and corrected for 75 deg. C			
	Tolerance, if any, on the above values:			
12.4	Total losses at normal ratio inclusive of auxiliary equipment losses: (No Load Loss + Load Loss + Auxiliary Loss)			
13	Regulation at full load at 75°C winding temperature at: a) upf b) 0.8pf			
14	Efficiency: At 100% load upf 0.8 lead 0.8 lag At 75% load upf 0.8 lead 0.8 lag At 50% load upf 0.8 lead 0.8 lag	%		
15	Load at maximum efficiency	%		

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
16	Fault level of system (in kA) and its duration (in sec)	kA (sec)	;	
17	Calculated short Circuit current (in kA) withstand capability for 3 seconds without exceeding temperature limit (i.e. Thermal ability to withstand SC current)	kA		
18	Test current (in kA) and duration (in ms) for short Circuit current test (i.e Dynamic ability to withstand SC)	kA & msec		
19	Maximum flux density in core and yoke			
	a) At 90% Voltage (Tesla)			
	b) At 100% Voltage (Tesla)			
	c) At 110% Voltage (Tesla)			
20	Capacitance between windings and			
	a) HV Winding to earth (PF)			
	b) LV Winding to earth (PF)			
21	Power and Energy Consumption of oil pumping equipment at -if applicable			
	a) Power consumption (kW)			
	b) Energy consumed at rated load (kWh)			
	c) Energy consumed at 75% rated load(kWh)			
	d) Energy consumed at 50% rated load(kWh)			
22.A	Resistance per phase at rated current and at 75 Deg C			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	a) HV Winding (ohm)			
	b) LV Winding (ohm)			
23.B	Percentage Impedance voltage at 75 Deg C, at nominal tap			
24	Thermal time constant			
25	Core			
	a) Type of core (Core or Shell)			
	b) Net core area (mm ²)			
	c) Type of joint between core & yoke			
	d) Material of core laminations & grade (built or interleaved)			
	e) Thickness of stampings (mm)			
	f) Hot rolled or cold rolled sheets			
	i) % silicon contents			
	ii) Specific loss w/kg at ... °C			
	iii) BIS certified (Yes/No)			
	g) Details of oil ducts in cores			
	i) Whether in the plane or at right angles to the plane of windings			
	ii) Across the plane of laminations			
	h) Core assembly			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	i) Whether core construction is with or without core bolts			
	ii) Insulation of core bolt			
	iii) Insulation of core bolt washers			
	iv) Insulation between core laminations			
	v) Core bolt insulation withstand voltage for 1 minute (kV r.m.s)			
	vi) Are the core bolts grounded. If so, how.			
	vii) Material, thickness & Insulation of core clamping plate			
	viii) Describe location/method of core grounding			
	ix) Max flux density in core at rated frequency at (Wb / m ²)			
	a) 90% Voltage			
	b) 100% Voltage			
	c) 120% Voltage			
26	Winding			
	i) Type and Material			
	a) H.V.			
	b) L.V.			
	ii) Current density at rated load & conductor area			
	a) H.V.			
	i) Current density (A/mm ²)			
	ii) Conductor area (mm ²)			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	b) L.V.			
	i) Current density (A/mm ²)			
	ii) Conductor area (mm ²)			
	iii) Maximum current density under short circuit	A/mm ²		
	a) H.V.			
	b) L.V.			
	iv) Insulation graded or ungraded			
	a) H.V. winding			
	b) L.V. winding			
	v) Type of Joints in winding			
	a) H.V. winding			
	b) L.V. winding			
	vi) Type of axial coil support			
	a) H.V. winding			
	b) L.V. winding			
	vii) Type of radial coil supports			
	a) H.V. winding			
	b) L.V. winding			
	viii) Maximum allowable torque on coil clamping bolts			
	ix) a) Whether HV winding are interleaved			
	b) Whether windings are pre-shrunk			
	c) Whether adjustable coil clamps are provided for HV and LV winding			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	d) Whether steel rings used for the windings, if so, whether they are split.			
	e) Whether electro-static shields are provided to obtain uniform voltage distribution in the HV windings.			
	x) Inter turn insulation			
	a) Extreme end turn reinforcement			
	b) End turns reinforcement			
	c) Reinforcement of turns adjacentappings			
	xi) Whether windings are varnish impregnated or merely dried under vacuum and flooded with hot dry oil			
	xii) Whether impregnated before assembly or after			
	xiii) Size of cooling ducts			
	xiv) Insulating material			
	a) Turn insulation of HV winding			
	b) Turn insulation of LV winding			
	c) Between core and lower voltage winding			
	d) Between higher and lower voltage winding			
	xv) No load current at frequency and at			
	a) 90 % Voltage			
	b) 100% Voltage			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	c) 120% Voltage			
	xvi) Magnetizing Current (A)			
	a) HV Winding			
	i) At 90% rated voltage			
	ii) At 100% rated voltage			
	iii) At 110% rated voltage			
	b) LV Winding			
	i) At 100% rated voltage			
	xvii) Leakage Reactance			
	a) HV Winding			
	b) LV Winding			
27	Press Board: i) Make ii) Type			
28	Conductor Insulating Paper i) Kraft paper ii) Thermally upgraded Kraft paper iii) Nomex			
29	Impulse volt-time characteristics of the transformer			
30	Off-circuit tap changer details			
	i) Manufacturer's name / make			
	ii) Type			
	iii) Rated Voltage			
	iv) Rated Current			
	v) No. of taps _____ (± range)			

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Generator Transformers (Guaranteed Technical Particulars)

Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	vi) Step Voltage			
31	Details of Bushings			
	a) Manufacturer,			
	i) Type,			
	ii) rated current and			
	iii) rated voltage			
	b) Name of bushing manufacturer			
	c) Standards applicable			
	d) Visible power frequency discharge voltage kV (rms)			
	e) One-minute dry/wet power frequency withstands test voltage kV (rms)			
	f) Lightning impulse withstand voltage kV (peak)			
	g) Switching impulse withstand voltage kV (peak)			
	h) Noise level (db)			
	i) Radio interference voltage for each bushing (micro volt)			
	j) Partial discharge level (pc)			
	k) Creepage distance (mm)			
	l) Weight of assembled single phase bushing (kg)			
	m) Spacing between bushings on the tank (mm)			
	n) Rated short time current (kA)			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	o) Duration of short time current (Sec)			
	p) Insulation material			
	i) Solid material			
	ii) Liquid volume (l)			
	iii) Gas volume (l)			
	q) Dimensional drawing (attached)			
32	Neutral Current transformers			
	a) Name of manufacturer			
	b) Type & location			
	c) Standard to which it conforms			
	d) Frequency (Hz)			
	e) i) Rated primary current (A)			
	ii) Rated Secondary current (A)			
	f) Insulation level			
	g) Turns ratio			
	h) Number of identical core			
	i) Rated output (VA) of the core			
	j) Class of Accuracy / Protection class			
	k) Knee point voltage			
	l) Magnetizing current at knee point voltage			
	m) Secondary resistance			
33	Phase Current Transformers		HV	

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Generator Transformers (Guaranteed Technical Particulars)				
Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	a) Name of Manufacturer			
	b) Type & Location			
	c) Standard to which it conforms			
	d) Frequency (Hz)			
	e) i) Rated Primary Current			
	ii) Rated Secondary Current			
	f) Insulation level			
	g) Turns Ratio			
	h) Number of identical cores			
	i) Rated output (VA) of the cores			
	j) Class of accuracy / Protection class			
	k) Knee point voltage			
	l) Magnetizing current at knee point voltage			
	m) Secondary resistance			
34	HV Connection Box and SF6 Insulated Transformer Termination-if applicable			
	a) Name of Manufacturer			
	b) Type			
	c) Standards to which it conforms			
	d) Frequency (Hz)			
	e) Maximum voltage (kV)			
	f) Rated current (A)			
	g) Short circuit withstand (kA-1 s)			

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Generator Transformers (Guaranteed Technical Particulars)

Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	h) Impulse level (kV)			
	i) SF6 concentration			
	j) SF6 pressure at 40°C (kPa)			
	k) Conductor size (mm ²)			
	l) Cable diameter range (mm)			
	m) Technical brochure			
35	Coolers / Heat exchanger-if applicable			
	a) Type and Make (Double tube/ Single tube)			
	b) Number of coolers for each transformer and capacity (kW)			
	c) Material of oil-to-water heat exchanger tubes			
	d) Total cooler losses with transformer operating at full load rating			
	e) Cooling water requirement			
	i) Flow rate at max. temperature of 30°C (L/min)			
	ii) Pressure (kPa)			
	iii) Pressure regulating arrangement			
	iv) Features offered for prevention of water ingress in oil in case of cooling tube leakage			
	v) Attach schematic drawing			
	f) Oil Pump			
	i) Capacity pump in L/min			

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Generator Transformers (Guaranteed Technical Particulars)				
Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	ii) Rated voltage			
	iii) Speed (rpm)			
	iv) Normal load kW			
	v) Locked rotor current (A)			
	vi) Efficiency of motor at full load (%)			
	vii) Temperature rise of motor at full load (°C)			
	viii) BHP of driven motor			
	ix) Whether pumps are suitable for continuous operation at 85% of their rated voltage			
	x) Type of cooling Equipment Control			
	xi) Temperature range over which control is adjustable			
	xii) Attach schematic drawing			
	g) Transformer loading capability in % with part of cooling tubes (at one bank) being out of circuit			
	i) 10% out circuit %			
	ii) 25% out circuit %			
	iii) 50% out of circuit %			
36	Pressure Relief device / Safety valve			
	a) Pressure at which safety valve will operate			
	b) Adjustable range for above			
	c) Opening time of valve and its characteristics			

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Generator Transformers (Guaranteed Technical Particulars)

Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	d) Pressure which transformer can safely withstand			
37	Temperature Indicators- Oil / Winding			
	a) Type and make			
	b) Indication range			
	c) Number of Indicators			
	d) Repeater for Control room			
	e) Setting range for alarm/trip			
	f) Pamphlets (to be attached)			
	g) Accuracy			
38	Oil / Water flow Indicators-if applicable			
	a) Type and make			
	b) Principle of operation			
	c) Flow Indication range			
	d) On/Off settings for control			
	e) Pamphlets			
39	Whether the following are designed for oil filling under full vacuum			
	a) Tank			
	b) Coolers			
	c) Conservators			
	d) Bushings			
40	Conservator			
	a) Type of conservator (attach details)			

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Generator Transformers (Guaranteed Technical Particulars)

Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	b) Volume between highest & lowest levels			
41	Total quantity of oil required for transformer			
	a) Including conservator and			
	b) Cooling system			
42	Quality of Oil			
	a) Governing standard			
	b) Resistivity			
	i) At 27°C (ohm-cm)			
	ii) At 90°C (ohm-cm)			
	c) Tan Delta values at 90°C			
	d) Water content threshold (ppm)			
	i) At the time of filling, sampled at room temp			
	ii) In operation, sampled hot			
	e) Dielectric strength (Break-down voltage) kV/mm			
	f) pH Value			
42	Gas and Oil operated relay			
	a) Make and type (attach pamphlets)			
43	Type and rating of phase and neutral terminal connectors			
44	Clearances mm			
	(attach drawings showing the clearance)			
	a) L.V. Termination			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	i) Spacing of LV terminals in air			
	ii) Clearance between phases in oil			
	iii) Clearance between phase and earth in oil			
	b) HV Termination			
	i) Clearance between phases in oil			
	ii) Spacing of HV terminals in air			
	iii) Clearance between phases tank and earth in oil			
	c) Other Clearance			
	i) Clearance of neutral to earth in air			
	ii) Clearance of neutral to earth in oil			
	iii) Clearance between coils			
	iv) Clearance between core and coils			
45	Approximate weight (kg):			
	a) Core			
	b) H.V. Winding			
	c) L.V. Winding			
	d) Core and Winding			
	e) Tank and fittings with accessories			
	f) Oil required for first filling			
	g) Untanking weight (Heaviest piece)			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	h) Total weight with oil and fittings			
46	Approximate overall dimensions (mm)			
	a) Length (attach drawing)			
	b) Breadth			
	c) Height			
47	Details of tank			
	a) Type of Tank (Bell type or tank with cover)			
	b) Approximate thickness of sides mm			
	c) Approximate thickness of bottom			
	d) Approximate thickness of cover mm			
	e) Location of tank joints			
	f) Joints welded or bolted			
	g) Material of gaskets provided in tank			
	h) Vacuum pressure for which transformer is designed			
	i) Drawing Enclosed			
48	Whether transformer is suitable for back-charge from HV side (Yes/No)			
49	Lifting Jack			
	i) Governing Standard			
	ii) No. of Jacks in one set			
	iii) Capacity (tonnes)			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	iv) Pitch (mm)			
	v) Lift (mm)			
	vi) Height in closed position (mm)			
	vii) Mean diameter of thread (mm)			
	viii) Jacks to be operated by common hydraulic package			
50	Control Cabinet			
	i) Make and type			
	ii) Class of protection			
	iii) Details of apparatus proposed to be housed in the Kiosk			
51	Marshalling Kiosk			
	i) Make and type			
	ii) Class of protection			
	iii) Details of apparatus proposed to be housed in the Kiosk			
52	Common Marshalling Box			
	i) Make and type			
	ii) Class of protection			
	iii) Details of apparatus proposed to be housed in the Box			
53	Details of anti-earthquake device provided			
54	Minimum clearance height for lifting core and winding from the tank (mm) / Minimum clearance height for lifting tank			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	cover (mm) for bell type of transformer			
55	a) No. of. bi-directional wheels provided			
	b) Type of Flanged wheel			
	c) Spacing of wheels			
	i) Long axis mm (Gauge distance)			
	ii) Shorter axis mm (Gauge distance)			
	d) Whether grease nipples provided in the wheel			
56	Jack Support			
	Location of Jacks from C/L			
	a) Longer axis			
	b) Shorter axis			
57	Proposed method of Transportation			
	(Detail planned route)			
58	Shipping details			
	a) Parts detached for transport			
	b) Weight of heaviest package to be transported Tons			
	c) Dimensions of largest package to be transported			
	i) Length mm			
	ii) Breadth mm			
	iii) Height mm			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	d) Gross weight to be handled			
	e) Method of protecting transformer winding during transport			
	Dynamic Short Circuit test report attached	(Yes/No)		
	Short Circuit Calculations attached in lieu of DSC Test report	(Yes/No)		
59	Oil handling system			
	a) Make			
	b) Type		Before filtration	After Filtration
	c) Break-down voltage (kV)			
	d) Moisture content (PPM)			
	e) Gas content (% volume)			
	f) Acidity (mg of KOH/g of oil)			
	g) Pre-filter			
	i) Flow capacity (l/h)			
	ii) Rating (mm)			
	h) Oil inlet pump			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	i) Capacity (l/h)			
	ii) Operating pressure (bar)			
	iii) Suction (m)			
	i) Rotary oil sealed pump			
	i) Nominal pumping speed (l/m)			
	ii) Cooling			
	j) Roots pump			
	i) Nominal pumping speed (m ³ /h)			
	k) Attach all technical data sheets			
50	TRANSFORMER OIL FILTRATION PLANT			
1	Type			
2	Make			
	Model No.			
	Capacity	Litre per hour		
	Standard			
	Overall Dimension	LxWxH		
	Weight	Tonnes		

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	Maximum Power Consumption	kW		
	Insulating Oil Media			
3	Inlet Pump			
	Make			
	Type			
	Capacity (L P H)			
	Power			
4	Inlet Pump-Stand By			
	Make			
	Type			
	Capacity (L P H)	M		
	Power	kW		
5	Heater Vessel			
	Make			
	Type			
	Construction			
	Total Heater Power	kW		
	Power			
6	Filter Vessel			
	Make			
	Construction			
	Type & No.			
	Degree of Filtration	Micron		
7	Degassing Chamber			
	Make			
	Construction			
	Type			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
8	Vacuums Pumps- for filtration			
	Make			
	Type			
	Capacity	(M ³ /HR)		
	Power			
	Type of Cooling			
	Make			
	Type			
	Capacity	(M ³ /HR)		
9	Vacuum Pumps for evacuation			
	Make			
	Type			
	Capacity	(M ³ /HR)		
	Power			
	Type of cooling			
	Make			
	Type			
	Capacity (M3 /HR)			
	Power			
	Type of cooling			
10	Outlet Pump			
	Make			
	Type			
	Capacity			

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Sl. No	Description	Units	To be filled by the Tenderer	Remarks (if any)
	Power			
	Discharge head	M		
11	Oil Hoses			
	For inlet			
	For outlet			
12	Digital vacuum Gauge			
	Make			
	Type			
13	VFD For Inlet & Outlet			
	Make			
	Rating			
14	Solenoid Valve			
	Make			
	Size for inlet & Outlet			
	Quantity			