SECTION - V

Technical Data Sheets
(to be filled up by the tenderer)

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.0	**Turbine, Governor and Main Inlet Valve**			
1.1	**Turbine**			
1.1.1	**Guaranteed characteristics**			
1.	General			
1.1	Manufacturer	-	_____	_____
1.2	Place of manufacture	-	_____	_____
1.3	Type designation	-	_____	_____
1.4	Applicable standards	-	_____	_____
2.	Main data			
2.1	Turbine rates output at rated net design and at rated speed	kW	_____	_____
2.2	Maximum continuous output at design net head	kW	_____	_____
2.3	Maximum continuous output at maximum net head	kW	_____	_____
2.4	Maximum continuous output at minimum net head	kW	_____	_____
2.5	Minimum output at the following heads and at rated speed			
	• Minimum net head	kW	_____	_____
	• Maximum net head	kW	_____	_____
2.6	Rated speed	rpm	_____	_____
2.7	Maximum runaway speed at following net head and at generator no-load (except friction losses)			
	• at net maximum net head	rpm	_____	_____
	• at rates net head	rpm	_____	_____
	• at minimum net head	rpm	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.8	Direction of rotation(viewed from drive end))	-	_____	_____
2.9	Water discharge through wicket gate output as per 2.1 above	$m^{3/s}$	_____	_____
2.10	Maximum leakage through wicket gate at maximum static head of	l/s	_____	_____
2.11	Maximum hydraulic axial thrust	kN	_____	_____
2.12	Axial thrust at 110% rated load rejected	kN	_____	_____
2.13	Fly wheel effect of turbine rotating parts	kg m^2	_____	_____
2.14	Fly wheel effect required from the generator	kg m^2	_____	_____
3.	Efficiency			
3.1	Turbine efficiency at rated net head and rated speed			
	- at 115% continuous rated output	%	_____	_____
	- at 100% continuous rated output	%	_____	_____
	- at 80% continuous rated output	%	_____	_____
	- at 60% continuous rated output	%	_____	_____
	- at 40% continuous rated output	%	_____	_____
3.2	Turbine efficiency at maximum net head And rated speed			
	- at 115% continuous rated output	%	_____	_____
	- at 100% continuous rated output	%	_____	_____
	- at 80% continuous rated output	%	_____	_____
	- at 60% continuous rated output	%	_____	_____
	- at 40% continuous rated output	%	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
3.3	Turbine efficiency at minimum net head and rated speed			
	- at 115% continuous rated output	%	_____	_____
	- at 100% continuous rated output	%	_____	_____
	- at 80% continuous rated output	%	_____	_____
	- at 60% continuous rated output	%	_____	_____
	- at 40% continuous rated output	%	_____	_____
3.4	Weighted average efficiency (according to clause 1.2.3 of specification)	%	_____	_____
3.5	Number of stay vanes	pcs	_____	_____
3.6	Number of wicket gates	pcs	_____	_____
4.	Maximum sound pressure level at a Distance of 1 m at rated operation			
	• at turbine pit	dB(A)	_____	_____
	• at draft tube manhole	dB(A)	_____	_____
5.	Weights			
5.1	Weight of finished-machined runner complete	kg	_____	_____
5.2	Weight of shaft	kg	_____	_____
5.3	Weight and designation of heaviest part or assembly of the turbine as prepared for shipment	kg	_____	_____
5.4	Heaviest turbine assembly to be handled by powerhouse crane during installation	kg	_____	_____
6.	Dimensions			
6.1	Turbine shaft diameter	mm	_____	_____
6.2	Required transport opening for largest turbine part			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• weight	mm	_____	_____
	• height	mm	_____	_____
1.1.2	**Information data**			
1.	Turbine water discharge quantities			
	• under maximum overload operation at maximum net head	$m^{3/s}$	_____	_____
	• at maximum runaway condition	$m^{3/s}$	_____	_____
	• at no-load at rated net head	$m^{3/s}$	_____	_____
2.	Turbine runner			
2.1	Dimensions of • inner inlet diameter	mm	_____	_____
	• outer inlet diameter	mm	_____	_____
	• discharge diameter	mm	_____	_____
	• net height of inlet	mm	_____	_____
2.2	Number of blades	pcs	_____	_____
3.	Spiral casing / stay ring			
3.1	Dimensions			
	• internal diameter of inlet extension piece	mm	_____	_____
3.2	Number of prefabricated sections of spiral case	pcs	_____	_____
3.3	Number of stay vanes	pcs	_____	_____
3.4	Number of wicket gates	pcs	_____	_____
4.	Draft tube			
4.1	Dimension			
	• discharge ring diameter	mm	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
5.	Turbine pit liner			
5.1	Inside diameter	mm	_____	_____
5.2	Material thickness	mm	_____	_____
6.	Guide bearing			
6.1	Maximum temperature rise above cooling medium, measured by embedded temperature detectors			
	• at continuous rated operation	K	_____	_____
	• at most unfavourable operating conditions as specified	K	_____	_____
6.2	Losses in the bearing at rated operating conditions	kW	_____	_____
6.3	Quantity of cooling water required (if applicable)	l/s	_____	_____
6.4	Capacity of bearing oil reservoir	l	_____	_____
7.	Servomotors (Guide Vane/Runner Blade)			
7.1	Number of servomotors	pcs	_____	_____
7.2	Full stroke	mm	_____	_____
7.3	Bore of cylinders	mm	_____	_____
7.4	Active volume	cm3	_____	_____
7.5	Maximum operating pressure	bar	_____	_____
7.6	Minimum operating pressure	bar	_____	_____
7.7	Max. operating energy per servomotor	kNm	_____	_____
7.8	Min. operating energy per servomotor	kNm	_____	_____
8.	Weights			
8.1	Total weight of complete turbine delivery	tons	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
8.2	Heaviest pieces for erection			
	• Spiral case	tons	_____	_____
	• Draft tube	tons	_____	_____
9.	Dimensions			
9.1	Maximum diameter and designation of turbine part to be removed through generator stator bore	mm	_____	_____
9.2	Minimum distance between centerlines of adjacent units	mm	_____	_____

1.1.3 **Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the tenderer. The tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents/descriptions

1. Compute pressure rise at turbine inlet under the most unfavourable conditions (load acceptance and rejection) as per the specification. Conditions considered as well as governor acting times to be clearly indicated in the computations
2. Compute turbine speed rise under conditions as above and for following load rejection parameters

    - From 115% rated output to zero
    - From 100% rated output top zero
    - From 80% rated output to zero
    - From 60% rated output to zero
3. Expected flow characteristics during closing and opening of wicket gates as function of time.
4. Expected performance curves for the rated/maximum/minimum net heads at different runner blade angles. The curves shall also show the overload output at maximum possible wicket gates opening extending beyond the guarantee points.
5. Provide dimensional drawing (cross section) of turbine and associated equipment showing main dimensions.
6. Describe proposed shaft seal system, preferably illustrated by schematic diagram. Figures of the required quantities of sealing water and / or compressed air to be given.
7. Provide information on model or field performance tests performed on a turbine which is hydraulically similar to the proposed turbine. Indicate at least the following:

    - Place of model of field tests
    - Year of model or field tests
    - Designed rated turbine output

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• Rates net head • Rated speed			
1.2	**Governing System**			
1.2.1	**Guaranteed characteristic**			
1.	General			
1.1	Manufacturer			
	• Control unit	-	_____	_____
	• Hydraulic unit	-	_____	_____
1.2	Placed of manufacture			
	• Control unit	-	_____	_____
	• Hydraulic unit	-	_____	_____
1.3	Type designation			
	• Control unit	-	_____	_____
	• Hydraulic unit	-	_____	_____
1.4	Applicable standards	-	_____	_____
2.	Main data			
2.1	Sensitivity of governor to respond to Minimum speed change of rated speed	%	_____	_____
2.2	Maximum dynamic pressure for total load rejection of both turbines working in parallel on 110% load at maximum net head	bar	_____	_____
2.3	Maximum speed rise for total load rejection of both turbines working in parallel on 110% load at maximum net head	%	_____	_____
2.4	Governor operating oil pressure			
	• minimum	-	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• maximum	-	_____	_____
2.4	Range of adjustment of gain control			
	• Proportional gain	-	_____	_____
	• Derivative gain	s^{-1}	_____	_____
	• Integral gain	s	_____	_____
1.2.2	**Informative data**			
1.	Governor oil pumps			
1.1	Number of main oil pumps	-	_____	_____
1.2	Type of oil pumps	-	_____	_____
1.3	Unit governor pump discharge	1/mm	_____	_____
	at pressure	bar	_____	_____
1.4	Power rating of main pump motor	kW	_____	_____
1.5	Power rating of jockey pump motor	kW	_____	_____
2.	Pressurised accumulator tank			
2.1	Total oil volume	1	_____	_____
2.2	Design pressure	bar	_____	_____
2.3	Minimum possible operating cycles of wicket gates (close-open) without recharging tank	-	_____	_____
3.	Sump tank			
3.1	Total oil volume	1	_____	_____
4.	Hydraulic oil			
4.1	Total quantity of oil required for complete system including servomotors	1	_____	_____
4.2	Oil quantity	-	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
5.	Weight of complete governor actuator cabinet with pump set equipment	kg	_____	_____

1.2.3 **Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or special technical features of his offer by additional documents/ descriptions.

1. Description of the governor, including schematic and block diagrams
2. Drawing showing overall dimensions and general arrangement of equipment
3. Description and technical data of the programmable, numerical type control unit
4. Applicable method and type of speed sensing equipment
5. Explanations of failsafe provisions according to the specification
6. Detail on the operating time adjustment for wicket gate closing and opening as per technical specification

1.3 Turbine main inlet valve

1.3.1 Guaranteed characteristic

1.	General			
1.1	Manufacturer	-	_____	_____
1.2	Place of manufacture	-	_____	_____
1.3	Type designation	-	_____	_____
	1.4 Applicable standards	-	_____	_____
2.	Main data			
2.1	Maximum leakage from main valve when Fully closed against maximum head in (with new seal)			
	• through service seal	1/min	_____	_____
	• through maintenance seal	1/min	_____	_____
2.2	Maximum head loss through the valve at a Flow required for rated turbine output Rated net head	m	_____	_____
2.3	Maximum torque required to close the valve with a flow corresponding to			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• Rated turbine output at rates net head	Nm	_____	_____
	• Specified turbine overload output at rates net head	Nm	_____	_____
	• Specified turbine overload output at rates net head	Nm	_____	_____
2.4	Main dimensions of main inlet valve			
	• Inside diameter	mm	_____	_____
	• Length of valve body (excluding Extensions)	mm	_____	_____
	• Maximum distance from horizontal centerline of valve to lowest portion of assembly	mm	_____	_____
2.5	Lowest factor of safety (referred to design stress) for any hydraulically loaded part of the valve	-	_____	_____
2.6	Valve operating oil pressure			
	• minimum	bar	_____	_____
	• maximum	bar	_____	_____
1.3.2	**Informative data**			
1.	Head loss through the valve at a flow required for rated turbine output			
	• at minimum net head	m	_____	_____
	• at maximum net head	m	_____	_____
2.	Servomotor			
2.1	Make	-	_____	_____
2.2	Nominal design oil pressure	bar	_____	_____
2.3	Active volume	cm^3	_____	_____
2.4	Range of opening time	s	_____	_____
2.5	Range of closing time	s	_____	_____
3.	Oil pressure unit			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
3.1	Number of main oil pumps	-	_____	_____
3.2	Type of oil pumps	-	_____	_____
3.3	Oil pump discharge capacity at pressure	1/min	_____	_____
3.4	Power rating of main pump motor	kW	_____	_____
3.5	Power rating of jockey pump motor	Kw	_____	_____
4.	Pressured accumulator tank			
4.1	Total oil volume	1	_____	_____
4.2	Design pressure	bar	_____	_____
4.3	Minimum possible operating cycles of main inlet valve (close-open) without recharging tank	-	_____	_____
5.	Sump tank			
5.1	Total oil volume	1	_____	_____
6.	Hydraulic volume			
6.1	Total quantity of oil required for Complete system including servomotor	1	_____	_____
6.2	Oil quality	-	_____	_____
7.	Weights			
7.1	Weight of complete main inlet valve	kg	_____	_____
7.2	Weight of complete oil pressure unit with pump set equipment	kg	_____	_____
7.3	Estimated shipping weight of valve	kg	_____	_____
7.4	Maximum weight of valve assembly to Be handled by powerhouse crane	kg	_____	_____
8.	Dimensions			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
8.1	Minimum floor opening required for Valve installation/removal			
	• Width	mm	_____	_____
	• Length	mm	_____	_____

1.3.3 Information to be supplied together with the bid

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or special technical features of his offer by additional documents/ descriptions.

1. Indicate type of construction for valve body and rotor
2. Describe method of operation on closure of the valve
3. Specify proposed type of by-pass valve
4. Describe method of operation of the automatic air inlet and vacuum release valve
5. Specify proposed type of service deal control valve
6. Provide dimensional drawing with cross section showing the type of trunnion seal, bearing, general arrangement of major valve parts and main dimensions
7. Provide schematic and block diagram of complete main inlet valve system
8. Indicate expected maximum dynamic and static loads on foundation for the most unfavourable conditions (opening/closure)
9. Provide information on field performance tests performed on a main inlet valve which is similar to the proposed valve. Indicate at least the following:
   - Place of field test
   - Year of field test
   - Size of valve
   - Design pressure

2.0 Generator, Excitation, AVR

2.1 Generator

2.1.1 Guaranteed characteristic

1.	General			
1.1	Manufacturer	-	_____	_____
1.2	Place of manufacture	-	_____	_____
1.3	Type designation	-	_____	_____
1.4	Applicable standards	-	_____	_____
2.	Main data			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.1	No. of phase	-	_____	_____
2.2	Generator continuous rating at rated frequency and voltage and:			
	- 0.9 power factor (lagging)	MVA	_____	_____
	- At unity power factor	MVA	_____	lagging
2.3	Rated power factor	-	_____	_____
2.4	Generator rated voltage	kV	_____	_____
	Guaranteed voltage range	%	_____	_____
2.5	Generator losses at full load, rated Voltage and power factor:			
	- Constant losses	kW	_____	_____
	- Load losses	kW	_____	_____
2.6	Rated frequency	Hz	_____	_____
2.7	Rated synchronous speed	rpm	_____	_____
2.8	Direction of rotation (viewed D.E)		_____	_____
2.9	Design runaway speed	rpm	_____	_____
	Lowest factor of safety (referred to yield strength) for a generator rotating part at runaway speed)	-	_____	_____
2.10	Maximum peripheral speed at runaway speed	m/s	_____	_____
2.11	Flywheel effect of the generator rotating parts, excluding turbine wheel:			
	- Inertia constant (H)	s	_____	_____
3.	Efficiency			
3.1	Generator efficiency at rated voltage, frequency and power factor			
	- at 115% continuous rated output	%	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	(MVA)			
	- at 100% continuous rated output (MVA)	%	_____	_____
	- at 80% continuous rated output (MVA)	%	_____	_____
	- at 60% continuous rated output (MVA)	%	_____	_____
	- at 40% continuous rated output (MVA)	%	_____	_____
3.2	Weighted average efficiency	%	_____	_____
	Corresponding to average generator total losses	kW	_____	_____
4.	Temperatures			
4.1	Maximum generator temperature rise above inlet cooling air temperature (40˚C) with the generator delivering rated output continuously at rated frequency and power factor and 90%-100% rated voltage			
	- Stator winding, measured by RTD	K	_____	_____
	- Field winding, measured by resistance	K	_____	_____
	Maximum temperature rise above inlet cooling water temperature (30˚C) with the generator delivering rated output continuously:			
	- Thrust bearing pad, measured by embedded temperature detector	K	_____	_____
	- Guide bearing segments, measured by embedded temperature detector	K	_____	_____
4.2	Temperature limit assigned by the Bidder to the generator:			
	- Stator winding, measured	K	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	- Field winding resistance	K	_____	_____
5.	Electrical characteristics			
5.1	Generator short-circuit ratio	p.u	_____	_____
5.2	Generator synchronous reactance			
	- Direct axis	p.u	_____	_____
	- Quadrature axis	p.u	_____	_____
5.3	Generator transient reactance			
	- Direct axis	p.u	_____	_____
	- Quadrature axis	p.u	_____	_____
5.4	Generator subtransient reactance			
	- Direct axis	p.u	_____	_____
	- Quadrature axis	p.u	_____	_____
5.5	Generator negative phase sequence reactance	p.u	_____	_____
5.6	Generator zero phase sequence reactance	p.u	_____	_____
5.7	Ratio of X''_q to X''_d	-	_____	_____
5.8	Telephone harmonic factor as specified in IEC-34	%	_____	_____
6.	Excitation conditions			
6.1	Maximum admissible continuous generator output when charging a transmission line under-excited without the generator becoming unstable or self-excited, at rated frequency and rated voltage	MVAr	_____	_____
6.2	Ratings of field winding at nominal			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	operating conditions of generator (corrected for 75˚C winding temperature)			
	- Field current	A	_____	_____
	- Field voltage	V	_____	_____
6.3	Maximum permissible continuous field Current	A	_____	_____
7.	Weight			
7.1	Weight of generator rotating parts Including shafts	kg	_____	_____
7.2	Weight of heaviest assembly or part of the generator to be lifted by the powerhouse crane	kg	_____	_____
7.3	Weight and name of heaviest part or assembly of the generator, as prepared for shipment	kg	_____	_____
8.	Dimensions			
8.1	Minimum required crane hook clearance above service bay floor elevation, for erection, dismantling or maintenance of the generator by means of the powerhouse crane	mm	_____	_____
8.2	Overall dimension of largest generator part or assembly, as prepared for shipment			
	- Length	mm	_____	_____
	- Height	mm	_____	_____
	- Width	mm	_____	_____
9.	Segregated losses at nominal operating conditions			
9.1	Constant losses			
	- Core losses	kW	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	- Ventilation losses	kW	_____	_____
	- Friction losses in top guide bearing	kW	_____	_____
9.2	Load losses			
	- I^2R losses in armature winding Including additional losses (corrected For 75˚C)	kW	_____	_____
	- I^2R Losses in field winding (corrected for 75˚C)	kW	_____	_____
	- Excited system	kW	_____	_____
9.3	Friction losses in combined thrust and Guide bearing			
	- Total losses caused by generator rotor, turbine runner and hydraulic thrust	kW	_____	_____
	- Losses caused by generator rotor only	kW	_____	_____
9.4	Total losses	kW	_____	_____
2.1.2	**Informative data**			
1.	Generator time constant			
	- Direct axis, open circuit transient time constant (T'_{do})	s	_____	_____
	- Direct axis, short-circuit transient time constant (T'a)	s	_____	_____
	- Armature short-circuit time constant (T_n)	s	_____	_____
2.	Dimensions			
2.1	Diameter of stator frame	mm	_____	_____
2.2	Generator stator bore, diameter	mm	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.3	Generator effective core length	mm	_____	_____
2.4	Diameter of rotor	mm	_____	_____
2.5	Diameter of shaft	mm	_____	_____
3.	Maximum expected current density (nominal operation)			
	- Stator winding	A/mm^2	_____	_____
	- Field winding	A/mm^2	_____	_____
4.	Generator braking jacking system (if provided)			
	- No of braking cylinders	pcs	_____	_____
	- Speed at which brakes may be applied for routine operation	rpm	_____	_____
	- Braking time for conditions as above	s	_____	_____
5.	Air-water heat-exchangers (stator air Coolers)			
	- No of units	pcs	_____	_____
6.	Quantity of cooling water required			
	- Air coolers, total	l/s	_____	_____
	- Combined thrust/guide bearing oil cooler	l/s	_____	_____
	- Upper guide bearing oil-cooler	l/s	_____	_____
7.	Thrust bearing			
	Total load on thrust bearing, including rotating turbine parts and hydraulic thrust	kN	_____	_____
	- Number of thrust bearing pads	pcs	_____	_____
	- Specific load on thrust bearing at			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	nominal operation	N/mm2	_____	_____
	- Total oil content of bearing housing	l	_____	_____
8.	Generator space heaters			
	- Number of units	pcs	_____	_____
	- Total rating of all units	kW	_____	_____
9.	Number of sections into which the generator stator is divided (for transportation)	pcs	_____	_____
10.	Net weight of complete generator, incl. Cooler, racks, platform etc. as offered	tons	_____	_____
2.1.3	**Current/voltage transformer, surge arrester and neutral grounding cubicle**			
1.	General			
1.1	Rated voltage of equipment	kV	_____	_____
1.2	Highest voltage for equipment U_m	kV	_____	_____
1.3	Rated frequency	Hz	_____	_____
1.4	Rated short duration power frequency withstand voltage, 1 min	kV_{rms}	_____	_____
1.5	Rated lightning impulse withstand Voltage	kV_{peak}	_____	_____
1.6	Applicable standards	-	_____	_____
2.	Current transformers			
2.1	Make	-	_____	_____
2.2	Type	-	_____	_____
2.3	Neutral-end current transformers			
	• Rated primary current	A	_____	_____
	• Rated secondary current	A	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• Accuracy class/burden of CT1	-/VA	_____	_____
	• Accuracy class/burden of CT2	-/VA	_____	_____
	• Accuracy class/burden of CT3	-/VA	_____	_____
	• Accuracy class/burden of CT4	-/VA	_____	_____
	• Rated short-time thermal current, 1 s	kA_{rms}	_____	_____
	• Rated dynamic current	kA_{peak}	_____	_____
2.4	Line-end current transformers			
	• Rated primary current	kA_{peak}	_____	_____
	• Rated secondary current	A	_____	_____
	• Accuracy class/burden of CT5	-/VA	_____	_____
	• Accuracy class burden of CT6	-/VA	_____	_____
	• Accuracy class burden of CT7	-/VA	_____	_____
	• Accuracy class burden of CT10	-/VA	_____	_____
	• Accuracy class burden of CT11	-/VA	_____	_____
	• Rated short-time thermal current, 1 s	kA_{rms}	_____	_____
	• Rated dynamic current	kA_{peak}	_____	_____
3.	Potential transformers			
3.1	Make	-	_____	_____
3.2	Type	-	_____	_____
3.3	Rated transformation ratio			
	• For protection	kV/V	_____	_____
	• For measuring	kV/V	_____	_____
	• For AVR	kV/V	_____	_____
3.4	Accuracy class/rated burden			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• For protection	kV/V	_____	_____
	• For measuring	kV/V	_____	_____
	• For AVR	kV/V	_____	_____
4.	Surge arrestors			
4.1	Rated voltage (U_r)	kV	_____	_____
4.2	Maximum continuous operating voltage (U_c)	kV	_____	_____
4.3	Nominal discharge current (8/20 µs)	kA	_____	_____
4.4	Pressure relief rated current	kA_{rms}	_____	_____
4.5	Line discharge class	-	_____	_____
2.1.4	**Informative data**			
1.	Grounding transformer			
1.1	Rated continuous power (both winding)	kVA	_____	_____
1.2	Rated voltages (no-load)			
	• HV winding	kV	_____	_____
	• LV winding	V	_____	_____
2.	Grounding resistor			
2.1	Resistance	ohm	_____	_____
2.2	Rated voltage	V	_____	_____
2.3	Maximum continuous current	A	_____	_____
2.4	Maximum current for one minute	A	_____	_____
3.	Dimensions			
3.1	Dimensions of complete 3-phase PT and Surge protection cubicle			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• Length	mm	_____	_____
	• Depth	mm	_____	_____
	• Height	mm	_____	_____
3.2	Dimensions of the neutral grounding Cubicle			
	• Length	mm	_____	_____
	• Depth	mm	_____	_____
	• Height	mm	_____	_____

2.1.5 Information to be supplied together with the bid

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or special technical features of his offer by additional documents/descriptions

1. Description of proposed construction and procedure for erection at site for the generator stator and rotor with view to transport limitations
2. Description of applicable stator winding insulation (material, insulation, method etc)
3. Cross section through a slot with winding
4. Description of rotor pole fitting including type of rotor rim construction
5. Description of proposed bearing insulation to prevent shaft current
6. Description of bearing seal system including measures to prevent discharge of oil from bearing
7. Description of high pressure lubrication system for the thrust bearing
8. Description and schematic diagram of the combined braking and jacking system
9. Dimensional drawing of the generator with major dimensions
10. Diagrams with electrical characteristics
    - No load
    - Short circuit curve
    - Capacity curves (power chart) for rated output to normal factor and 0.9/1.0/1.1xnormal voltage
    - Load curves (V-curves)
    - Inverse current I_2=f(t)
11. Calculated no load harmonics in the voltage wave form
12. Supporting documents for the guarantor output and efficiencies (reference)

2.2 Excitation and AVR system

2.2.1 Guaranteed characteristics

1. General

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.1	Manufacturer	-	_____	_____
1.2	Place of manufacture	-	_____	_____
1.3	Type designation	-	_____	_____
1.4	Applicable standards	-	_____	_____
2.	Main data			
2.1	Ratings of excitation system at rated generator output and power factor (hot rotor winding)			
	- Field voltage	V	_____	_____
	- Field current	A	_____	_____
	- Field power	kW	_____	_____
2.2	Ceiling voltage in per units of rated Field voltage			
	- Ceiling voltage at no load	p.u	_____	_____
	- Ceiling voltage at rated load	p.u	_____	_____
2.3	Field current at rated ceiling voltage	A	_____	_____
2.4	Excitation system voltage repose ratio	l/s	_____	_____
2.5	Response time to reach 95% of the difference between rated ceiling voltage and full load field voltage	s	_____	_____
2.6	Time to each +0.5% of ceiling Voltage from rated field voltage	s	_____	_____
2.7	Maximum time period for operation at Ceiling voltage without damage	s	_____	_____
2.8	Date of excitation system at 110% rated generator terminal voltage, power factor 0.9 and maximum generator power			
	- Field voltage	V	_____	_____
	- Field current	A	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.9	Maximum continuous output Capability of one 100% excitation			
	- Maximum field current	A	_____	_____
	- Maximum field voltage	V	_____	_____
2.10	maximum duration of over excitation period	s	_____	_____
2.11	Time to reach 5% limit of generator terminal voltage in case of load rejection	s	_____	_____
2.12	maximum overshot of generator terminal voltage in case of load rejection	%	_____	_____
2.13	Settling time to reach 0.5% limit of generator terminal voltage after overspread conditions	s	_____	_____
2.14	Range of voltage level setting	%	_____	_____
2.15	Range of manual control of excitation	%	_____	_____
3.	Voltage Regulating System			
3.1	Voltage regulator, make	-	_____	_____
3.2	Voltage regulator, type	-	_____	_____
4.	Rectifier			
4.1	Type of diodess	-	_____	_____
4.2	Ratings of diodes	-	_____	_____
4.3	Rated current of rectifier	A	_____	_____
4.4	rated voltage of rectifier	V	_____	_____
4.5	Maximum safe operating temperature	˚C	_____	_____
4.6	Maximum surge current rating	A	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
4.7	Max. permissible duration of surge current	s	_____	_____

2.2.2 Information to be supplied together with the bid

At least the information listed hereunder shall be given by the Tenderer. The tenderer may support advantages in his design of the delivery or special technical features of his offer by additional documents / description

1. Description and schematic diagram of the proposed excitation system including field flashing equipment.
2. \Description of the voltage regulating system giving technical characteristics and all necessary information on automatic and manual control, change over from automatic to manual control and vice versa, as well as on the protective and limiting devices
3. Describe method of equal load sharing between rectifier elements
4. Describe method used to prevent damage due to reverse field current during pull-out conditions
5. Information on field winding monitoring system
6. Describe method used to provide a signal to annunciate failure of diode and/or fuse

3.0 Power Transformer

3.1 Transformers

3.1.1 Guaranteed characteristics

1.	General			
1.1	Manufacturer	-	_____	_____
1.2	Place of manufacture	-	_____	_____
1.3	Type designation	-	_____	_____
1.4	Applicable standards	-	_____	_____
2	Main data			
2.1	No. of phases	-	_____	_____
2.2	No. of windings	-	_____	_____
2.3	Rated continuous power of each winding at all tappings and of max. cooling water temperature (with one cooling unit out of service)	MVA	_____	_____
2.4	Rated frequency	Hz	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.5	Rated voltages (no-load)			
	* HV winding (at principal tapping)	kV	_____	_____
	* LV winding	kV	_____	_____
2.6	Voltage adjustment (on HV side)	%	_____	_____
2.7	Highest voltage of equipment U_m for			
	* HV winding	kV	_____	_____
	* LV winding	kV	_____	_____
2.8	Vector group	-	_____	_____
2.9	Type of cooling	-	_____	_____
2.10	Percent impedance voltage at rated Power referred to 75˚C winding temperature			
	• At principal tapping	%	_____	_____
	• At tapping weigh highest voltage	%	_____	_____
	• At tapping with lowest voltage	%	_____	_____
3.0	Losses			
3.1	No-load losses at rated voltage and rated frequency	kW	_____	_____
3.2	Load losses at rated power, frequency and at principal tapping, referred to 75˚C winding temperature	kW	_____	_____
3.3	Total losses (as per 3.1 and 3.2)	kW	_____	_____
4.0	Temperature			
4.1	Maximum temperature rises at rated Power, on tap producing highest losses			
	• Top oil (measured by thermometer)	K	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• Windings (measured by resistance)	K	_____	_____
5.0	Electrical characteristics			
5.1	Short duration separate source power Frequency withstand voltage			
	• HV winding (design value)	kV_{rms}	_____	_____
	• HV neutral	kV_{rms}	_____	_____
	• LV winding	kV_{rms}	_____	_____
5.2	Lightning impulse withstand voltage			
	• HV winding	kV_{peak}	_____	_____
	• LV winding	kV_{peak}	_____	_____
5.3	Induced AC withstand voltage			
	• HV winding	kV_{rms}	_____	_____
	• LV winding	kV_{rms}	_____	_____
5.4	Maximum partial discharge voltage (HV side)	kV_{rms}	_____	_____
6.0	Off-circuit tap changer			
6.1	Make	-	_____	_____
6.2	Type	-	_____	_____
6.3	Number of steps	-	_____	_____
6.4	Rated through current	A	_____	_____
6.5	Rated step voltage	V	_____	_____
7.0	Maximum sound pressure level (according to IEC 551)			
	• at no-load	dB(A)	_____	_____
	• at rated current	dB(A)	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
8.0	Weights			
	• Total weight of complete transformer (filled with oil)	kg	_____	_____
	• Weight of oil filling	kg	_____	_____
	• Transportation weight	kg	_____	_____
9.0	Dimensions			
	• Overall length	mm	_____	_____
	• Overall width	mm	_____	_____
	• Overall height	mm	_____	_____
10.0	Electrical Characteristics			
10.1	Calculated no-load losses at rated frequency and			
	• at 95% rated voltage	kW	_____	_____
	• at 105% rated voltage	kW	_____	_____
10.2	Calculated load losses at rated power, Frequency and			
	• at highest tapping	kW	_____	_____
	• at lowest tapping	kW	_____	_____
3.1.2	**Informative data**			
1.	Electrical characteristics			
1.1	Nominal currents			
	• HV principal tapping	A	_____	_____
	• HV highest tapping	A	_____	_____
	• HV lowest tapping	A	_____	_____
	• LV	A	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.2	Design current density at nominal rating			
	• HV winding	A/mm^2	_____	_____
	• LV winding	A/mm^2	_____	_____
1.3	No-load current on HV side at rated voltage and frequency	A	_____	_____
1.4	Inherent voltage regulation at rated power, principal tapping and			
	• Power factor 1.0	%	_____	_____
	• Power factor 0.8	%	_____	_____
1.5	Coupling capacitance between HV and LV winding, per phase	nF	_____	_____
1.6	Zero sequence impedance X. for 3-phase bank	ohm	_____	_____
2.	Constructional features			
2.1	Type of core	-	_____	_____
2.2	Maximum flux density in limbs and Yokes at rated conditions	T	_____	_____
2.3	Minimum vacuum withstand of the tank	Pa	_____	_____
3.	Transformer bushings			
3.1	Minimum over pressure withstand of the Tank	bar	_____	_____
3.2	HV bushings/cable termination			
	• Manufacturer	-	_____	_____
	• Type	-	_____	_____
	• Current rating	A	_____	_____
	• Voltage rating	kV	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• Cantilever strength	kN	_____	_____
3.3	HV neutral bushing			
	• Manufacturer	-	_____	_____
	• Type	-	_____	_____
	• Current rating	A	_____	_____
	• Voltage rating	kV	_____	_____
	• Cantilever strength	kN	_____	_____
	• Creeping distance in air	mm	_____	_____
3.4	LV bushing			
	• Manufacturer	-	_____	_____
	• Type (kind)	-	_____	_____
	• Current rating	A	_____	_____
	• Voltage rating	kV	_____	_____
	• Cantilever strength	kN	_____	_____
	• Creeping distance in air	mm	_____	_____
3.5	Busing CT's detail	-	_____	_____
4.	**Cooling system**			
4.1	ONAN/ONAF Cooler			
	• No of Radiators		_____	_____
	• Overall Dimension(lxbxh)		_____	_____
	• Thickness of radiator tube		_____	_____
	• Vacuum withstand capability		_____	_____
4.2	Fan/motor			
	• Manufacturer	-	_____	_____
	• Type	-	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• Number of connected/stand by units	pcs	_____	_____
	• Rated power of motor	kW	_____	_____
	• Estimated time constant for Natural/Forced air cooling	hrs		
5.	**Insulating oil**			
	• Supplier	-	_____	_____
	• Type and trademark	-	_____	_____
6.	**Dimensions**			
6.1	Rail gauges for			
	• Longitudinal movement	mm	_____	_____
	• Transversal movement	mm	_____	_____

3.1.3 Information to be supplied together with the bid

At least the information listed hereunder shall be given by the Tenderer. The tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents/descriptions

1. Describe lap procedure for core lamination and lamination (magnetic losses) being used
2. Give details of types of windings and their arrangement
3. Provide dimensional drawing of transformer showing main dimensions and weight
4. Detail of rails
5. List of references of comparable transformers already supplied and installed, comprising of at least:
    - Power rating
    - Rated voltages
    - Year of delivery
    - Name of station(client)

4.0 LV AC System

4.1 Guaranteed characteristics

1.	General (applicable to all switchgear)			
1.1	Nominal voltage	V	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.2	Highest voltage for equipment Um	V	_____	_____
1.3	Rated frequency	Hz	_____	_____
1.4	Power frequency withstand voltage 1 minute			
	- for main circuit	V	_____	_____
	- for control circuits	V	_____	_____
1.5	Applicable standards	-	_____	_____
2.	Unit auxiliary board			
2.1	Cubicle assemblies			
2.1.1	Make	-	_____	_____
2.1.2	Type designation	-	_____	_____
2.1.3	Rated current of busbar and board	A	_____	_____
2.1.4	Maximum temperature rise of busbar at rated current	K	_____	_____
2.1.5	Short circuit rating of main circuits			
	- initial symmetrical short time current, 1 s	kV_{rms}	_____	_____
	- peak withstand current	kV_{peak}	_____	_____
2.1.6	Protection class	-	_____	_____
2.2	Circuit breaker			
2.2.1	Manufacturer	-	_____	_____
2.2.2	Type	-	_____	_____
2.2.3	Number of poles	-	_____	_____
2.2.4	Rated current (at 40˚C)	A	_____	_____
2.2.5	Rated short circuit breaking current			
	- symmetrical	kV_{rms}	_____	_____
	- asymmetrical	kV_{rms}	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.2.6	Rated short circuit making current	kV_{peak}	_____	_____
2.2.7	Permissible short time current I s	kV_{rms}	_____	_____
2.2.8	Dynamic short time current	kV_{peak}	_____	_____
2.2.9	Total opening time (instantaneous)	s	_____	_____
2.2.10	Total closing time	s	_____	_____
2.2.11	Type of overcurrent relay	-	_____	_____
2.2.12	Basic function of release system	-	_____	_____
2.2.13	Adjustable range of overload protection	% I_r	_____	_____
2.2.14	Adjustable range of overcurrent protection	% I_r	_____	_____
2.2.15	Adjustable range of delay time for overcurrent protection	s	_____	_____
2.3	Mould case circuit breaker (outgoing circuits)			
2.3.1	Manufacturer	-	_____	_____
2.3.2	Type	-	_____	_____
2.3.3	Applicable	-	_____	_____
2.3.4	Number of poles	-	_____	_____
2.3.5	Short-circuit current limiting characteristics	yes/no	_____	_____
2.3.6	symmetrical short circuit breaking current	kV_{rms}	_____	_____
2.3.7	Short-circuit making current	kV_{peak}	_____	_____
2.3.8	Adjustable range of overload protection	% I_r	_____	_____
2.3.9	Instantaneous overcurrent protection	% I_r	_____	_____
2.4	Current transformers (incoming circuits)			
2.4.1	Make	-	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.4.2	Type	-	_____	_____
2.4.3	Applicable standards	-	_____	_____
2.4.4	Number of CTs	-	_____	_____
2.4.5	Rated current primary side	A	_____	_____
2.4.6	Rated current secondary side	A	_____	_____
2.4.7	Thermal short time current 1 sec	A_{rms}	_____	_____
2.4.8	Short time dynamic current	kV_{peak}	_____	_____
2.4.9	Number of measuring/protection cores	-	_____	_____
2.4.10	Measuring cores			
	- accuracy class	-	_____	_____
	- rated burden	VA	_____	_____
2.4.11	Protection cores			
	- accuracy class	-	_____	_____
	- rated burden	VA	_____	_____
2.5	Voltage Transformer			
2.5.1	Make		_____	_____
2.5.2	Type		_____	_____
2.5.3	Applicable Standards		_____	_____
2.5.4	No. of TV's		_____	_____
2.5.5	Impulse withstand		_____	_____
2.5.6	Rated transformation ratio		_____	_____
2.5.7	Max. temp rise over ambient		_____	_____
2.5.8	Class of insulation		_____	_____
2.5.9	No. of secondary winding		_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
2.5.10	Winding connection		_____	_____
2.5.11	Rated secondary voltage		_____	_____
2.5.12	Rated for dual purpose of protection and measurement		_____	_____
2.5.13	Rated output of each secondary winding		_____	_____
2.5.14	Accuracy class of each secondary winding		_____	_____
2.5.15	Rated voltage factor		_____	_____
3.0	Station service board			
3.1	Cubicle assemblies	-	_____	_____
3.1.1	Make	-	_____	_____
3.1.2	Type designation	-	_____	_____
3.1.3	rated current of busbar and board	A	_____	_____
3.1.4	Maximum temperature rise of busbar at rated current	K	_____	_____
3.1.5	Short circuit rating of main circuits			
	- initial symmetrical short time current, I s	kV_{rms}	_____	_____
	- peak withstand current	kV_{peak}	_____	_____
3.1.6	Protection class			
3.2	Circuit breaker (incoming circuit)			
3.2.1	Manufacturer	-	_____	_____
3.2.2	Type	-	_____	_____
3.2.3	Applicable standards	-	_____	_____
3.2.4	Number of poles	-	_____	_____
3.2.5	Rated current (at 40˚C)	A	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
3.2.6	Rated short circuit breaking current - symmetrical - asymmetrical	 kV_{rms} kV_{rms}	 _____ _____	 _____ _____
3.2.7	Rated short circuit making current	kV_{peak}	_____	_____
3.2.8	Permissible short time current I s	kV_{rms}	_____	_____
3.2.9	Dynamic short time current	kV_{peak}	_____	_____
3.2.10	Total closing time (instantaneous)	s	_____	_____
3.2.11	Total closing time	s	_____	_____
3.2.12	Type of overcurrent relay	-	_____	_____
3.2.13	Basic functions of release system	-	_____	_____
3.2.14	Adjustable range of overload protection	% I_r	_____	_____
3.2.15	Adjustable range of overcurrent protection	% I_r	_____	_____
3.2.16	Adjustable range of delay time for overcurrent protection	s	_____	_____
3.3.0	Moulded case circuit breaker (outgoing circuits)			
3.3.1	Manufacturer	-	_____	_____
3.3.2	Type	-	_____	_____
3.3.3	Applicable standards	-	_____	_____
3.3.4	Number of poles	-	_____	_____
3.3.5	Short-circuit breaking characteristics	yes/no	_____	_____
3.3.6	Symmetrical short-circuit breaking current	kV_{rms}	_____	_____
3.3.7	Short-circuit making current	kV_{peak}	_____	_____
3.3.8	Adjustable range of overload protection	% I_r	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
3.3.9	Instantaneous overcurrent protection	% I_r	_____	_____
1.3	Current transformers (incoming circuits)			
3.4.1	Make	-	_____	_____
3.4.2	Type	-	_____	_____
3.4.3	Applicable standards	-	_____	_____
3.4.4	Number of CT's	-	_____	_____
3.4.5	Rated current primary side	A	_____	_____
3.4.6	Rated current secondary side	A	_____	_____
3.4.7	Thermal short time current 1 sec	kV_{rms}	_____	_____
3.4.8	Shot time dynamic current	kV_{peak}	_____	_____
3.4.9	Number of measuring/protection cores	-	_____	_____
3.4.10	Measuring cores			
	- accuracy class	-	_____	_____
	- rated burden	VA	_____	_____
3.4.11	Protection cores			
	- accuracy class	-	_____	_____
	- rated burden	VA	_____	_____
3.5.0	Voltage Transformer			
3.5.1	Make		_____	_____
3.5.2	Type		_____	_____
3.5.3	Applicable Standards		_____	_____
3.5.4	No. of TV's		_____	_____
3.5.5	Impulse withstand		_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
3.5.6	Rated transformation ratio		_____	_____
3.5.7	Max. temp rise over ambient		_____	_____
3.5.8	Class of insulation		_____	_____
3.5.9	No. of secondary winding		_____	_____
3.5.10	Winding connection		_____	_____
3.5.11	Rated secondary voltage		_____	_____
3.5.12	Rated for dual purpose of protection and measurement		_____	_____
3.5.13	Rated output of each secondary winding		_____	_____
3.5.14	Accuracy class of each secondary winding		_____	_____
3.5.15	Rated voltage factor		_____	_____
4.0	Other distribution board			
4.1	Manufacturer	-	_____	_____
4.2	Type designation	-	_____	_____
4.3	Number of boards provided	-	_____	_____
4.4	Minimum rating of board	A	_____	_____
4.2	**Informative data**			
1.	Unit auxiliary board			
1.1	Weight of complete board	kg	_____	_____
1.2	Dimensions of complete board a) length	mm	_____	_____
	b) width	mm	_____	_____
	c) height	mm	_____	_____
1.3	Weight if withdrawable portion of circuit breaker	kg	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.4	CB motor drive (for stored-energy operating mechanism)			
	a) nominal voltage	v	_____	_____
	b) power consumption	w	_____	_____
1.5	CB closing and tripping coils			
	a) nominal voltage	v	_____	_____
	b) power consumption	w	_____	_____
2.	Station service board			
2.1	Weight of complete board	kg	_____	_____
2.2	Dimensions of complete board			
	a) length	mm	_____	_____
	b) width	mm	_____	_____
	c) height	mm	_____	_____
2.3	Weight of withdrawal portion of circuit breaker	kg	_____	_____
2.4	CB motor drive (for stored-energy operating mechanism)			
	a) nominal voltage	v	_____	_____
	b) power consumption	w	_____	_____
2.5	CB closing and tripping coils			
	a) nominal voltage	v	_____	_____
	b) power consumption	w	_____	_____
3	Auxiliary Relays			
	- Make		_____	_____
	- Type		_____	_____
	- Rated current / voltage and			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	permissible variation		_____	_____
	- Rated burden		_____	_____
	- No. and type of contact (whether 'NO' or 'NC'		_____	_____
	- Rating of contacts		_____	_____
	- Total operating time or relays		_____	_____
	- One minute power frequency withstand voltage		_____	_____
	- Detailed literature furnished with reference		_____	_____
	- Detail of testing facilities provided		_____	_____
4	Indicating Lamp			
	- Make		_____	_____
	- Type		_____	_____
	- Rated voltage		_____	_____
	- Rated power consumption (watts)		_____	_____
	- Series resistor provided		_____	_____
5	Indicating maters			
	- Make		_____	_____
	- Type of Movement		_____	_____
	- Size (square mm)		_____	_____
	- Scale size in degree		_____	_____
	- Accuracy		_____	_____
	- Range offered in line with specification		_____	_____
	- VA burden		_____	_____
	- Applicable standard		_____	_____
6.	Energy meters			
	- Make		_____	_____
	- Type		_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	- Range		_____	_____
	- Detailed literature furnished		_____	_____
	- Standard to which it conform to		_____	_____
	- Rated current		_____	_____
	- Rated voltage and frequency		_____	_____
	- Drawout / nom dawout		_____	_____
	- Class of accuracy		_____	_____
	- Rated VA burden			
	a) Current coil…..VA		_____	_____
	b) Voltage coil…..VA		_____	_____
	- Test plug / test blocks/ testing terminal with links		_____	_____
7	Miniature Circuit breaker			
	- Make		_____	_____
	- Rated voltage		_____	_____
	- Rated current		_____	_____
	- Rupturing capacity		_____	_____
	- Setting for short circuit		_____	_____
	- Setting range for over load		_____	_____
	- Operating time		_____	_____
	- No. of auxiliaries contacts		_____	_____
	- Rating for auxiliary contacts		_____	_____
	- Operating characteristics furnished		_____	_____
8	Control winding			
	- Make		_____	_____
	- Type		_____	_____
	- Material and size conductor			
	a) For CT circuit		_____	_____
	b) For other circuit		_____	_____
	- Solid / standard conductor		_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	- Tinned / untinned		_____	_____
	- Material of insulation and sheath		_____	_____
	- Voltage grade of control wiring		_____	_____
	- Colour coding of wires		_____	_____
	a) For AC metering circuit		_____	_____
	b) For DC control circuit		_____	_____
	c) AC auxiliary power circuit like panel space heater		_____	_____
	d)Earthing		_____	_____
	- Numbered ferrules at both ends		_____	_____
	- Insulator sleeves provided at both ends		_____	_____
	- terminals		_____	_____

4.3 Information to be supplied together with the bid

At least the information listed hereunder shall be by the tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / description

1. Pamphlets of the proposed switchgear showing the following
    - principle of segregation of various compartments
    - air circuit breaker handling and control including interlocking features
    - basic function and characteristics of CB protection relay
2. Illustration of the drawout type mccb
3. Information on energy meters installed

5.0 DC system

5.1 Guaranteed characteristics

1.1	Make	-	_____	_____
1.2	Type designation	-	_____	_____
1.3	Applicable standards	-	_____	_____
1.4	Number of batteries	-	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.5	Battery cells			
	• type of cells	-	_____	_____
	• number of cells per battery	-	_____	_____
1.6	Battery data			
	• rated voltage U_N	V	_____	_____
	• floating charging voltage	V	_____	_____
	• maximum variation of voltage under all conditions of service	% U_N	_____	_____
	• normal charging current	A	_____	_____
	• maximum permissible charging current	A	_____	_____
	• battery capacity at 25˚C a) at 10 hours b) at 1 hour	 Ah Ah	 _____ _____	 _____ _____
1.7	Maximum permissible ambient temperature	˚C	_____	_____
2	DC main distribution board			
2.1	Manufacturer	-	_____	_____
2.2	Type designation	-	_____	_____
2.3	Number of boards	-	_____	_____
2.4	Number of outgoing feeders	-	_____	_____
2.5	Rated voltage	-	_____	_____
2.7	Power frequency withstand voltage, 1 min	kV	_____	_____
2.7	Rated current of incoming and busbar	A	_____	_____
2.8	Short-circuit withstand current (1 s)	kA	_____	_____
3	Static inverter			
3.1	Manufacturer	-	_____	_____
3.2	Type designation	-	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
3.3	Applicable standards	-	_____	_____
3.4	Number of inverters	-	_____	_____
3.5	DC supply			
	• input voltage	V	_____	_____
	• maximum admissible variation of input voltage	%	_____	_____
	• input current at rated output	A	_____	_____
3.6	AC output			
	• rated voltage U_N	V	_____	_____
	• number of phases	-	_____	_____
	• rated frequency f_N	Hz	_____	_____
	• rated output	kVA	_____	_____
	at power factor	cosphi	_____	_____
	• rated current I_N	A	_____	_____
3.7	Voltage stability of load variation from no-load to full load	$\%U_N$	_____	_____
3.8	Frequency stability (island operation)	$\% f_N$	_____	_____
3.9	Range of load power factor			
	• inductive	cosφ	_____	_____
	• capacitive	cosφ	_____	_____
3.10	Short time overload capability			
	• for 1 second	$\% I_N$	_____	_____
	• for 1 minute	$\% I_N$	_____	_____
3.11	Maximum distortion factor of voltage wave form	%	_____	_____

6.0 Protection System

6.1 Guaranteed characteristics

1. General features

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.1	Protective devices			
	a) manufacturer	-	_____	_____
	b) entire system for same manufacturer	yes/no	_____	_____
	c) numeric type	yes/no	_____	_____
	d) year of commissioning of first plant with identical equipment	-	_____	_____
	e) D.C. infeed:			
	• supply voltage	V	_____	_____
	• D.C/D.C converter included	yes/no	_____	_____
	• tolerance of supply voltage	%	_____	_____
	a) overload protection	yes/no	_____	_____
	b) short-circuit protection	yes/no	_____	_____
	c) power consumption per cubicle	W	_____	_____
	d) insulation acc. To IEC 255-4	yes/no	_____	_____
	e) indication:			
	• hand reset flag	yes/no	_____	_____
	• light emitting diode	yes/no	_____	_____
	a) accuracy:			
	• time error of calibration/repeatability	yes/no	_____	_____
1.2	Protection cubicles			
	a) Type - _____ _____			
	b) Protection class	IP	_____	_____
	c) Dimension (L/W/H)	mm	_____	_____
	d) Maximum weight	kg	_____	_____
1.3	Trip circuit supervision			
	a) type/designation	-	_____	_____
	b) continuous/on command	-	_____	_____
	c) time delay:			
	• fixed setting approx.	s	_____	_____
	d) auxiliary elements:			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• hand reset	yes/no	_____	_____
	e) supervision current:			
	• max. trip circuit supervision current	mA	_____	_____
1.4	Test device			
	a) type/designation	-	_____	_____
	b) current rating	A	_____	_____
	c) current setting:			
	• differential elements	-	_____	_____
	• differential current	%	_____	_____
	• bias	%	_____	_____
	d) high set overcurrent elements:			
	operating time:			
	• less than 3 x I_N	ms	_____	_____
	e) harmonic restraint:			
	• based on second harmonic, content included	yes/no	_____	_____
	f) relay stability:			
	• through-fault	xI_N	_____	_____
2.	Underimpedance relay			
	a) type/designation	-	_____	_____
	b) setting ranges:			
	• current	xI_N	_____	_____
	• ratio R/X	-	_____	_____
	• time stage t_1	s	_____	_____
	t_2	s	_____	_____
3.	Stator 100% earth fault relay			
	a) type/designation	-	_____	_____
	b) voltage setting	%	_____	_____
	c) time setting	s	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
4.	Generator bus ground fault relay			
	a) type/designation	-	_____	_____
	b) voltage setting	%	_____	_____
	c) time setting	s	_____	_____
5.	Overcurrent relay			
	a) type/designation	-	_____	_____
	b) setting range of time relay	s	_____	_____
	c) setting range of instantaneous element	ms	_____	_____
	d) setting range of overcurrent	%	_____	_____
	e) setting range of instantaneous element	%	_____	_____
6.	Overvoltage relay			
	a) type/designation	-	_____	_____
	b) setting ranges of the pick-up values:			
	• delayed trip	xU_N	_____	_____
	• instantaneous trip	xU_N	_____	_____
	c) time setting range	s	_____	_____
	d) reset ratio	s	_____	_____
7.	Under voltage relay			
	a) type/designation	-	_____	_____
	b) definite time	yes/no	_____	_____
	c) inverse time	yes/no	_____	_____
	d) two setting levels	yes/no	_____	_____
	e) voltage setting:			
	• setting range	% U_N	_____	_____
	• start element reset at	% U_N	_____	_____
	• continuously variable	yes/no	_____	_____
	• steps	yes/no	_____	_____
	f) operating time:			
	• continuously variable	yes/no	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	• steps	yes/no	_____	_____
	• setting range	s	_____	_____
8.	Rotor earth fault relay			
	a) type/designation	-	_____	_____
	b) impedance setting	kOhm	_____	_____
	c) time setting	s	_____	_____
	d) harmonic filter	yes/no	_____	_____
9.	Negative phase sequence relay (46)			
	a) type/designation	-	_____	_____
	b) adjustable pick-up value:			
	• first stage	% I_N	_____	_____
	• second stage	% I_N	_____	_____
	c) tripping time-lag adjustable:			
	• first stage	s	_____	_____
	• second stage	s	_____	_____
10.	Loss of excitation and out of step relay			
	a) type/designation	-	_____	_____
	b) setting range of pick-up generator x_d	% I_N	_____	_____
	c) time setting:			
	• first stage	s	_____	_____
	• second stage	s	_____	_____
	d) time integrator setting:			
	• first stage	s	_____	_____
	• second stage	s	_____	_____
11.	Rotor excitation circuit overcurrent relay			
	a) type/designation	-	_____	_____
	b) setting range of time relay	s	_____	_____
	c) setting range of instantaneous element	ms	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	d) setting range of overcurrent	%	_____	_____
	e) setting range of instantaneous element	%	_____	_____
12.	Under/Over frequency relay			
	a) settings:			
	• level 1	% f_N	_____	_____
	• level 2	% f_N	_____	_____
	• level 3	% f_N	_____	_____
	• level 4	% f_N	_____	_____
	b) continuous/steps	-	_____	_____
	c) time setting	s	_____	_____
	d) number of steps	-	_____	_____
13.	High-speed distance relay			
	a) type/designation	-	_____	_____
	b) setting ranges:			
	• current	xI_N	_____	_____
	• distance measurement	-	_____	_____
	• ratio R/X	-	_____	_____
	• time stage t_1	s	_____	_____
	t_2	s	_____	_____
	t_3	s	_____	_____
	t_4	s	_____	_____
	c) distance error	%	_____	_____
	d) time error	%	_____	_____
14.	Line earth fault relay			
	a) type/designation	-	_____	_____
	b) voltage setting	%	_____	_____
	c) time setting	s	_____	_____
15.	Synchro-check relay (25)			

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
	a) type/designation	-	_____	_____
	b) 2 channel device	yes/no	_____	_____
	c) independent check on criteria (3)	yes/no	_____	_____
16.	Auto reclosing relay			
	a) type/designation	-	_____	_____
	b) single phase AR	yes/no	_____	_____
	c) three-phase AR	yes/no	_____	_____
	d) dead time setting	ms	_____	_____

6.2 Information to be supplied together with the bid

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents/descriptions.

1. Pamphlets of each type of the proposed protection relays as well as of cubicles assemblies for complete systems.
2. Description of the proposed power supply concept as well as of the trip function arrangement for the protection system to receive an adequate safety and some kind of redundancy or back-up protection.
3. Describe processing and indication of trip signals coming from protective devices or actuators outside of this section (e.g. transformer Buchholz relays etc.)
4. Indicate deviations from the specification.

7.0 Power & Control cables including cable trays

7.1 Guaranteed characteristics

1.	3.3kV Power cables			
1.1	Manufacturer	-	_____	_____
1.2	Type designation	-	_____	_____
1.3	Applicable standards	-	_____	_____
1.4	Rated voltage	kV	_____	_____
1.5	Highest voltage for equipment U_m	kV	_____	_____
1.6	Power frequency withstand voltage	kV_{rms}	_____	_____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
1.7	Test voltage at factory during minutes	kV_{rms}	_____	_____
1.8	Test voltage at site after laying	kV	_____	_____
1.9	Materials of conductor	-	_____	_____
1.10	Material of insulation	-	_____	_____
1.11	Minimum thickness of insulation	mm	_____	_____
1.12	Type of screen	-	_____	_____
1.13	Material of screen	-	_____	_____
1.14	Max. conductor temperature at - service conditions - fault conditions	 ˚C ˚C	 _____ _____	 _____ _____
2.	Low voltage power cables (to be filled in for every type)			
2.1	Manufacturer	-	_____	_____
2.2	Type designation	-	_____	_____
2.3	Applicable standards	-	_____	_____
2.4	Rated voltage	kV	_____	_____
2.5	Test voltage at factory during	kV_{rms} minutes	_____ _____	_____ _____
2.6	Material of insulation	minute	_____	_____
2.7	Material of conductor	-	_____	_____
2.8	Minimum thickness of insulation	mm	_____	_____
2.9	Type of screen	-	_____	_____
2.10	Material of screen	-	_____	_____
1.14	Max. conductor temperature at - service conditions - fault conditions	 ˚C ˚C	 _____ _____	 _____ _____

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
3	Control cables (to be filled in for every type)			
3.1	Manufacturer	-	_____	_____
3.2	Type	-	_____	_____
3.3	Standards	-	_____	_____
3.4	Voltage rating	V	_____	_____
3.5	Test voltage	V	_____	_____
3.6	Conductor material	-	_____	_____
3.7	Conductor insulation material	-	_____	_____
3.8	Screening/armouring	-	_____	_____
4	Cable tray			
4.1	Manufacturer	-	_____	_____
4.2	Type	-	_____	_____
4.3	Standards	-	_____	_____
4.4	Material	-	_____	_____
4.5	Corrosion protection	-	_____	_____
4.6	Material of bolts, nuts etc	-	_____	_____

7.2 Information to be supplied together with the bid

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions.

Documentation on each of the following categories of cables and accessories:

- 3.3 kV power cables
- Low voltage power cables
- Control cables
- Cable trays

8.0 Grounding & lightning protection system

ITEM	DESIGNATION	UNITS	VALUE	REMARKS
8.1	**Guaranteed characteristics**			
1.	Design short-circuit and ground fault Current, I s			
	- 33kV switchgear system	kA_{rms}	_____	_____
	- 3.3 kV generator and bus duct system	kA_{rms}	_____	_____
	- 415 V low voltage system	kA_{rms}	_____	_____
2.	Type of earthing conductor			
	- buried in ground	-	_____	_____
	- embedded in concrete	-	_____	_____
	- installed above ground/floor	-	_____	_____
3.	Material of earthing conductors			
	- buried in ground	-	_____	_____
	- embedded in concrete	-	_____	_____
	- installed above ground/floor	-	_____	_____
4.	Method (type) of connection of conductors laid in ground	-	_____	_____
5.	Expected total earthing impedance of earthing system (informative)	ohm	_____	_____