

SECTION - XIII**GUARANTEED TECHNICAL PARTICULARS**

Schedule No.	Name of equipment
1.	Turbines
2.	Generators
3.	Generator Terminal Equipment
4.	Power Transformers
5.	Control, Protection and Metering
6.	415 V Switchgear
7.	24 V Batteries
8.	Mechanical Auxiliaries
9.	Power and Control Cables
10.	11 kV Isolators
11.	11 kV Vacuum Circuit Breakers
12.	11 kV Lightning Arrestors
13.	11 kV Potential Transformers
14.	11 kV Current Transformers
15.	11 kV Bus Bar, Conductor and Insulators
16.	Control/Relay Panels

SCHEDULE -1**TURBINES****To be filled by tenderer**

1. Type of Turbine/Shaft orientation
2. Name of the manufacturer
3. Guaranteed Output
 - (a) Guaranteed rated output at rated head.
 - (b) Guaranteed max. output at max. head.
 - (c) Guaranteed max. output at min. head.
4. Efficiency

Guaranteed efficiency at rated head for the following outputs:

 - (a) 100%
 - (b) 80%
 - (c) 60%
5. Discharges

Turbine discharge at rated head for the following percentage of rated outputs:

 - (a) 100%
 - (b) 80%
 - (c) 60%
6. Speed
 - (a) Specific speed in M.K.W. units.
 - (b) Rate speed in r.p.m.
 - (c) Maximum runaway speed in r.p.m.
 - (d) Direction of rotation when viewed from generator end/top.
7.
 - (a) Momentary rise in speed on suddenly reducing load to zero from full load ----- % of rated speed.
 - (b) Time of gate closing for regulation in item 7(a) above ----- secs.
8.
 - (a) Momentary drop in speed in increasing load from zero to full load -----% of rated speed.
 - (b) Time of gate opening for regulation at (a) above.

EE (E-M)

0/0 the CE, DHPD, Itanagar

9. Flywheel effect of:
- | | |
|--|-------------------|
| (a) The generator unit for regulation stated above | -kgm ² |
| (b) Generator | -kgm ² |
| (c) Turbine runner end shaft | -kgm ² |
| (d) Flywheel, if any | -kgm ² |
10. Factor of safety
- (a) Guaranteed minimum factor of safety under worst conditions based on yield point of the material.
- (b) Name and location of the part having the factor of safety in (a) above.
11. Max. water hammer pressure-----% of rated head.
12. Runner
- (a) Material of composition
- (b) No. of runner blades
- (c) Runner discharge diameter
- (d) Weight of runner
- (e) Source of runner casting
13. Shaft
- (a) Material of composition
- (b) Diameter
- (c) Length
- (d) Weight
14. Guide Apparatus
- (a) Material of guide vane
- (b) No. of guide vanes
- (c) (i) Leakage through fully closed gate
(ii) Torque on runner due to leakage.
- (d) Description of the method of lubrication
15. Spiral Casing and speed Ring
- (a) Inlet diameter of casing
- (b) Dimensions of casing
- (c) Maximum/design/working pressure
- (d) Test pressure
- (e) Material of casing
- (f) No. of sections of casing
- (g) Material and construction of speed/stay ring
- (h) No. of vanes in speed/stay ring
16. Elevation of centre line distributor

17. (a) Critical cavitation value
(b) Cavitation guarantee in kg/1000 hrs of operation
18. Recommended plant
19. Draft tube
 - (a) Type
 - (b) Elevation of lowest point in draft tube
 - (c) (i) Total length of draft tube
(ii) Length of steel liner
 - (d) Velocity under full load at:
 - (i) Draft tube exit
 - (ii) Draft tube liner end
20. Guide vane servomotor
 - (a) No. of servomotor
 - (b) Material of servomotor body and piston
 - (c) Rating kg. m
 - (d) Range of oil pressure of satisfactory operation
21. Governing system
 - (a) Make
 - (b) Type of governor
 - (c) Rating
 - (d) Guaranteed sensitivity (minimum speed range to which governor will respond)
 - (e) Range of adjustment of permanent speed droop
 - (f) Range of adjustment in speed setting
 - (g) Governing opening and closing times
 - (h) Description and method of operation
 - (i) Adjustment range in governor opening and closing time
22. Oil pressure Vessels
 - (a) No. of vessels per unit
 - (b) Dimensions of pressure vessels
 - (c) Normal volume of oil in each
 - (d) Normal working pressure
 - (e) Grade of oil recommended
23. Oil Pump and Sump Tank
 - (a) No. of oil pump per unit
 - (b) Type of pump
 - (c) Capacity of each pump
 - (d) Dimensions of sump tank

- (e) Effective volume of sump tank
 - (f) Total volume of oil in the governing system
24. Inlet Valve
- (a) Type
 - (b) Operating method
 - (c) Diameter
 - (d) Materials
 - (e) Seals provided
 - (f) Operating pressure
25. Draft Tube Dewatering System
- (a) No. of pumps
 - (b) Capacity of each pump
 - (c) Total dynamic head
26. Cooling Water System
- (a) Source (penstock) tapping or tailrace pumping
 - (b) No. of pumps
 - (c) Rating of each pump
 - (d) Capacity of duplex strainers
 - (e) Material and size of strainer element
27. Dewatering and Drainage System
- (a) No. of pumps
 - (b) Type
 - (c) Discharge of each pump
 - (d) Total dynamic head
28. Compressed Air Equipment
- (a) No. and capacity of compressors
 - (b) Working pressures
 - (c) Volume of air receiver
29. Gear Box
- (a) Type of Gear
 - (b) Material of gear
 - (c) Gear ratio
 - (d) Overall efficiency
30. Heaviest Package of Shipment
- (a) Name
 - (b) Weight
 - (c) Dimensions (L x W x H)
31. Largest Package for Shipment
- (a) Name

- (b) Weight
 - (c) Dimensions (L x W x H)
32. Heaviest assembly to be lifted by power house crane
- (a) Name
 - (b) Weight
 - (c) Dimensions (L x W x H)

SYNCHRONOUS GENERATORS

To be filled by tenderer

1. Name of manufacturer.
2. Type of reference.
3. Shaft orientation.
4. Speed and direction of rotation.
5. (a) Normal voltage between phases
(b) Voltage variation
6. (a) Frequency
(b) Frequency variation
7. Guaranteed rated output at rated conditions
with temperature as mentioned in the specifications.
8. Rated power factor.
9. Guaranteed maximum temperature rise for output
guaranteed in item 7 above over cooled
air/ambient temperature with cooling water temperature
not exceeding.....30.....^o C.
10. Guaranteed maximum temp. rise for the output
guaranteed in item 9 above over cooled
air/ambient temperature with cooling
water temperature not exceeding:
 - (a) Stator Winding by ETD
 - (b) Rotor Winding by resistance
 - (c) Bearing by ETD
11. Guaranteed overall efficiency of generator at
rated voltage, p.f. frequency and 75^oC winding
temperature computed by the summation of losses

method in accordance with IS:4889 – 1968
subject to tolerance in IS:4722 – 1968.

- (a) Full load
 - (b) 80% full load
 - (c) 60% full load
12. Inherent regulation, i.e., increase in voltage at constant speed and excitation on taking off.
- (a) Full load
 - (b) 80% full load
 - (c) 60% full load
13. Generator Reactances:
- (a) Synchronous Reactance (saturated)
 - (i) Direct axis
 - (ii) Quadrature axis
 - (b) Direct axis transient Reactances
 - (i) Saturated
 - (ii) Quadrature axis
 - (c) Sub-transient Reactances
 - (i) Direct axis
 - (ii) Quadrature axis
14. Negative phase sequence Reactance.
15. Zero phase sequence Reactance.
16. Resistance of armature winding per phase.
17. Resistance of field winding.
18. Generators time constants
- (i) Direct axis transient open circuit
 - (ii) Direct axis transient short circuit
19. Generator characteristic curves
- (i) Open circuit saturation curve

- (ii) Short circuit saturation curve
 - (iii) Full load saturation curve at rated power factor
20. Short circuit ratio
21. Synchronizing power at kV full load, 50 Hz, p.f. (lagging)
22. Flywheel effect of
- (a) The rotating parts of the generator
 - (b) Flywheel (if any)
23. Duration for which all parts are guaranteed to withstanding safely maximum runaway speed.
24. Guaranteed minimum factor of safety based on yield point of material under runaway/short circuit conditions and name and location of part having the minimum factor of safety.
25. Maximum I_2^2t
26. Inertia constant.
27. Maximum runaway speed which all parts are guaranteed to withstand for 15 minutes.
28. Embedded Temperature Detectors
- (a) Number
 - (b) Type
29. Excitation Equipment
- (a) Name of the manufacturer
 - (b) Type
 - (c) Accuracy of voltage regulation
 - (d) Range of voltage level setting
 - (e) Range of compounding/reactance

- drop compensation
 - (f) Range of control in auto mode
 - (g) Range of control in manual mode
 - (h) Frequency range of operation
 - (i) Excitation power feed
 - (j) Maximum continuous current rating
 - (k) Nominal voltage
 - (l) Ceiling voltage
 - (m) Response ratio
 - (n) Ambient temperature
 - (o) Protection glass of excitation cubicles
30. Field current for full load on generator at rated power factor and terminal voltage.
31. Stator
- (a) Material of stator core
 - (b) Insulation of laminations
 - (c) Number of sections in which stator is divided for transport
 - (d) Insulation of winding
 - (e) maximum temperature rise
32. Rotor
- (a) Construction of field poles
 - (b) Method of attaching field poles
 - (c) Rotor material and construction
 - (d) Field winding construction
 - (e) Insulation of field winding
 - (f) Construction of damper winding
 - (g) Air gap
 - (h) Diameter of assembled rotor
 - (i) Factor of safety at maximum runaway speed based on yield point of material
 - (j) Maximum temperature rise of field winding when operating at rated conditions
33. Generator Cooler (if applicable)
- (a) Number of air coolers
 - (b) Number of oil coolers
 - (c) Cooling water requirement

- (d) Cooling water pressure
34. Bearings
- (a) Type
 - (b) Number of bearings
 - (c) Bearing oil specification
 - (d) Quantity required for first filling
35. Generator Brakes
- (a) Air pressure for satisfactory operation
 - (b) Speed at which brakes are applied
36. Main Shaft
- (a) Material
 - (b) Details of coupling flange
37. Weight of generator rotating parts
38. Weight of complete generator
39. Current Transformer
- (a) Type
 - (b) Name of manufacturer
 - (c) Rated transformation ratio
 - (d) Output at rated current and accuracy
 - (e) Accuracy class
 - (f) Rated over current factor
 - (i) Times rated current
 - (ii) Time in seconds
 - (g) Knee point voltage
 - (h) Basic insulation level
 - (i) Winding temperature rise
 - (j) Secondary winding resistance
40. Neutral Grounding Equipment
- (i) Distribution Transformer and secondary Resistor
 - (a) Type

- (b) Name of manufacturer
 - (c) Voltage ratio
 - (d) Continuous rating
 - (e) One minute rating
 - (f) Secondary load resistance (ohms)
 - (g) Current rating of resistor
 - (h) Duty cycle of resistor and cooling medium
 - (i) Overall dimensions and weight
- (ii) Neutral Isolation Switch
- (a) Type
 - (b) Name of manufacturer
 - (c) Voltage rating, frequency
 - (d) Normal current
 - (e) Short time rating
 - (f) 1.2/50 Micro Second impulse level
 - (g) 1 minute power frequency dry withstand voltage
 - (h) Dimensions and weight

41. Generator Terminal Equipment

(A) Lightning Arrestors

- (a) Type
- (b) Name of manufacturer
- (c) Standards to which it conforms
- (d) Name of units
- (e) Rated voltage kV
- (f) Nominal discharge current amps
- (g) Power frequency spark over voltage kV (rms)
- (h) Impulse spark over voltage (1.2/50 μ s wave) kV (peak)
- (i) Virtual steepness of front of wave for above kV Micro sec.
- (j) Maximum front of wave impulse
spark over voltage kV (peak)
- (k) Maximum residual voltage for 10 KA discharge kV (peak)
current (of 8/20 micro second wave)
- (l) Long duration current tests
 - (i) Current peak amps
 - (ii) Virtual duration Micro Sec.
- (m) Overall height
- (n) Total weight
- (o) Mounting details

- (p) Tests
- (B) Protective capacitors
- (a) Type
 - (b) Name of manufacturer
 - (c) Standard to which it conforms
 - (d) Voltage rating Volts
 - (e) Capacitance Micro-farads
 - (f) Total weight
 - (g) Mounting details
 - (h) Tests
- (C) Potential Transformer
- (a) Type
 - (b) Name of manufacturer
 - (c) Standard to which it conforms
 - (d) Manufacturer's type design Volts
 - (e) Rated primary voltage Volts
 - (f) Rated secondary voltage
 - (g) Rated burden
 - (h) Accuracy class
 - (i) Temperature rise at 1.1 times rated voltage with rated burden and frequency
 - (j) One minute power frequency withstand test voltage on primary kV (rms)
42. Heaviest package for shipment
- (a) Name
 - (b) Weight
 - (c) Dimensions (L x B x H)
43. Largest package for shipment
- (a) Name
 - (b) Weight
 - (c) Dimensions (L x B x H)
44. Heaviest assembly to be lifted by power house crane
- (a) Name
 - (b) Weight
 - (c) Dimensions (L x B x H)

GENERATOR TERMINAL EQUIPMENT

Sl. No.	Items	To be filled by tenderer
1.	<p>INSULATORS/ SEAL BUSHING</p> <p>Manufacturer</p> <p>Type</p> <p>Rated Voltage</p> <p>Applicable standards</p> <p>One minute power frequency withstand voltage (kV)</p> <p>Dry</p> <p>Wet</p> <p>Impulse withstand voltage (1.2/50 micro second wave) of (peak)</p> <p>Power frequency puncture withstand voltage (kV)</p> <p>Minimum Creep age distance (mm)</p> <p>Cantilever strength (kg) for insulator only</p> <p>Upright</p> <p>Under hung</p> <p>Mechanical strength (kg) for seal off busing</p> <p>Compressor</p> <p>Tension</p> <p>Weight of each</p>	
2.	<p>CURRENT TRANSFORMERS</p> <p>(To be supplied for each core separately in tubular farm)</p> <p>CT Number/Location</p> <p>Qty.</p> <p>Application</p> <p>Name of manufacturer</p> <p>Type</p> <p>Winding of connection</p> <p>Rated burden of earth secondary winding per phase</p> <p>Insulation level</p> <p>Insulation class</p> <p>Impulse withstand voltage of primary winding (1.2/50 micro second wave) kV (peak)</p>	

	<p>One minute power frequency dry withstand voltage (kV)</p> <p>Primary winding Secondary winding</p> <p>Characteristic enclosed (Yes/No) Accuracy class</p>	
3.	<p>FUSES (Primary side & Secondary side) (To be supplied separately)</p> <p>Make Type Rated voltage (V) Rated current (A) Rupturing capacity (kA) Symmetrical Asymmetrical Qty.</p>	
4.	<p>LIGHTNING ARRESTER</p> <p>Make Type Rated voltage Max. system voltage across arrester Power frequency spark over voltage (kV) Impulse spark over Kv (peak) Max. front of wave impulse Spark over kV (P) Rated discharge current Max. discharge voltage in kV crest for discharge Current 8/20 micro sec. Wave Leakage current at rated voltage insulator (kV) One minute dry withstand voltage of arrester external insulator (kV) Quantity per set</p>	
5.	<p>SURGE CAPACITOR</p> <p>Make Type Nominal voltage Max. voltage Insulation class Phase Frequency</p> <p>Capacitance Impulse withstand voltage (1.2/ 50 micro second wave)</p>	

	Qty. Applicable standard Residual voltage after 5 minute of disconnection	
6.	GROUNDING TRANSFORMER Make Type Applicable standards Rated primary voltage (v) Rated secondary voltage (V) Insulation class Rated output BIL of primary winding (kV) peak Max. Temperature rise over ambient °C No load losses Type of cooling Resistance Primary winding Secondary winding Short time rating for one minute Short time rating for 5 minute Load losses	
7.	GROUNDING RESISTANCE Make Type Rate current Volume of resistance at 20°C Short time rated current for one minute Short time rated current for five minutes Maximum temperature rise over ambient °C	

POWER TRANSFORMERS
(Separately for all Transformers)

Sl. No.	Particulars	As specified	As offered
1.	Name of manufacturer		
2.	Service whether indoor or outdoor Type (Core or shell)	Outdoor	
3.	Reference standard		
4.	Type of cooling	ON	
5.	Rating: Rated kVA Rated current, amps (rms) LV/HV Rated voltage, kV (LV/HV)	1750 3.3/33	
6.	Temperature rise above 45°C ambient for oil filled type: In oil by thermometer °C In winding by resistance °C b. Hot spot temperature in winding limited to °C		
7.	Windings: No. of windings per phase Insulation class Connections: i. Vector group reference (in accordance with IS:2026) Terminal arrangement: HV LV d. Winding Insulation Category	Uniform/ Non-Uniform Uniform/Non-Uniform	
8.	Type of tap changer		
9.	Taps: Capacity Steps and range Tapping provided on HV side?	Yes/No	
10.	Losses: No load loss at rated voltage and frequency Load loss at rated current and at 75°C		
11.	Impedances: Impedance at rated current, frequency and at 75°C(%) Reactance at rated current and frequency % Resistance at rated current, frequency at 75°C(%) Zero sequence impedance (%) Zero sequence capacitance of LV winding, micro farad/phase HV winding, micro farad/phase		

12.	Efficiency at 75°C and 0.9 p.f. lag %: At 100% load At 75% load At 50% load		
13.	Efficiency: Load and power factor at which maximum efficiency occurs, % full load Maximum efficiency (%)		
14.	Regulation at full load and at 75°C: At unity power factor, % At 0.80 power factor lagging %		
15.	No load current referred to HV and 50 Hz% rated current: At 90% load rated voltage At 100% load rated voltage At 110% load rated voltage At 125% load rated voltage		
16.	Flux density: Approximate maximum flux density Web/m ² At 90% rated voltage, 50 Hz At 100% rated voltage, 50 Hz At 110% rated voltage, 50 Hz At 125% rated voltage, 50 Hz At 140% rated voltage, 50 Hz		
	Following particulars shall be provided for the worst conditions of simultaneous occurrence of 110% rated voltage and 95% rated frequency Maximum flux density Temperature rise Period of allowable operation under the above worst condition		
17.	Maximum current density, Amps/cm ² : HV, winding LV, winding		
18.	Clearance in mm: Maximum clearances in mm Between phase In air ii. In oil Between phase and ground In air In oil	H.V. L.V.	
19.	Withstand time without injury for Three phases dead short circuit with rated voltage maintained on the other side sec. Single phase short circuit with rated voltage maintained on the other side sec		
20.	Tap-Changer:	Yes/No	
	Tap-changer operable at standing height from ground	Yes/No	

	Provided with: Tap position indicators? Operation counter? Padlocking provisions? All contacts silver plated?	Yes/No Yes/No Yes/No		
21.	Details of tank: Material Maximum internal pressure the tank is capable of withstanding (kg/cm ²)			
22.	Explosion vent: Minimum pressure the diaphragm is set to rupture, (kg/cm ²)			
23.	Details of core material			
24.	Insulation material			
25.	Details of bushings: Make Type Voltage class, (kV) Creepage distance (mm) Free space required at top for bushing removal mm Minimum clearance in air Phase to phase (mm) Phase to earth (mm) Phase to neutral (mm) Impulse withstand voltage, kV (peak) Power frequency withstand voltage kV (rms)	H V	L V	HV Neut ral
26.	Insulation oil: Approx volume of oil (litre) Whether first fillings of oil with 10% excess included? Oil conforms to IS:335			
27.	Marshalling box: Weather proof, suitable for outdoor? Degree of protection	Yes/No		
28.	Terminal blocks: Make Whether stud type terminals are offered 10% spare terminals furnished?	Yes/No Yes/No		
29.	Wiring: Cable type Voltage grade (volt) Conductor size Current circuits (mm ²) ii. Other circuits (mm ²)			
30.	Contact rating Amps x Volt DC: Buchholz relay Oil temperature indicator Winding temperature indicator Magnetic oil level gauge	Making inductive break		
31.	Gaskets:			

	Material of gaskets No. of gaskets for one complete set (break up of gaskets shall be given)		
32.	Valves: Type of valve No. of valve comprising one complete set (break up of valve shall be given)		
33.	Tests: Routine test as per IS:2026 Tank pressure test i. Pressure, kg/cm ² ii. Duration, hour Tank vacuum test i. Vacuum, mm of Hg ii. Duration, hour		
34.	Accessories Each transformers furnished with fittings and accessories as per technical specification	Yes/No	
35.	Approximate overall dimensions (mm): Length Breadth Crane lift for untanking core and coil assembly (including sling)		
36.	Approximates weight (kg): Core and coil Tank and fittings Oil Total weight		
37.	Shipping data: Weight of the heaviest package (kg) Dimensions of the largest package (LxBxH) mm		

CONTROL, PROTECTION AND METERING

A.	CONTROL SYSTEM	To be filled by tenderer
1	Control components and their parameters & makes	
2	No. of inputs	
	a. Digital	
	b. Analogue	
	c. Provision for spares	
3	No. of outputs	
	a. Digital	
	b. Analogue	
	c. Provision for spares	
4	Start/stop operation	
	a. Local Manual	
	b. Local Automatic	
5	Mimic diagram display	
	a. Electrical System	
	b. Hydraulic System	
6	Mode of control	
	a. Level control	
	b. Speed control	
	c. Flow control	
	f. Sequence control	
	g. Step by step control	
7	Temperature measurement	
	a. Make of the scanner	
	b. Holding capacity	
	c. Time for scanning cycle	

	f. Alarm setting range	
	g. No. of setting levels	
8	Generator, transformer & feeder control panels	
	a. Ammeter	
	b. Voltmeter	
	c. MW meter	
	d. MVAR meter	
	e. Power factor meter	
	f. Frequency meter	
	g. DC ammeter for field current	
	h. DC voltmeter for field voltage	
9	Transducers	
	a. Make	
	b. Output	
	c. Accuracy class	
	B. ALARM & ANNUNCIATION SYSTEM	
1	Make	
2	Type	
3	Wattage of window indicating lamp	
4	Wattage of a set of windows	
5	Interface with auto control system	
6	Adjustable range of cut-off time, if unacknowledged	
7	No. of active windows	
8	No. of spare windows	
9	Response time	
10	UPS arrangement	
11	Dimension of each windows	
12	Dimensions of a set of window	
13	Over all dimensions of annunciation panel	
	C. ENERGY METERING SYSTEM	

1	Make	
2	Type	
3	CT/PT connection direct or through transducers	
5	Accuracy of meters	
6	Accuracy of transducers, if any	
7	Parameters measured	
8	Maximum current rating for 1 second	
9	Service voltage range and tolerance	
10	Service frequency range and tolerance	
11	Service temperature range	
12	Power consumption	
	a. Current circuit	
	b. Voltage circuit	
13	Service life	
14	Protection against electromagnetic/radio interference	
D. PROTECTION SYSTEM		
1	Make	
2	Type of numerical relays their functions	
	a. For Generators	
	b. For transformers	
3	Built in testing facility	
4	Methodology to provide redundancy	
5	Type of back-up protection in case of failure of numerical relays	
	a. For generators	
	b. For transformers	
6	Parameter/command documentation	
7	Maximum operating time	
8	Sensitivity in %age of rated current	
9	ANALOGUE INPUT VARIABLES	
	a. Rated frequency	

	b. Rated current	
	c. Thermal rating of current circuits	
	i. Continuous	
	ii. For 10 seconds	
	iii. For 1 second	
	iv. Dynamic	
10	Rated Voltage	
11	Thermal rating of voltage circuits (continuous)	
12	Burden per phase	
	a. At rated current	
	b. At rated voltage	
13	CURRENT TRANSFORMER REQUIREMENTS	
	a. Generator Protection	
	i. VA burden	
	ii. Saturation factor	
	iii. Minimum knee point voltage	
	iv. Maximum excitation current	
	b. Transformer Protection	
	i. VA burden	
	ii. Saturation factor	
	iii. Minimum knee point voltage	
	iv. Maximum excitation current	
	c. Feeder Protection	
	i. VA burden	
	ii. Saturation factor	
	iii. Accuracy class	

415 VOLT SWITCHGEAR

Sl. No.	Particulars	To be Filled in by Tenderer	
1.0	BUS BAR		
1.01	Type		
1.02	Rated Voltage		
1.03	No. of Phases		
1.04	Frequency		
1.05	System Earthing		
1.06	Continuous current rating within the cubicle at 50°C ambient.		
1.07	Short time current rating for (1) Sec.		
1.08	Temperature rise of bus bar joints under normal working conditions at rated current and at 50°C Ambient.		
1.09	HV withstand test voltage for (1) minute.		
1.10	Minimum clearances. i) Phase to phase ii) Phase to earth		
1.11	Insulation to Bus Bar. Size of bus bar.		

2.00	BUS SUPPORT INSULATOR:		
2.01	Type & Service.		
2.02	Material		
2.03	Voltage Class		
2.04	HV withstand test for one (1) minute.		
3.00	CIRCUIT BREAKER:		
3.01	System		
3.02	Service		
3.03	Type		
3.04	Pole		
3.05	Rated Service Voltage		
3.06	One (1) minute power frequency		

	withstand voltage.		
3.07	Rated continuous current at 50°C and within the cubicle.		
3.08	Short time current for one (1) Sec.		
3.09	Rated breaking capacity.		
3.10	Rated breaking current. a) Symmetrical b) Asymmetrical		
3.11	Rated making capacity		
3.12	Operating mechanism		
3.13	Tempt. rise above 50°C		
3.14	Operating duty		
3.15	AUXILIARY VOLTAGE: i) Closing		

	ii) Tripping iii) Spring charging motor iv) Space heater & lamp 240 VAC, 50 Hz		
3.16	Mounting		
4.00	CURRENT TRANSFORMER:		
4.01	System		
4.02	Service		
4.03	Type		
4.04	Rated voltage		
4.05	Quantity		
4.06	Power frequency withstand voltage.		
4.07	Mounting		

4.08	Rated short time current for one (1) Sec.		
4.09	Current ratio and accuracy.		
5.00	MAGNETIC CONTACTOR (AC):		
5.01	Service		
5.02	Poles		
5.03	Rated voltage		
5.04	Frequency		
5.05	Continuous current rating		
5.06	Power frequency test voltage		
5.07	Short time current rating		
5.08	Over load protection.		
5.09	Control circuit voltage		

5.10	Operation Indicator		
5.11	AUXILIARY CONTACT: i) Normally closed ii) Normally open iii) Breaking capacity		
5.12	CONTACTOR COIL RATING: i) Pick-up ii) Drop out		
5.13	Temperature rise limit for magnetic coil.		
5.14	Temperature rise limit for power circuit and other accessories.		
5.15	Duty class		
5.16	Utilization category		

i. 1 hour ($^{\circ}\text{C}$) ii. 2 hour ($^{\circ}\text{C}$) iii. 4 hour ($^{\circ}\text{C}$)		
Whether D.G. Set is auto start or not (Yes/No) load on Battery for Auto Start		

24 V BATTERY & CHARGER

Sl. No.	Items	Specified Value, if any	To be filled by tenderer
A.	BATTERIES	12 V and AH	
1.	Manufacturers name		
2.	Capacity of battery at 10 hr discharge rate	Amp. hr.	
3.	Cells Cell designation according to IS:1651-1970 Method of connection between cells whether bolted or soldered Distance between the centre of cells when erected Overall dimension of the cells Weight of cell complete with KOH	Cm Cm Kg	
4.	Type and material of cover		
5.	Cell insulators(whether provided)		
6.	Container Material of container Thickness of container Whether container is moulded type		
7.	Separator Type and material Thickness of separator in mm		
8.	Plates Type of positive plate & dimensions in cms. Type of negative plate & dimensions in cms.		

9.	Clearances Clearance between edges of plate and inner surface of container Clearance between bottom of negative plate and bottom of container Clearance between top of the plate and top of the container	Cm Cm Cm	
10.	Electrolyte Amount and specific gravity of electrolyte required for first filling Recommended specific gravity at the end of full charge Expected specified gravity at the end of discharge at 10 hr. rate Max. electrolyte temperature which cell can stand Continuously Short time	°C °C	
11.	Voltage per cell at the end of charge at finishing rate	V	
12.	Capacity of battery in Amp. hrs. at 27°C At 10 hr. rate of discharge At 3 hr. rate of discharge At 1 hr. rate of discharge At 1 minute rate of discharge	AH AH AH AH AH	
13.	Voltage of the battery at the end of discharge at: At 10 hr. rate of discharge At 3 hr. rate of discharge At 1 hr. rate of discharge at 1 minute rate of discharge	V V V V	
14.	Recommended charging	Amp.	

	rates of the battery Starting rate of charge Finishing rate of charge	Amp.	
15.	Recommended trickle charging rate	Amp.	
16.	How long the battery can remain uncharged without any deterioration in active material before first charge is given		
17.	Maximum discharge current of battery (with reference to time as per para 18 below)		
18.	Time for which max. current as referred above can be continuously drawn such that voltage does not fall below 10% of rated voltage	Hr.	
19.	Nominal watt-hour efficiency of the battery at 10 hr. rate	%	
20.	Nominal amp. hr. efficiency of battery at 10 hr. rate	%	
21.	Type of wood used for battery stand		
22.	Type of paints used		
23.	Size and material of insulators		
B.	FLOAT & BOOST CHARGER FOR BATTERY		
1.	Rectifiers and filters Type and make Material and construction of rectifier Power rating Peak inverse voltage Current rating Type of filters and ripple factors	Watts V	
2.	Automatic voltage		

	regulator (A.V.R.) Type of AV.R. Regulating bank Auto-setting rate of A.V.R. When set to trickle charging When set to boost charging Manual control range Sensitivity of A.V.R.		
3.	Transformer V.A. rating of transformer Transformation ratio		
	and taps Type of connection Type of overload device		
4.	Instruments Ammeter range Voltmeter range		
5.	Miniature circuit breaker Rated normal current carrying capacity Rated short circuit current capacity No. of auxiliary contacts for alarm and annunciation		
6.	Type of alarm and annunciation arrangement for over voltage under voltage and grounded bus conditions		
7.	Alarm and annunciation scheme for HRC fuses		
C.	D.C. Distribution Board		
1.	D.C. Bus Bars Current rating of	Amp.	
	positive bus Current rating of negative bus Type & class of Insulator	Amp. Amp.	

2.	<p>Incoming Circuits No. of moulded case circuit breaker and their normal and short circuit current rating</p> <p>Outgoing circuits No. of MCB Normal rating Short circuit current rating</p>		
3.	<p>Selector switches Current rating of the switches Current rating of auxiliary contacts</p>		
4.	<p>Type and range of the ammeter</p>		
5.	<p>Voltmeter range</p>		
6.	<p>Alarm and annunciation scheme for HRC fuses</p>		

MECHANICAL AUXILIARIES OF POWER HOUSE

S.No	Description	Value (to be filled by bidder)
1	<p>i) Dewatering System: No. of pumps Type & make of pumps Rating of each pumps (discharge, speed, head) Diameter of impellor Material of casing, shaft & impellor Type, rating, speed and insulation type of motors Type and make of level controllers</p> <p>ii) Drainage System No. of pumps Type & make of pumps Rating of each pumps (discharge, speed, head) Diameter of impellor Material of casing, shaft & impellor Type, rating, speed and insulation type of motors Type and make of level controllers Pressure rating of valves used</p>	
2	<p>Cooling Water System:</p> <p>Source of cooling water (Intake / tail race) No. of pumps Rating of each pumps (discharge, speed, head) Diameter of impellor Material of casing & impellor Motor type, rating, speed & insulation Type of starter for motors Capacity & make of self cleaning strainers Material and size of strainer element Capacity & make of actuator for strainer</p> <p>Pressure rating of valves Materials of casing, valve seat & stem of valves</p>	

3	Compressed Air System No. and capacity of compressors Type & make of compressors Rating of motor, speed & type of insulation Working pressure Volume of high pressure air receiver Volume of low pressure air receiver Test pressure for air receivers Nos., type & make of pressure switches Type & make of pressure reducer	
4	Fore bay & tail race water level measuring device Type / basic principle of head sensors Output signals from sensors Make	
5.	FIRE EXTINGUISHERS	
	1. CO₂ TYPE WHEEL & HAND PORTABLE TYPES a. Name of Manufacturer (Word equivalent not acceptable) b. Standard to which it conforms c. Capacity d. Pressure of CO ₂ when charged e. Weight of CO ₂ f. Weight of Cylinders when full and empty g. Effective range max./min h. Discharge time i. Test pressure	

POWER AND CONTROL CABLES

Sl.No.	Particulars	To be Filled in by Tenderer
1.	General	1100 V
	i. Name and address of the manufacturer	
	ii. Name and address of contractor's representative from whom technical as well as commercial clarifications can be obtained.	
	iii. Location of factory	
	iv. Validity of tender	
2.	Cable Type	
	i. Type and size of Cables	
	ii. Standard applicable	
	iii. Voltage rating	
	iv. Permissible variation in voltage, frequency and combined voltage and frequency.	
	v. Suitable for earthed/ unearthed system	
3.	Conductor	
	i. Material copper/ aluminium/ grade	
	ii. Nominal cross-sectional area.	
	iii. Form of conductor-circular/ shaped	
	iv. No. of strands	
	v. Nominal dia. of each strand	
4.	Conductor Screen	
	i. Material	
	ii. Minimum thickness	

- iii. Whether extruded

5. Insulation

- i. Material (Mention type)
- ii. Minimum average thickness
- iii. Tolerance on the smallest of the measured values of thickness of insulation.
- iv. Dia of core over insulation.
- v. Specific insulation resistance at 27°C
- vi. Colour scheme of identification of cores.
- vii. Average dielectric strength
- viii. Suitability with regard to moisture zone, acid, oil and alkaline cup-roundings.

6. Insulation Screen(for 1100 V Cables)

- i. Whether extruded semi-conducting screen is supplied
- ii. Material of the semi-conducting screen
- iii. Thickness of the semi-conducting screen
- iv. Whether copper tape screening is applied
- v. Thickness of the copper tape.
- vi. For braided screen, material and dia. of screen wire and minimum percentage coverage.

7. Inner Sheath(for 1100 V Cables)

- i. Material (mention type)
- ii. Whether extruded
- iii. Minimum thickness of inner sheath
- iv. Calculated diameter over stranded cores of the cables.

- v. Whether the inner sheath and the filling material are suitable for the operating temperature of the cable.

8. Armour (for 1100 V Cables)

- i. Type and material
- ii. Nominal dimensions of steel strip or nominal dia. of round armour wire.

9. Outer Sheath/ Overall Covering

- i. Material (mention type, if any)
- ii. Whether extruded
- iii. Minimum average thickness
- iv. Tolerance on the smallest of the measured values of thickness of outer sheath.
- v. Calculated dia. under the sheath.
- vi. Whether anti-termite treatment has been given in the outer sheath.

10. Electrical Properties

- i. Conductor resistance at 20°C per km.
- ii. Maximum permissible conductor temp.
 - a. Under continuous full load
 - b. Under transient conditions
- iii. Loss tangent at normal frequency
- iv. Reactance at 50 C/s per km.
- v. Capacitance at 50 C/s per km.
- vi. Current rating.
 - a. In air (continuous)
 - b. In duct (continuous)
 - c. Reference ambient temperature for the above
 - d. Short circuit current rating for 1 sec. duration

- vii. Derating factors.
 - a. For ambient temperature of 50°C
 - b. For grouping of 4 to 6 cables in racks and trays and in 4 to 6 tiers for different spacings and also touching each other.

11.**Mechanical Data**

(For each of the cable sizes of different voltage grade)

- i. Overall dia. of the cable
- ii. Dia. of the cable under the sheath
- iii. Diameter under armouring
- iv. Diameter over the stranded cores
- v. Weight of cable per kg.
- vi. Drum length
- vii. Tolerance on drum length
- viii. Total weight of the drum
- ix. Dimensions of the drum
- x. Recommended minimum installation radius

Maximum safe pulling force.

11 kV ISOLATORS

Sl. No.	Particulars	As specified	As offered
1.	Name of manufacturer		
2.	Manufacturer's type designation		
3.	Standards applicable		
4.	Type	Double Break/ Horizontal	
5.	Rated voltage (kV)	11 kV	
6.	Rated frequency	50 Hz	
7.	Current rating Continuous (at design temp.) (A) Current rating at site condition (A) Dynamic through fault (A) Second rating (kA) Making current (A)		
8.	Design ambient temperature (°C)		
9.	Maximum temperature of current carrying parts with carrying rated current at specified ambient temperature, (°C)		
10.	Maximum temperature of current carrying parts with carrying short circuit current for 3 seconds at temperature, (°C)		
11.	One minute power frequency dry & wet withstand voltage		
12.	1.2/50 micro-second impulse withstand voltage		
13.	Switch contact particulars Type of main isolating contacts Area & material of contacts Thickness of silver facing Blade material		
14.	Number of auxiliary contacts on disconnecting switch		
15.	Rating of auxiliary contacts Continuous (A) Breaking current (A)		
16.	Type of interlock between earthing blade and isolator		
17.	Particulars of isolator operating mechanism		
18.	Duty	Outdoor	
19.	No. of operations the disconnecting switch can withstand without deterioration of contacts		
20.	Clearance between phases, between live parts & earth mm between fixed contacts and blade in open position mm		
21.	a. Capacitive current that can safely be interrupted by the switch (A) b. Magnetizing current that can safely be interrupted by the switch (A).		
22.	Type and make of insulators		
23.	No. of insulators per stack		

EE (E-M)

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24.	One minute dry & wet withstand voltage per stack, kV (rms)		
25.	Impulse voltage of insulator stack at 1.2/50 micro seconds positive full wave kV (peak)		
26.	Creepage distance Total (mm) Protected (mm)		
27.	Total weight (kg)		
28.	Dimensions of switch L x B x H (mm x mm x mm)		
29.	Shipping dimension of largest package		
30.	Provision of earthing switch	One side/both side	
31.	GA drg. of disconnect switch along-with support structure	Submitted/not submitted	
32.	Supporting structures Material Total weight/isolator (kg) Thickness of galvanizing micron Total height of structure in mm		
33.	Power and control power supply voltage		
34.	Confirm that all particulars given in technical particulars are acceptable to tenderer	Yes/No	
35.	If answer is 'NO' in above then indicate point wise deviation		

11 kV VACCUM CIRCUIT BREAKERS

Sl. No.	Particulars	As specified	As offered
1.	Name of manufacturer		
2.	Manufacturer's type designation		
3.	Type	Vacuum	
4.	Standards followed		
5.	Suitable for outdoor duty	Yes/No	
6.	Rated voltage (kV)		
7.	No. of poles of circuit breaker		
8.	Continuous current rating (A) i. Under normal conditions (amps) (at °C) ii. Under site conditions (Amps)		
9.	Short time current rating i. 1 second kA (rms) ii. 3 seconds kA (rms)		
10.	Maximum temperature rise over ambient of different parts °C.		
11.	Breaking capacity i. Symmetrical kA rms ii. Asymmetrical Ka		
12.	Making capacity kA (peak)		
13.	Kilometric fault level (MVA)		
14.	Maximum interrupting capacity under phase opposition condition MVA		
15.	Maximum line charging current braking capacity without over exceeding 2.5 to 3 times the rated phase to neutral voltage		
16.	Maximum line charging current breaking capacity and corresponding over voltage recorded in test		
17.	Total break time (measured from instant of trip coil energization)		
18.	Arcing time (ms)		
19.	Make time (ms)		
20.	Dry and wet 1-minute power frequency withstand test voltage for complete circuit breaker i. between phase to phase kV (rms) ii. between phase to ground kV (rms)		
21.	1.2/50 micro-second full wave impulse withstand voltage for complete circuit breaker i. between phase to phase kV (peak) ii. between phase to ground kV (peak)		
22.	Dry 1-minute power frequency withstand voltage for insulator Kv (rms)		
23.	1.2/50 micro-second full wave impulse withstand voltage for the insulators, kV (peak)		

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0/0 the CE, DHPD, Itanagar

24.	Creepage distance to ground, mm i. between phase ii. live parts to earth iii. live parts to ground level		
25.	Number of break per phase		
26.	Total length of break per phase, mm		
27.	Rate of contact travel, mm/sec		
28.	Type of main contacts		
29.	Type of auxiliary contacts		
30.	Material of auxiliary contacts		
31.	Main contact silver plated or not, if yes, thickness of silver plating		
32.	Number of trip coils in each breaker		
33.	Number of auxiliary contact provided Those closed when breaker is closed. Those open when breaker is closed. Those adjustable w.r.t. the position of main contact. Rating and braking capacity of each contact.		
34.	Type of operating mechanism Opening Closing Emergency tripping		
35.	Control cum circuit volt. For close/trip coil (volt)		
36.	Power required for closing/trip coil (watt)		
37.	Duty cycle		
38.	Anti-pumping device	kg	
39.	Weight of 3 phase CB complete with operating mechanism, bushing, framework etc.		
40.	Overall dimensions (mm x mm x mm)		
41.	Confirm that all details given in technical particulars are acceptable to tenderer	Yes/No	
42.	If answer is No in 41, indicate point wise deviation		
43.	Manufacture's catalogue enclosed	Yes/No	

11 kV LIGHTNING ARRESTORS

Sl.	Particulars	As specified	As offered
1.	Name of manufacture		
2.	Manufacturer's type designation		
3.	Standards applicable		
4.	Arrestor class and type		
5.	Rated arrestor voltage kV (rms)	11	
6.	Nominal system voltage kV (rms)		
7.	Rated frequency Hz		
8.	Nominal discharge current (8/20 micro sec wave) kA (peak)		
9.	Max. 100% 12/50 micro sec. spark over voltage kV (peak)		
10.	Max. wave front spark over voltage kV (peak) & front steepness kV/sec.		
11.	Max. residual voltage at rated nominal discharge current kV (peak)		
12.	Impulse current withstand High current short duration (4/10 micro sec. wave) kA (peak) Low current long duration Amps. (peak)		
13.	Wet and dry power frequency withstand voltage for the housing kV (rms)		
14.	Impulse withstand strength of arrestor housing with 1.2/50 micro-sec wave kV (peak)		
15.	Total creepage distance of the arrestor housing mm		
16.	Protected creepage distance of the arrestor housing mm		
17.	Total weight of material included for supporting structures Thickness of galvanizing micron Total height of structures in mm		
18.	Suitable for outdoor duty.	Yes/No	
19.	Confirm that all particulars given in Tech. Particulars in GTP sheet are acceptable	Yes/No	
20.	If answer is 'NO' in 19 indicate point-wise deviation		

11 kV POTENTIAL TRANSFORMERS

S. No.	Particulars	As specified	As offered
1.	Manufacturer's name, type & designation		
2.	Type		
3.	Rated voltage	11	
4.	Rated primary voltage (kV)		
5.	Rated secondary voltage (kV) Winding I Winding II		
6.	Rated burden (VA) Winding I Winding II		
7.	Accuracy class Winding I Winding II		
8.	Maximum ratio error with rated burden and 5% normal primary voltage		
9.	Maximum ratio angle error with rated burden and 5% normal primary voltage		
10.	Variation in ratio and phase angle error for variation in Voltage by 1°C Frequency by 1Hz		
11.	Temperature rise at 1.1 times rated voltage with rated burden		
12.	Rated voltage factor and time		
13.	1.2/50 micro second impulse wave withstand test voltage (kV peak)		
14.	One minute power frequency withstand test (dry) voltage kV rms		
15.	One minute power frequency withstand test (wet) voltage kV rms		
16.	One minute power frequency withstand voltage on secondaries (kV rms)		
17.	Minimum creepage distance (mm) Moderately polluted atmosphere Heavily polluted atmosphere i. Total ii. Protected		
18.	Whether corona shield provided or not		
19.	Total weight (kg)		
20.	Overall dimensions		
21.	Mounting details		

11 kV CURRENT TRANSFORMERS

Sl. No.	Particulars	As specified			As offered
1.	Name of manufacturer				
2.	Manufacturer's types designation				
3.	Type				
4.	Standards followed				
5.	Rated voltage (kV)				
6.	Rated primary current				
7.	Rated secondary current				
8.	Number of cores: Core I Core II Core III	Rated output	Class of accuracy	Accuracy limit factor	
9.	Short time current rating: i. 1 seconds kA (rms) ii. 3 seconds kA (rms)				
10.	Dynamic current kA (peak)				
11.	Temperature rise over max. ambient °C: i. Oil at top of housing (°C) ii. Winding (°C)				
12.	Class of insulation				
13.	Current voltage and phase errors at rated burden and frequency				
14.	Confirm that all particulars given in technical data sheet are acceptable	Yes/No			
15.	If answer is 'NO' in 14 indicate point wise deviation				

11 kV BUS BAR, CONDUCTOR AND INSULATORS**BUS BAR**

Sl. No.	Particulars	As specified	As offered
1.	Make		
2.	Type		
3.	Size		
4.	Nominal current rating at maximum site ambient		
5.	Short time rating for 3 sec (in kA)		
6.	Rated dynamic stability current kA (peak)		
7.	Weight per metres in kg		
8.	Clearance i. Phase to phase (mm) ii. Phase to earth		

ACSR CONDUCTOR

Sl.	Particulars	As specified	As offered
1.	Make		
2.	Type		
3.	Size		
4.	Nominal current rating at maximum site ambient temperature		
5.	Short time rating for 3 sec. (in kA)		
6.	Rated dynamic stability current kA (peak)		
7.	Weight per mtr in kg		
8.	Clearance Phase to phase Phase to earth		

INSULATORS

Sl.	Particulars	As specified	As offered
1.	Make		
2.	Type		
3.	Material of insulator		
4.	Colour		
5.	Insulation level: Dry (PF) Wet (PF) Impulse		
6.	Creepage distance Total (mm) Protected (mm)		
7.	Power freq. Puncture test		
8.	Visible discharge test volt		
9.	For support insulators minimum height of base from ground		
10.	Number of disc in string insulators		
11.	Rated voltage for disc in kV		
12.	Deviation if any from the data sheet		

CONTROL AND RELAY PANELS

Sl. No.	Particulars	As specified	As offered
1.	Make		
2.	Type		
3.	Reference standard		
4.	Construction Degree of protection Sheet metal thickness mm Floor channel sills, vibration damping pads and kick plate furnished?		
5.	Equipment mounting All relays, meters and switches are flush mounted? Relays furnished in draw out cases with built-in test facilities?		
6.	Name plate Material Thickness Size for :- Equipment Panels		
7.	Internal illumination Volt Watt Door switch controlled		
8.	Space heater Volt Watt Thermostat controlled?		
9.	Plug socket Type Rating		
10.	Panel illumination, space heater and plug socket circuits provided with individual switch fuse units?		
11.	Internal wiring Wire type Voltage grade Conductor material Conductor size for i. Current/control circuit ii. Voltage circuit e. Wires identified at both ends with ferrules?		
12.	Terminal block Make Type/catalogue No. 20% spare terminals furnished?		
13.	Ground bus Material Size mm		

14.	Painting Type of finish Colour shade Inside/Outside Details of painting procedure furnished?		
15.	Breaker control switch Make Type Reference standard Contact rating		
16.	Make & Continuous Amp Break (inductive) Amp		
17.	Meter selector switch Make Type Reference standard Contact rating Make and continuous Amp Break (inductive) Amp		
18.	Push button Make Type Reference standard Contact rating Make and continuous Amp Break (inductive) Amp 5. No. and type of contacts per button		
19.	Lamps Make Type Reference standard Rating Volt Watt Series resistance		
20.	Indicating instruments Make Type Reference standard Type of movement Accuracy class Scale in degrees VA burden Current coil Voltage coil Size Range Rated input Overload capacity without loss in accuracy (%) Continuous Short time 12. Burden on CT/PT		

21.	Annunciator Make Type Referred standard No. of annunciator groups furnished? No. of windows per group Overall dimension of a group mm Details write-up on scheme furnished?		
22.	Illumination status indication for isolators Make Type Rating Volt Watt		
23.	Semaphore indicators Make Rating Volt Watt		
24.	Fuses Make Type Fuse bases provided with imprints of fuse rating and voltage	Yes/No	
25.	Relays Catalogue of all relays submitted with bid Whether tenderer agree to conduct all site tests as asked If 'NO' indicated deviations Whether quality assurance plan is acceptable If 'NO' indicate deviations Whether tenderer agree to provide No. of aux. Relays timers, range of relays/meters terminal blocks, control switches, wiring etc. as per approved drawings Minimum clearance between relays/meter/casings Horizontal Vertical Deviation if any on technical design parameters for control protection metering and alarm system Any additional protection, metering control; features, if necessary/desirable from tenderer's point of view	Yes/No Yes/No	