



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	GV	MM	VK
TITLE LT SWITCHGEAR (AC & DC BOARDS)				SIGN			
				DATE			
				GROUP	TBEM		
CUSTOMER	UJVN LIMITED (UJVNL)						
PROJECT	220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND						

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	(* Offers without filled Checklist shall not be evaluated)	

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
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SECTION-1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE:

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch, supervision of erection, testing and commissioning of metal enclosed, indoor floor mounted, compartmentalized double front construction and free standing type AC and DC Distribution Board as listed in clause **1.2** below.

This section covers the scope and quantities of LT AC & DC DB. The specific technical Requirements for the above item as specified by the customer are given in Section-2. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

In case of any discrepancies between the requirements mentioned under Section-1/Section-2 and those specified in the Section-3, the specifications given under Section-1/Section-2 shall prevail and shall be treated as binding requirements.

The term "Owner/Customer/Employer" appearing in this specification shall refer to ultimate customer, the term "Purchaser/Contractor" shall refer to BHEL and the term "Sub-contractor/Bidder/Manufacturer" shall refer to the successful Bidder.

The equipment is required for the following project:

Name of Customer: UJVN LIMITED (UJVNL)

Name of the Project: 220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT.
DEHRADUN, UTTARAKHAND

Refer Section - 3 for Project Details and General Specifications.

1.1 SPECIFIC TECHNICAL REQUIREMENTS:

Please refer Annexure-A drawing for Single Line Diagram of LT AC/DC Boards

TB-3-398-316-010	SLD FOR LT AC & DC SYSTEM
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For further Technical Requirements, refer Section-2

1.2 BILL OF QUANTITY:

Bidder must quote addition /deletion price for each and every type of complete module (Type of modules are defined in Section-2). This is required to account for any changes in the Single Line Diagram during detailed contract engineering stage.

For details of fitments of each module, refer Section 2 and enclosed Single Line diagram.

Annexure-1 attached for Detailed BOQ.

Fault rating is as per attached S.L.D

1.3 TECHNICAL PRE-QUALIFYING REQUIREMENTS

Refer Annexure-B.

1.4 TYPE TESTING, ERECTION, TESTING & COMMISSIONING

- a. Type tests shall be in line with Section 2.
- b. Commissioning check tests shall be as per Section 2.
- c. The type test reports submitted shall be of tests conducted after **08.05.2007**. The bidder should have conducted type test on identical or similar equipment/components to those offered. In case type test reports are found to be technically unacceptable to BHEL/UJVNL, the type test shall be conducted without cost and delivery implication to BHEL/UJVNL.

1.5 DEVIATIONS

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

1.6 PACKING

- 1.6.1** All equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and outdoor storage (for a minimum period of 2 years) at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.
- 1.6.2** The Bidder shall include and provide for security, protection and packing the equipment so as to avoid loss or damage during transport by any mode.
- 1.6.3** All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'UP' and 'DOWN' side of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit and storage. Gas seals or other methods proposed to be adopted for protection against moisture during transit shall be to the satisfaction of the purchaser.
- 1.6.4** The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, USE NO HOOKS etc.
- 1.6.5** Each package delivered under the contract shall be marked by the Bidder at his expense and such marking must be distinct (all previous irrelevant marking being carefully obliterated). Such marking shall show the description and quantity of contents, the name of consignee and address, the gross and net weights of the package, the name of Bidder with a distinctive number of mark sufficient for purpose of identification. All markings shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.
- 1.6.6** Each Package shall contain a note quoting specifically the name of the Bidder, the number and date of contract or order and the name of office placing the contract, nomenclature of the stores and include a schedule of parts for each complete equipment giving the parts number with reference to the General Arrangement/ Assembly drawing

and the quantity of each part, drawing number and tag numbers.

- 1.6.7** All equipment/ material shall be suitably packed for transport, carriage at site and outdoor storage during transit. The Bidder shall be responsible for any damage to the equipment during transit. The contents of each package shall bear marking that can be readily identified from the package list and packing shall provide complete protection from moisture, termites and mechanical shocks etc.
- 1.6.8** Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.
- 1.6.9** Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.

1.7 QUALITY PLAN:

Bidder shall follow UJVNL approved Quality Plan at contract stage. Any Comments during detailed engineering from BHEL/UJVNL to be incorporated without any cost and delivery implications to BHEL/UJVNL.

1.8 SUPERVISION OF INSTALLATION & COMMISSIONING

Manufacturer of LT Switchboard shall supervise the installation and commissioning and perform commissioning tests as recommended in O&M manual / or relevant standards. All necessary instruments, material, tools and tackles required for installation, testing at site and commissioning are to be arranged by the manufacturer.

1.9 DRAWINGS / DOCUMENTS

Bidder shall submit all necessary drawings and documents for approval.
However, Following drawing/documents are required for Manufacturing clearance:

- GA
- Schematic Drawings
- Type Test Reports (TTR)
- Manufacturing Quality Plan (MQP)

Date of Submission of first lot of drawing will be counted only from the date of submission of reasonably correct drawings.

BILL OF QUANTITY FOR LT SWITCHGEAR		Annexure-1	
S.No.	Description	Unit	Qty
A.	Main Items		
1	415V, 3Ph, 4 wire, 200A, 40kA for 1s AC DISTRIBUTION BOARD (1A)	Set	1
2	220V, 100A, 35kA (DC) for 1s DC DISTRIBUTION BOARD (1D)	Set	1
B.	Mandatory Spares- DCDB		
1	Circuit Breaker of each type and size used	Nos.	5
2	Indicating lamps of each type	Nos.	20
3	Control switch and supervision relay of each type	Nos.	2
4	Voltmeter	Nos.	1
	Mandatory Spares- ACDB		
5	Push buttons of each type	Set	2
6	Fuses of all type used	Nos.	10
7	MCCB of each type used	Nos.	2
8	CTs and PTs of each type and rating	Nos.	3
9	Supporting insulator of each type used	Nos.	6
10	Contactors of each type used	Nos.	4
11	Indicating instruments of each type	Nos.	2
12	Under Voltage relays	Nos.	2
13	Over Current and E/F relays	Nos.	2
14	Indicating lamps used including assemblies	Nos.	10
15	Control and instrumentation switches	Nos.	3
C.	Supervision of Erection Testing & Commissioning.	LOT	1
D.	Unit Rate Items:		
1	Module G1	Nos.	1
2	Module E – 200A	Nos.	1
3	Module E – 100A	Nos.	1
4	Module E – 63A	Nos.	1
5	Module E – 32A	Nos.	1
6	Module E – 16A	Nos.	1
7	Module X – 100A	Nos.	1
8	Module X – 32A	Nos.	1
9	Module X – 16A	Nos.	1
10	Muti Function Meter (MFM)	Nos.	1

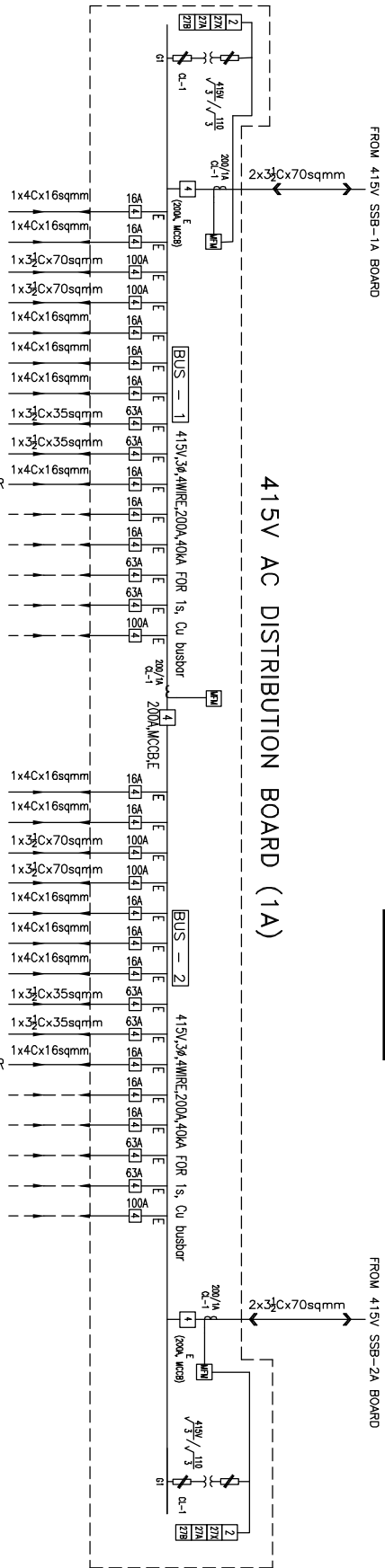
NOTE:

- Unit Prices of Individual Equipment included here or in mandatory spares are required for any Addition/Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items (Boards). The unit rate shall include associated engineering, services, wiring, mounting accessories and associated enclosures etc.
- Quoting for unit prices is mandatory and shall be considered for evaluation.
- If any of the unit rate items is not quoted, but is required due to damages, theft, replacement, change in feeder rating etc. or any other reason during execution, the required quantity shall be supplied free of cost within guarantee period.
- It will be the bidders responsibility to organise deputation of OEM of protection relays and devices. Equipments required for testing of protection relays is in Bidders scope.
- One Set shall be defined as the total quantity required for one assembly.
- Any Spare list item not included in BOQ but mentioned in Section-2 and is applicable for the project is deemed to be supplied.

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ANNEXURE- B

TECHNICAL PRE-QUALIFYING REQUIREMENTS

Name of Project: -220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND

Name of Item : -LT Switchgear

Sr. No	Description	Supporting Document to be attached	Reference of attached documents																
01	The bidder should have designed, manufactured, tested and supplied at least 50 nos. panels comprising of MCCB (i.e. Moulded Case Circuit Breakers) modules of the type being offered which should be in successful operation# for minimum 2 years as on date of bid Opening. The Switchgear items (such as circuit breakers, fuse switch units, contactors etc.), may be of his own make or shall be procured from reputed manufacturers and of proven design. At least One Hundred Circuit Breakers of the make and type being offered shall be operating satisfactory# as on date of bid opening. #: satisfactory operation means certificate issued by the End customer/EPC Client certifying the satisfactory operation without any adverse remark.	1. Bidder to Provide Compliance/Confirmation of fulfilling SL No.1 Technical Requirement. 2. Performance certificate /Letter /MOM etc. issued by end customer/EPC client for Satisfactory operation 3. PO Copy / PO list in following format <table><tr><th>Sr No</th><th>ITEMS SUPPLIED TO</th><th>ORDER REFERENCE No. & DATE</th><th>ITEMS</th><th>QTY</th><th>ORDER FULLY EXECUTED</th><th>STATUS, IF ORDER UNDER</th><th>REMARK</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 4. Dispatch instructions/ Material receipt at site/ lorry receipt details etc. 5. Factory License and certificate	Sr No	ITEMS SUPPLIED TO	ORDER REFERENCE No. & DATE	ITEMS	QTY	ORDER FULLY EXECUTED	STATUS, IF ORDER UNDER	REMARK									
Sr No	ITEMS SUPPLIED TO	ORDER REFERENCE No. & DATE	ITEMS	QTY	ORDER FULLY EXECUTED	STATUS, IF ORDER UNDER	REMARK												

SECTION-2

1. 220V DC System

1.1 Special Design and Layout Conditions

1.1.1 General

The 220V DC system shall consist of a Distribution Board as shown in Single Line Diagram as per Annexure-A. The 220V system shall serve the Control and Protection circuits in the GIS and Switchyard area.

The incoming feeders (2Nos.) for 220V Distribution Board shall be taken from another 220V DC Boards installed for catering Powerhouse loads. The two bus system shall be separated by a Bus-Coupler breaker. Proper interlocking shall be provided so as to avoid mixing of two sources. The SLD for the same may be referred in Annexure-A.

1.1.2. Standards

Unless otherwise stated hereafter, ratings, characteristics, tests and test procedures, etc. concerning the 220V DC system, shall comply with the provisions and requirements of the latest IEC Publications / Indian Standards, each as they apply.

1.2 Design and Construction

1.2.1 Cubicles

1.2.1.1 General

The cubicle assemblies shall be of metal enclosed, free floor standing type, of manufacturer's standard production. The cubicle assemblies shall be designed in accordance with the recommendations of IEC Publication 60439/ IS 8623 with protection IP-42 according to IEC Publication 60529 or Indian Standards. The assemblies must be built to suit the equipment. Hinged doors and removable covers shall be provided wherever necessary to allow access to all equipments. The frame of the cubicles shall be sufficiently sturdy and the metal sheeting of sufficient thickness to ensure safe transportation, mounting and operation without deformation or bulging. Ventilation as required shall be provided.

Continuous lifting angles or lifting hooks shall be provided to facilitate the installation of the cubicles.

1.2.1.2 Compartments

Each cubical shall be divided into sections, or compartments, for housing the respective equipment as described below. Separate Hinged doors shall be provided for each compartment in the respective cubicles.

The circuit breakers for the outgoing feeders in the main distributions shall be housed in one compartment.

1.2.1.3 Cable compartments

Each cubicle in the Assembly shall be provided with a separate vertical cable compartment or as per manufacturer's standard design. Entrance of incoming and outgoing cables into the cable compartment shall be from the bottom. Provisions shall be made to clamp and fasten cable inside the cable compartment.

1.2.1.4 Name Plates

Each incoming and outgoing feeder shall be clearly identified with suitably located nameplate(s). Nameplates shall be furnished for all instruments, control switches etc. where the circuit and function of the particular device cannot readily be determined. Each section of an assembly have an identifying nameplate placed near the top edge. Sizes and types of nameplate are subject to approval.

1.2.1.5 Wiring

The insulation of all wires shall be rated for 650V. All control wiring will be done with stranded wires of minimum size 1.5 mm square. All control wiring within the Assembly housing shall be installed at the manufacturer's premises.

All connections shall be made with solder less lugs. All wires and connections to remote equipment shall be wired to Terminal blocks, according to IEC Publication 60947-7-1 / IES 13947.

All terminals and terminal blocks shall be marked according to an approved system. Terminal blocks shall have 10% extra terminals as spare and for future circuits.

1.2.1.6 Instruments

Control switches and instruments shall be installed in the respective battery charger and circuit breaker compartment doors.

1.2.2. Circuit Breakers

1.2.2.1 General

The contractor shall provide MCCB in accordance with clause - Schedule of equipment, The Circuit Breakers shall be designed in accordance with the recommendations of IEC publication 60947.1 and 60947.2. The service life of the Circuit Breakers shall be at least 20,000 operations at rated current.

1.2.2.2 Contacts

The Circuit breaker contacts shall be of the self-cleaning type, made from an arc resisting material and provided with auxiliary arcing contacts as a protection against burning during the operation of the breaker. All contact shall be self aligning, and shall be easily replaceable.

Auxiliary contacts for position indication, control, interlocking etc. showing whether the Breaker is in open, closed or tripped, shall be provided. The auxiliary contact shall be wired to terminal blocks.

1.2.2.3 Protection

All Circuit breakers, for both incoming and outgoing feeders, shall be provided with adjustable magnetic short circuit over current and instantaneous trip mechanism. The Circuit Breakers shall be provided with the auxiliary contacts for tripped condition. The auxiliary contacts shall be wired to Terminal blocks.

1.2.2.4 Operating Handle

All Main Circuit breaker shall be equipped with an operating handle or other adequate means so that CB can be operated without opening the relevant compartment door.

1.3 Schedule of Equipment

1.3.1 220V DC Distribution Board

- One cubical assembly, with the following equipment:
- Two incoming disconnecting switch.
- Required number of outgoing MCCBs of suitable rating.
- Ammeters
- Voltmeters
- Earth leakage meter
- Supervision equipment including protection relays
- Cubicle lighting fixtures
- Automatically controlled heating element, if necessary
- One Tie Breaker

2. 415 V AC Distribution Board

2.1 Special Design and Layout Conditions

2.2.1 General

The 415V Switchgear system shall consist of a AC Distribution Board as shown in Single Line Diagram as per Annexure-A. The 415V system shall serve the AC supply requirements for various loads in GIS and Switchyard area.

The incoming feeders (2Nos.) for AC Distribution Board shall be taken from another 415V Station Service Boards. The two bus system shall be separated by a Bus-Coupler breaker. Proper interlocking shall be provided so as to avoid mixing of two sources. The SLD for the same may be referred in Annexure-A.

2.2.2. Standards

Unless otherwise stated hereafter, ratings, characteristics, tests and test procedures, etc. concerning the equipment, shall comply with the provisions and requirements of the latest approved recommendations of IEC Publications, each as they apply.

2.2 Basic Dimensions and Rating

Unless otherwise agreed upon the rating, insulation levels and test voltages of equipment and devices in the system shall be as follows:

For 415V AC Distribution Board

Nominal Voltage	415V
Rated Frequency	50Hz
Rated busbar current	200A
Rated short time withstand current of busbar and boards	40kA for 1s
Rated Circuit Breaker Short Ckt. Bearing capacity	40kA

2.3 Design and Construction

2.3.1 415V AC Distribution Board

2.3.1.1 General

The 415V ACDB switchgear shall be metal enclosed, indoor cubicles free floor standing type complete with cubicles, protection, metering, Bus bar system, draw out type MCCBs, instrument transformers, instruments, cabling, wiring, and other accessories not specified above but are necessary for satisfactory operation of the system and for making the equipment complete and for warranting a trouble free safe operation.

The cubicle assemblies shall be designed in accordance with the recommendations of IEC Publication 60439-1 with protection class IP 40 according to IEC Publication 60529. The assemblies must be built to suit the equipment shown on the single line diagram. Hinged doors and removable covers shall be provided wherever necessary to allow access to all equipment. The frame of the cubicles shall be sufficiently sturdy and the metal sheeting of sufficient thickness to ensure safe transport, mounting and operation

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without deformation or bulging. Natural ventilation as required shall be provided. Provision for future expansion of cubicles shall be made in end cubicles.

Continuous lifting angle or lifting hooks shall be provided to facilitate the installation of the cubicles.

2.3.1.2 Compartments

Each cubicle shall be divided into sections, or compartments, housing the incoming, interconnecting or outgoing feeder moulded case circuit breaker units

Each MCCB unit shall be mounted on a carriage assembly, constructed so that the unit can be removed and replaced while the buses are energized. The carriage shall have self-engaging definite position stops for disconnected, test and connected positions. All necessary means shall be provided for easy removal and handling of the unit.

2.3.1.3 Cable Compartments

All feeders to and from the cubicle assemblies will be cables. The assemblies shall be accessible for the cables from bottom to each feeder circuit breaker via separate cable compartment. Solder less connectors shall be furnished for each power conductor entering the equipment. Provisions shall be made to clamp and fasten cables in the cable compartment.

2.3.1.4 Name Plates

Each feeder shall be clearly identified with suitably located nameplate(s). Nameplates shall be furnished for all instruments, control switches, etc. Each section of an assembly shall have an identifying nameplate placed near the top edge.

2.3.1.5 Wiring

All secondary and control wiring shall be done with stranded copper wires, of size 1.5mm², with voltage rating 1.1 kV, except that current transformer secondary leads shall not be less than 2.5 mm². All control wiring within the assembly housing shall be installed at the manufacturer's premises.

All connections shall be made with solder less lugs. All wires and connections to remote equipment shall be wired to terminal blocks. The terminal blocks shall be according to IEC Publication 60947-7-1. All spare compartments shall be completely wired. All terminals and terminal blocks shall be marked according to an approved system. Terminal blocks shall have approximately 10% extra terminals as spare and for future circuits.

2.3.1.6 Bus Bar

The bus bars shall have a continuous current carrying capacity of 200A. **Bus bar conductors shall be made of copper.** All connections shall be in accordance with the best modern practice. A continuous PEN bus of the same cross section as the main bus

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shall be furnished and connection of ample size shall be brought to each feeder compartment, for bolted connection of the feeder PEN wire.

Phase arrangements shall be R-Y-B from top to bottom, from back to front and from left to right when facing the front of the equipment. All bus bars shall be clearly marked by engraved letters. Adequate provisions must be made for the expansion and contraction of the bus bars and other bus bar connections with variation in temperature. Bus bars shall be so arranged that they can be extended in length without difficulty.

All field connections shall be bolted. The connections shall be kept as short and straight as possible. Bus bars, connections and their insulating supports shall be of approved construction, mechanically strong and shall withstand all the stresses, which may be imposed upon them under ordinary working conditions due to vibration, temperature fluctuations, short circuit or other reasonable causes.

2.3.1.7 Instruments

Control switches and instruments shall be mounted on the circuit breaker compartment doors / front side of the panel.

2.3.2 Moulded Case Circuit Breaker (MCCB)

2.3.2.1 General

The Contractor shall provide MCCBs in accordance with Schedule of equipment of this specification. The MCCBs shall be designed in accordance with the IEC Publications 60947.1 and 60947.2. All MCCBs shall be manually operated and shunt trip type.

All MCCB shall be of the draw out type, housed in individual metal enclosed compartments. Each MCCB shall be mounted on a carriage assembly with wheels running on tracks secured to the inside of the compartment. The carriage shall have self-engaging definite position stops for disconnected and connected position. Means shall be provided for easy removal and handling of the units. ON, OFF, TRIP position of MCCBs should be indicated. A mechanical interlock shall prevent moving of the MCCB from the connected position, while the breaker is closed, and prevent the access door being opened unless the breaker is in withdrawn position. MCCB shall be operable by means of Push button switches/handle.

2.3.2.2 Contacts

The MCCB contacts shall be of the self-cleaning type, made from an approved arc resisting material. All contacts shall be self-aligning, and shall be readily replaceable.

Main and secondary disconnecting contacts shall be silver plated, with spring, which will ensure high-pressure contact. Secondary contacts shall be engaged both in connected and test position.

2.3.3 Schedule of Equipment

415V AC Distribution board shall contain the following major equipment including

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necessary busbars and wiring. The quantities are to be worked out by the contractor based on the Single line diagram enclosed in Annexure and shall be approved by the employer during detailed engineering.

- MCCB as per single line diagram.
- Required no. of single phase CTs for incomer feeders
- Required no. of single phase CTs for Tie feeder.
- Required no. of MFM meters.
- Local Control switches
- Indicators
- All necessary auxiliaries for control and supervisory circuits.
- Other feeder units necessary to fulfil the requirements of the specification and sockets etc.
- All secondary wiring, terminal blocks, labelling and nameplates, sockets etc.
- All necessary AC bus bars. (including N- bus bar)
- Cubicle lighting including lighting fixtures and power and communication sockets
- Cubicle heating including heating elements

3 Equipment to be furnished

3.1 The Bidder shall quote for various AC/DC distribution boards as given in Bill of Materials and in accordance with this specification.

3.2 Standard scheme of interconnection of switchboards and distribution boards along with tentative feeder disposition for each board shall be provided by the bidder for the approval of the employer. Any other feeder required as per system requirement for efficient and reliable operation shall be deemed to be included in bidder's scope.

3.3 The Bill of Materials for each type of module shall be as under. These are minimum indicative requirement of the system. The necessary auxiliary relays, push buttons and indicating lamps shall be provided as per scheme requirement. Any other item / component required with in a module for efficient and reliable operation shall be deemed to be included in bidder's scope.

3.4 Module Type E

- i) One (1) Four pole MCCB having thermal and magnetic release. Incomers and Bus-Coupler MCCB shall have shunt trip provision.

3.5 Module G-1 (VT Module with Under Voltage relay)

- i) Three (3) $415/\sqrt{3}$ / $110/\sqrt{3}$ volts single phase voltage transformer star / star connect with star point solidly earthed mounted on common draw out chassis. Accuracy Class 0.5 for protection and metering with 50VA Burden.

- ii) Six(6) HRC Fuses mounted on the above chassis.

- iii) One (1) Four Position voltmeter selector switch/MFM.

- iv) One (1) Voltmeter (0-500V)/MFM

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- v) One (1) Double pole instantaneous under voltage relays with continuous variable setting range of 40-80% of 110 Volts.
- vi) One (1) Time delay pick up relay having a time setting range of 0.5 to 3 s. With 3 'NO'. Self reset contacts, suitable for 220V DC.
- vii) One (1) Auxiliary relay 220V DC with 2 No. self reset contacts.
- viii) Three(3) Indicating lamps with series resistor and colour lenses (Red, Blue & Yellow).

3.6 Module Type G-2

- i) Three (3) HRC Fuse
- ii) One (1) Voltmeter (0-500V) /MFM.
- iii) One (1) Voltmeter selector switch four position (R-Y, Y-B, B-R OFF) /MFM.
- iv) Three (3) Indication lamps (Red, Blue & Yellow)

3.7 Module Type S : (DC Metering and Protection Module)

- i) One (1) Voltmeter 300-0-300V DC for 220V DC DB / Voltmeter 0-75V DC for 48V DC DB (MFM or with suitable transducer)
- ii) One (1) Three (3) position voltmeter selector switch/MFM.
- iii) One (1) Instantaneous under voltage relay with 95% of 220V DC. The resetting ratio of relay should not be more than 1.25. the relay shall be provided with a series resistor and a push button across it for resetting (pick up) the relay at about 105% of the drop out voltage.
- iv) One (1) Instantaneous over voltage relay with setting range of 110% of 220V DC. The resetting ratio of relay should not be less than 0.8. the relay shall have a push button in series for resetting the relay at about 95% of the operating voltage.
- v) One (1) Earth leakage relay only for 220V DC system having adjustable pick up range between 3 to 7 milliamps the relay shall be suitable for 220V DC/240V AC Auxiliary supply.

3.8 Module Type X

- One (1) Double pole 250V MCCB

3.9 Module Type-DC (Incomer from Battery & Chargers)

- i) One (1) Double pole 250V DC MCCB for incomer from Battery.
- ii) One (1) DC ammeter with shunt and range of 90-0-400 Amps. for 220V DC DB and 90-0-200 Amp. for 48V DC DB.

- iii) Two (2) Double pole 250V DC MCCB / MCB.
- iv) One (1) Double pole single throw 250V DC air Break switch connecting battery & charger sections to DC DB.

4 Parameters

4.1 MOULDED CASE CIRCUIT BREAKER

	AC System	DC System
a) No. of poles	4	2
b) Voltage & Frequency	415 $\pm$ 10% 50 HZ $\pm$ 5%	250 V
c) Rated Operating Duty	P2	P2
d) Symmetrical interrupting rating	--	--
e) Short Circuit making current	45 kA (Peak)	--
f) Rated Short Ckt. Capacity	40kA	20kA
g) No. of auxiliary contacts	2 NO & 2 NC	2 NO & 2 NC
h) Short Circuit breaking current		
I. AC Component	As per IS	As per IS
II. DC Component	As per IS 13947	As per IS 13947

4.2 Meters

a) Accuracy Class	2.5
b) One minute power frequency withstand test voltage in kV	2.0

4.3 Current Transformers

a) Type	Cast resin, Bar primary
b) Voltage class and frequency	1100 V, 50 Hz
c) Class of Insulation	E or better
d) Accuracy class metering CT	Class 1, VA adequate for application but not less than 7.5 VA

e) Short Time Current Rating (for CTs Associated with circuit breakers)

I. Current	20 kA (RMS)
II. Duration	One second
III. Dynamic Rating	45 kA (Peak)
IV. One minute Power frequency Withstand test Voltage	2.5 kV (rms)

4.4 Voltage Transformer

a) Type	Cast Resin
b) Rated Voltage	
Primary	415/ $\sqrt{3}$ V
Secondary	110/ $\sqrt{3}$ V
c) Method of connection	
Primary	Star
Secondary	Star
d) Rated Voltage Factor	1.1 continuous, 1.5 for seconds
e) Class of insulation	E or better
f) One minute power frequency withstand voltage	2.5 kV (RMS)
g) Accuracy class	0.5, not less than 20 VA

4.5 Relay

a) One minute power frequency withstand test	2 kV (rms)
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5 Type Tests

5.1 Type test reports of Panels (Switchgear and Control gear assemblies) as per IS 8623 Part-I shall be submitted for the following tests before the fabrication of switchgear is started :

- i) Verification of temperature rise limits
- ii) Verification of the dielectric properties
- iii) Verification of short circuit strength
- iv) Verification of the continuity of the protective circuit
- v) Verification of clearances and creepage distances
- vi) Verification of mechanical operation
- vii) Verification of degree of protection

Section-2: Equipment Specifications

5.2 Contractor shall submit type test reports for the following Switchgear and Control gears before the fabrication of switchgear is started :

1. Circuit Breakers / MCCB as per IS 13947 Part-II
2. Protective Relays as per IEC:60255
3. Busbar and Panels, Contactors, Instrument Transformers, meters, Isolating switches and fuses etc.

The reports shall cover all applicable type tests listed in relevant Indian Standards for all component for each type and ratings being supplied.

6 COMMISSIONING CHECK TESTS

Following commissioning checks shall be carried out, in addition to other checks and tests recommended by the manufacturers.

6.1 General

- 6.1.1 Check name plate details according to the specification.
- 6.1.2 Check for physical damage.
- 6.1.3 Check tightness of all bolts, clamps, joints connecting terminals.
- 6.1.4 Check earth connections

6.2 Circuit Breakers

- 6.2.1 Check alignment of breaker truck for free movement
- 6.2.2 Check correct operation of shutters
- 6.2.3 Check control wiring for correctness of connections, continuity and IR values
- 6.2.4 Manual operation of breaker completely assembled
- 6.2.5 Power closing/opening operation, manually and electrically
- 6.2.6 Breaker closing and tripping time
- 6.2.7 Trip free and anti-pumping operation
- 6.2.8 IR values, minimum pick up voltage and resistance of coils
- 6.2.9 Contact resistance
- 6.2.10 Simultaneous closing of all the three phases
- 6.2.11 Check electrical & mechanical interlocks provided
- 6.2.12 Check on spring charging motor, correct operation of limit switches and time of charging.
- 6.2.13 All functional checks

6.3 Current Transformers

- 6.3.1 Meggar between winding and winding terminals to body
- 6.3.2 Polarity test
- 6.3.3 Ratio identification checking of all ratios on all cores by primary injection of current.
- 6.3.4 Spare CT cores, if available, to be shorted and earthed.

6.4 Voltage Transformer

- 6.4.1 Insulation resistance test
- 6.4.2 Ratio test on all cores
- 6.4.3 Polarity test
- 6.4.4 Line connections as per connection diagram

Section-2: Equipment Specifications

6.5 Cubicle Wiring

- 6.5.1 Check all switch developments
- 6.5.2 Each wire shall be traced by continuity tests and it should be made sure that the wiring is as per relevant drawing. All interconnections between panels/equipment shall be similarly checked.
- 6.5.3 All the wires shall be meggered to earth
- 6.5.4 Functional checking of all control circuit e.g. closing, tripping control, interlock, supervision and alarm circuit.

6.6 Relays

- 6.6.1 Check connections and wiring
- 6.6.2 Megger all terminals to body
- 6.6.3 Megger AC to DC terminals
- 6.6.4 Check operating characteristics by secondary injection
- 6.6.5 Check minimum pick up voltage of DC coils
- 6.6.6 Check operation of electrical/mechanical targets
- 6.6.7 Relays settings
- 6.6.8 Check CT and VT connections with particular reference to their polarities for directional relays wherever required.

6.7 Meters

- 6.7.1 Check calibration by comparing it with a sub-standard.
- 6.7.2 Megger all insulated portions.
- 6.7.3 Check CT and VT connections with particulars reference to their polarities for power type meters.

7 SPECIAL TOOLS AND TACKLES

- 7.1 The Bidder shall include in his proposal any special tools and tackles required for erection, testing commissioning and maintenance of the equipments offered.
- 7.2 The list of these special tools and tackles shall be given in the bid proposal sheets along with their respective prices.
- 7.3 The total price of the special tools and tackles shall be included in proposal sheets.

8 Inputs required for Substation Automation Purpose:

8.1 DIGITAL (Potential Free) INPUTS:

LT System shall have provision of following digital inputs for owner's substation automation purpose. These digital inputs shall be made available in the form of potential free contacts to be provided in respective modules.

Further, All alarm devices shall be provided with auxiliary contacts for remote indication.

Atleast, These potential free contacts shall be wired up to respective terminal blocks.

- i) ACDB Incomer-1 breaker On/Off
- ii) ACDB Incomer-2 breaker On/Off
- iii) ACDB 415V Bus-1 U/V
- iv) ACDB 415V Bus-2 U/V
- v) ACDB Bus-Coupler breaker on/off

Section-2: Equipment Specifications

- xii) 220V DC Bus-1 Earth fault
- xiii) 220V DC Bus-2 Earth fault

8.2 ANALOGUE INPUTS:

LT System shall have provision of following analogue inputs for owner's substation automation(SAS) purpose. These analogue inputs shall be generated by distinct transducers to be provided in respective modules.

These inputs shall be wired up to respective terminal blocks.

- i) Voltage R-Y, Y-B, B-R of ACDB Bus-1
- ii) Voltage R-Y, Y-B, B-R of ACDB Bus-2
- iii) R, Y, B Phase Current from Incomer SSB-1A
- iv) R, Y, B Phase Current from Incomer-SSB-2A
- v) Voltage of 220V DCDB Bus-1
- vi) Voltage of 220V DCDB Bus-2
- vii) Current from 220V Incomer-1
- viii) Current from 220V Incomer-2

It is to be noted that :

1. Multi-Function Panel Meter (MFM) is with RS-485 communication port with Modbus protocol and LED display.
2. Mapping address/looping to SAS BCU is in the scope of Vendor.
3. RS-485 cable is in the scope of Vendor.

9 Quality Control And Assurance

The contractor shall follow the quality assurance and testing requirements specified separately in Section XII – Quality Assurance Plan.

Section-XII

Model Quality Assurance Plan (QAP)

1 Shop Tests

Routine test on Distribution boards shall be performed as per relevant IEC with latest amendments. Following shop tests shall be carried out by the manufacturer at their works:

Following test on DC Distribution Boards shall be performed as per IEC.

- HV and IR test
- Scheme Checking

Following shop tests on 415V Switchgear shall be carried out by the manufacturer at their works:

- Visual and BOM check
- Scheme Checking
- Insulation Resistance Test
- High Voltage test

2 Field tests

All field tests including tests during installation, pre-commissioning, commissioning and field acceptance tests shall be conducted in presence of representative of employer.

The following tests shall be performed:

- Installation check of all components installed according to as-built drawings and Engineering,
- Functional test of subsystems,
- Functional test of complete system,
- AC withstand voltage tests,
- Functional and operational tests,
- Measurement of IR of power and control circuits against Earth,
- Adjustment of protection equipment,
- Resistance measurement of all major circuits,
- Other tests as suggested by the contractor.
- Verification of interlocks
- Verification of Components temperature.
- Contact Resistance measurement of Circuit Breaker.

SECTION-3

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Uttarakhand Jal Vidhyut Nigam Limited
b)	Project Title	220kV switchyard for 2 X 60MW Vyasi HEP
c)	Location	Village Vyasi, 5.0 Km.d/s of Lakhwar, Dehradun
d)	Elevation above MSL	535 m
e)	Transport Facilities	Airport ,Railways at Dehradun, accessible by Road from National Highway NH-123 at Barawala (3 km from Dakpathar).
f)	Postal Address	To follow
SITE CONDITIONS		
a)	Max. temp.	42.8°C
b)	Min. temp.	0.3°C
c)	Design ambient temp.	40°C
d)	Latitude/Longitude	30° 31' 00" N/ 77° 53' 00" E
e)	Maximum Relative humidity	100 %
f)	Minimum Relative humidity	8%
g)	Pollution Severity	Less Polluted
h)	Seismic acceleration	0.18g
i)	Seismic zone	Zone-IV
l)	Wind Velocity & Zone	47 m/s Zone IV

SYSTEM PARAMETERS :

Nominal system voltage	220 kV
Highest system voltage	245 kV
Rated Normal Current at Nominal System Voltage	1600 A
Basic Impulse level	1050 kVP
Power frequency withstand voltage	460 kVrms
Switching Impulse voltage	850 kV
	-
Maximum Permissible Switching Over Voltage to Earth (kV)	487 kV
Frequency	50 Hz $\pm$ 5%
Rated short time current	50 kA for 1 sec

Creepage distance	25 mm/kV
System Earthing	Solidly Grounded

Note: -

Seismicity: -The project is situated in a seismic zone and falls within Zone IV of the seismic zoning Map of India. Value of peak ground acceleration has been recommended as 0.36g for maximum Credible Earthquake (MCE) and 0.18g for Design Basis Earthquake (DBE).

Wind Load: - The basic wind load as per IS875 (part-3) shall be applied on the vertical projected area, multiplied with the applicable factor for different type of structures.

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V, 50 Hz, 3-phase 4 wire, solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%.
1 phase A.C power supply	240V, 50 Hz, 1-phase, AC supply with variation in frequency of +/-5% and variation in voltage +/-10%.
D.C. power supply	220V (variation under worst condition from 198V to 242V) , 2-wire ungrounded, 50V, 2 wire system (+) earthed , 48V +/-20%

Transportation Limitations: - For shipments, the Manufacturer shall pack the items to meet size and weight restrictions of the Indian railways and road systems. Shipments from Manufacturer's work (in case of foreign manufacturer) shall travel to the Port of entry in India, from where these will be transported, after necessary port clearances etc., by the Contractor to Dehradun, which shall be the nearest rail head for the Project, and further transported to site. However, in certain cases the Contractor may be required to transport the materials from Point of entry to Dehradun and further to Vyasi HE Project site directly by road transport. However, Indian contractors shall be responsible in all respects for transportation of all materials and equipment up to the project site. Manufacturers shall consult with the concerned authorities of railways and highways to ensure that their packaging will be such as to permit them to transport the plant and equipment within such imposed limits. Manufacturers shall arrange to deliver the maximum size subassemblies consistent with safe and convenient transport. All materials and equipment etc. arrived at Dehradun will be unloaded from rail wagons and reloaded on to road transport for shipment to project site by the Contractor. The roads and bridges en-route shall be made suitable for 70R loading capacity.

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 SPECIFIC TECHNICAL REQUIREMENT

As per section-1

3.2.2 TYPE TESTS

For all the items of equipment's, bidder shall furnish copies of Type Tests Certificates for the equipment's of the type and ratings similar to those specified. Type Tests Certificates furnished shall be as per the provisions of relevant standards for such equipment's. In case the contractor is not in position to furnish, such type tests certificates or the type tests certificate furnished by him are not as per the relevant standard for such equipment and, therefore, not acceptable to the Employer, Type Test for such items and equipment's will have to be conducted by the contractor at his cost.

All the switchyard equipment's shall be type and routine tested as per relevant IS / IEC- Publication or Type tests certificate shall be furnished to prove that the equipment fulfils all characteristics defined in Specifications. The contractor is required to carry out all type tests on one apparatus of each type and routine tests on all apparatus and submit the reports to the Employer. If approved by the Employer, type test certificates can be accepted in place of type tests in case of the same have been carried out on same type & similar capacity. All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type.

The Bidder / Contractor shall furnish the reports of all the type tests carried out after **08.05.2007** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last ten years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.3 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended. All design calculations, materials, works, manufacturing and testing shall conform to the latest applicable standards.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be

designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipment located in non-air conditioned areas shall also be of same type.

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment
Finishing colour of Outdoor equipment.
Finish colour of all cubicles.
Finishing colour of various auxiliary system equipment including piping
Finishing colour of various building items.

All steel structures, plates etc shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade RAL 7032. All The indoor cubicles shall be of same color scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

All surfaces that are so indicated on the drawings or those that require machining for their intended function, or those that are usually machined according to good workshop practice shall be machined. Surface finish qualities shall be adequate for the intended use and shall be indicated on the Contractor's Drawings. Suitable measuring device such as scatter meter or other acceptable measuring device will be used to determine compliance with specified surface finish.

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per RAL 7032.

Before delivery, all exposed, unfinished metal surfaces shall be cleaned and shop painted. Cleaning and Preparation of steel surfaces shall be in accordance with relevant standards and they shall be given at least one prime coat the same day. Paint shall be in accordance with applicable portions of relevant Indian and International standards. The colours of the paint will be selected at the Employer's option. All interior surfaces of the crane those are accessible for maintenance inspections shall also be completely painted. All other interior surfaces shall be painted with only the 1 coat of primer. The inside of all gear housings shall be painted with 2 coats of oil resisting enamel as recommended by the gear housing manufacturer. A quantity and type of paint equal to 15% of the paint used for the second and third coats shall be provided for field touchup work. Monorail hoists shall be painted with the manufacturer's standard finish. The colour of the paint will be subject to approval of the Employer/Customer.

3.8 GALVANIZING

All structural steel including ladders, platforms, hand rails and the like and all exterior and interior steel surfaces of outdoor Works, as well as bolts and nuts associated with galvanized parts shall be hot-dip galvanized, electrolytic galvanized or serialized, as may be appropriate to the particular case. Galvanizing shall be performed in accordance with VDE Standard 0210 (Verband Deutscher Elektrotechniker) or IS 4795:1996. For galvanizing, only original blast furnace raw zinc shall be applied, which shall have a purity of 98.5%. The thickness of the zinc coat shall be for bolts and nuts, approx. 60 micrometers.

Conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be **610 gms. per square meter** and minimum thickness of coating shall be 85microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

- a) Name and address of the consignee.

- b) Purchase order number.
- c) Name of supplier/s.
- d) Description of equipment / material.
- e) Net weight.
- f) Gross weight.

All the equipment's shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.

The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc. All electrical parts shall be carefully protected from damage by sand, moisture, heat or humid atmospheric conditions by packing them in high-pressure polyethylene foil.

All the cable shall be supplied on nonreturnable wooden drums with adequate barrel diameter so as to avoid any damage to the cables and to withstand rough handling during transportation and storage. A layer of waterproof paper shall be applied to the surface of the drums and over the outer cable layer.

A circular space of at least 40mm shall be left between the cable and the lagging. Each drum shall carry the name of the manufacturer, the name of the Employer, his address, order number, item number, type, size length of cable, net and gross weight duly stenciled thereon.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the

purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

The supplier shall propose following Degree of protection for those equipment/Items for which the degree of protection has not been specified in the specification for the approval of BHEL/UJVNL. The decision of BHEL/UJVNL shall be final. The enclosures of the Control Cabinet, Junction boxes and Marshalling boxes panels etc. to be installed shall be provided with degree of protection as detailed here under:

- a) Installed outdoor: IP-55
- b) Installed indoor in air conditioned area: IP-42
- c) Installed in covered area IP: 52
- d) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS: 13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval. If necessary, the cubicles shall be equipped with automatically controlled heating elements for protection against internal condensation and moisture. All panels/cubicles shall have approximately 20% space for mounting of future devices. Door operated interior illuminating lamps, power socket for 240V 5 /15A and communication socket shall be provided in all panels.

3.12 RATING PLATES, NAME PLATES AND LABELS

The switchyard equipment shall have a rating plate with the information required by relevant IEC i.e. at least the following:

- Manufacturer's name
- Type number
- Serial number
- Rated Voltage
- Rated impulse withstand voltage
- Rated power frequency withstand voltage
- Rated frequency
- Rated current
- Rated short circuit breaking current
- Rated short time current (r.m.s), & duration Each instrument transformer must have its own rating plate with the information as required in IEC 600441 and IEC 60186.

3.13 EARTHING

The operating mechanism housing, control cabinets, support structure etc. shall be provided with two separate earthing terminals suitable for bolted connection to 50x6mm mild steel flat to be provided for connection to station earth mat.

Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat of Size 75X12 mm. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

The Contractor shall connect all equipment included in the scope of delivery to the grounding system. In addition to the grounding through cable screens, all equipment such as cubicles, motors, etc. shall be connected directly to the grounding system using copper wire of area not less than 50 mm sq. at two different points. In general, all iron parts such as supports, covers, railing, etc. shall be connected to the grounding system. Each conductor shall have its own separate connection point. Pressed on closed shoes shall be used for connections to bars.

3.14 TERMINAL BLOCKS AND WIRING

Wiring within cubicles and equipment enclosures shall conform to requirements of this section unless otherwise specified. Control wiring shall be stranded copper and shall be not smaller than 1.5 mm sq. except as otherwise agreed by the Engineer.

Larger size wiring shall be used where needed for the current carrying capacity requirements. Cables shall have at least 1000 V grade PVC insulation except for 110V DC and telemetering or communication system equipment for which 650V and 300 V ratings respectively may be acceptable.

For current and potential transformer secondary circuits the minimum cross section of the conductors shall not be less than 2.5mm sq. Wiring shall terminate at terminal blocks at one side only. Where tap connections are required, they shall be made on terminal blocks. Wiring shall be neatly arranged and laid in plastic conduits accessible from the front door. The conduits shall not be filled more than 70 %.

Each cubicle shall be provided with an earthing bar (PE) of sufficient cross section carrying any possible fault current without undue heating. All metallic parts of the cubicle not forming part of the live circuits, all instrument transformer terminals to be earthed and other earthing terminals as well as all cable screens and PE-wires shall be connected to the earthing bar.

The terminal blocks shall be located to allow a neat and easy connection work and shall be safely accessible while the equipment is in service. Control circuits and power circuits shall be completely separated by use of divided or separate terminal blocks. Power terminal blocks shall be rated in accordance with applicable standards and shall be provided with covers. Control wiring terminal

shall be equipped with facilities for opening the circuit. It shall be possible to interchange a single terminal block for a new one without dismantling a whole row. Current transformer terminal blocks shall have provisions for short-circuiting and disconnecting. Not more than two wires shall be connected to any one terminal. Terminal blocks using screws acting directly on the wire will not be accepted. At least **20%** spare terminals shall be provided. Terminals shall be marked with printed labels.

Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, marshalling boxes & Terminal boxes shall be made of sheet steel or aluminium and shall be dust, water and vermin proof. Sheet used shall be least 2.0 mm cold rolled or 2.5mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminium enclosed box the thickness of aluminium shall be such that it provides adequate rigidity and long life as comparable with sheet of specified thickness. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Removable plates with gaskets shall be fitted at the top and bottom of the box to provide the entry for conduit or cable. The door shall be provided with suitable gasket and fitted with a lock type handle. The door shall be hung on hinges having brass bodies and stainless steel pins. Each cable junction box shall be provided with terminals of adequate rating on the terminal strip of suitable thickness. Disconnecting (sliding) type terminal blocks shall be provided, to facilitate testing & maintenance without disconnecting the cables.

Multi block terminal board of 15 A, 500 V rating shall be provided to form in assembly of number of terminal block. Assembly may be secured with only two screws on the surface. There shall be provision on the strips to add more terminal in case of further requirement.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled EPDM gaskets. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required

3.16 SPACE HEATERS

The space heaters shall be suitable for single phase 50 Hz AC supply from an independent source, which should automatically switch off before starting of unit. However, once the dehumidification unit is switched ON, it shall be controlled automatically with a thermostat. The dehumidification unit shall be designed to avoid hot spot. The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 GUARANTEE:

The supplier shall guarantee that the goods under the Contract are new, unused of the most recent or current models and incorporated all recent improvements in design and materials unless provided otherwise in the Contract. The supplier shall further guarantee that the goods supplied under this Contract shall have no defects arising from design, materials or workmanship, installation and erection, if that may develop under normal use of the supplied goods. The supplier shall also guarantee the performance of the works executed by him including the performance of all the materials/goods supplied by him.

BHEL shall promptly notify supplier in writing of any claims arising under guarantee in respect of goods. Upon receipt of such notice, the supplier shall, with all reasonable speed, repair or replace the defective works or parts thereof, free of cost at site. All the expenses towards transportation of defective parts to supplier's works and of repaired/replaced parts to site shall be borne by the Supplier.

If the Supplier, having been notified, fails to remedy the defects within 14 days, the BHEL will proceed to take such remedial action as may be necessary, at the supplier's risk and expenses. All expenses in this regard will be recovered from Supplier.

3.19 DOCUMENTATION

3.19.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless anything is waived. All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the employer in Writing.

3.19.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipment's and materials, clearances and spaces required for installation and interconnection between various portions of equipment's and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant, the unit designation, contract no., and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.19.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalized at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer.

The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings.

3.19.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

- 1) Drawings
- 2) Guaranteed Technical Particulars
- 3) Type Test Reports
- 4) Manufacturing Quality Plan

3.20 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
				Prints	CDs
1	Drawings and Data Sheets	1	10	13	-
2	Drawings "As Built "	-	-	13	05
3	Type Test Reports	1	05	13	-
3	Erection Manuals	-	11	13	-
4	Operation and Maintenance Manuals	-	11	13	-
5	Manufacturing Quality Plan	1	11	13	-
6	Field Quality Plan	1	11	13	-
7	Inspection Test Reports	-	-	13	-

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

SECTION-5 **CHECKLIST**

FURNISH THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

PLEASE NOTE:

a) The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

b) The evaluation of bidder against technical requirement criteria specified under Section –I of technical specification shall be based on the documentary proof submitted by bidder along with the offer.

Hence bidder shall ensure the completeness of their offer in this regard.

BHEL ENQUIRY NO.:

BIDDER OFFER REFERENCE:

EQUIPMENT: LT AC / DC Boards

S.No.	Technical Requirements of PQR	Documentary proof required	Yes/No	Remarks
1	As per Annexure- B	Documentary proof attached	Yes	
S. No.	Parameters	Data	Yes/No	Remarks
1.	Applicable Standards	IS 8623, IS 13947 PART-II , IEC 60255, IS 2026	Yes	
2.	Type of Boards	Metal enclosed, indoor floor mounted , compartmentalized double front construction and free standing	Yes	
3	Ingress Protection requirement	Shall be as per clause 1.2.1.1 of Section 2	Yes	
4	Special tools & tackles	List of special tools and tackles as per Clause 7 of Section 2 (as applicable) is included in the offer price	Yes	
5	Offered Boards	Bidder has quoted for the AC/DC distribution boards in line with the specification	Yes	
6	Addition / deletion	Bidder has quoted unit rates or addition /deletion prices for each and every type of complete module (as mentioned in BOQ. Annexure-1)	Yes	
7	Analogue Input for SAS interface	Shall meet requirements mentioned in SLD	Yes	
8	Digital Input for SAS interface	Shall meet requirements mentioned in SLD	Yes	
9	Cubicle Color finish	As per TS	Yes	
10	Type test reports	Type test reports furnished shall be in line with Section-2	Yes	
11	Special Tools and Tackles	List of special tools and tackles (which are proprietary in nature) in included in offer	Yes	
12	Type test	The type test reports submitted shall be of tests conducted after 08.05.2007 . If type test reports are not acceptable to UJVNL/BHEL then above tests shall be conducted by the bidder free of cost	Yes	
13	Conformation to the Minimum indicative	This should be available at respective equipment for remote indication & control	Yes	

	requirement of Analog signals, Potential Free contacts & Command signals. Refer Signal Chart mentioned in SLD drawing.	from Auxiliary BCU located in S/s control room. Included.		
14	Quotation for items	Bidder has quoted for Unit Rate items and Mandatory spare items mentioned in BOQ.	Yes	
15	Supervision of ETC	Bidder has quoted for Supervision of Erection Testing & Commissioning of LT Switchboards.	Yes	
16	Control Wiring	2.5sqmm., 1100V grade, PVC insulated stranded Cu cable	Yes	
17	Supply of unit rate items, if not quoted	If any of the unit rate items is not quoted, but is required due to damages, theft, replacement, change in feeder rating etc. or any other reason during execution, the required quantity shall be supplied free of cost within guarantee period.	Yes	
18	Unit rate items	The unit rate shall include associated engineering, services, wiring, mounting accessories and associated enclosures etc.	Yes	
19	ACDB Module–E, (4 P MCCB)	Having thermal and magnetic release. Incomers and Bus-Coupler MCCB is having shunt trip provision	Yes	

ANNEXURE - C

SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Page No.	Clause No.	Deviation	Reason / Justification
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Tenderer's Stamp & Signature