



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-398-316-015	Rev. No.	01		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	GV	MM	VK
TITLE 48V VRLA BATTERY BANK				SIGN			
				DATE			
				GROUP	TBEM		
CUSTOMER	UJVN LIMITED (UJVNL)						
PROJECTS	220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND						

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Section-1: Scope, Specific Technical Requirements & Quantities

SECTION - 1

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch and supervision of installation & commissioning Valve Regulated Lead Acid Battery, complete with spares and accessories like Rack, interconnecting links, cables lug etc at site.

This section covers the scope and quantities of VRLA Battery Bank. The Specific Technical Requirements for the above item as specified by the customer (UJVNL) 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 equipment is required for the following project:

Name of the Customer : UJVN LIMITED (UJVNL)

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

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the enquiry.

1.2 BILL OF QUANTITIES

As per Annexure- A.

Please Note: -

- i. The size of batteries shall be as below:
 - a. 48V Battery - 200 AH VRLA Normal discharge type
- ii. Tap cell arrangement to be provided in battery bank i.e Charger in boost mode shall feed the battery and DCDB load is feed by battery with tap cell arrangement. Refer Clause 1.1.2 of Section-2
- iii. Minimum ambient design temperature =0 deg C
- iv. End Cell Voltage=1.85V
- v. Maximum ambient design temperature=25 deg C
- vi. Bidder shall select number of cells, float and Boost voltage to achieve following system requirement:

System Voltage	Maximum Voltage during Float operation	Minimum voltage available when no charger working and battery fully discharged upto 1.85V per cell.	Minimum Nos of cells
48 Volt	52.8 Volt	44 Volt	24

- vii. Battery bank shall comprise of –
 - Batteries
 - Metallic Stand/ rack with 3 coats of anti-acid paints for battery Bank. Battery racks shall be designed to withstand earthquake forces of the area without damage to the batteries.

Technical Specification of 48V VRLA BATTERY BANK

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- Individual cells shall be furnished in completely closed transparent plastic containers with over pressure protection device. Polarity of batteries shall be engraved and shall be easily legible.
- Stand insulators
- Inter-cell/ inter-tier/ inter-rack connectors for Battery bank and all fastening devices.
- Cable Terminal box with battery DC MCCB (2 poles). Adequate alarm devices (with aux. contacts for remote indication) shall be provided with the battery DC MCCB in order to indicate the blow of a DC MCCB.
- Cell numbering tags with fixing arrangement
- Electrolyte for first filling with 10% Extra
- One (1) lot of items not specified but are necessary for satisfactory operation of 48V Battery bank
- All special devices, tools, maintenance equipment etc. required for installation, testing, commissioning and maintenance of the batteries.

1.3 SPECIFIC TECHNICAL REQUIREMENTS

Parameter	48V DC
Nominal Voltage Rating	48V
AH Capacity	200 AH
Duty Requirement	Normal discharge type
Cell designation	VRLA type
No. of Cells per battery	24 nos.
Maximum Battery Bank Voltage	52.8 V
Minimum Battery Bank Voltage	44 V
Nominal Cell Voltage	2V
Cell voltage at equalizing charge	2.33V
End cell voltage	1.85 V
Tap cell connection for continuity during boost charging required	Yes
BATTERY ROOM SIZE	Room Size as per enclosed Control Room Building drawing, bidder to confirm that battery banks can be suitably accommodated in room size with adequate clear space from inside wall surface. ##
Terminal of battery suitable for	2x 1 C , 150 sqmm cable

Bidder to submit the layout for battery as per enclosed battery room size on the marked location.

For detailed technical requirement for VRLA Battery, please refer Section-2

Section-1: Scope, Specific Technical Requirements & Quantities

1.4 ACCESSORIES REQUIRED

The following accessories and devices required for maintenance and testing of batteries shall be provided for each set of battery bank:

Sl. no.	Description	Quantity (in Sets) (Per battery bank)
1	Protective Gloves	1
2	Cover Aprons	1
3	Torque wrench	1
4	Cell testing Voltmeter (3 — 0-3V)	1

1.5 TECHNICAL REQUIREMENTS OF PQR

Refer Annexure-B

1.6 TYPE TESTING

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) for approval. 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.

1.7 PACKING

- 1.7.1 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.
- 1.7.2 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.
- 1.7.3 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.
- 1.7.4 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.
- 1.7.5 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

Section-1: Scope, Specific Technical Requirements & Quantities

shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.

- 1.7.6 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.
- 1.7.7 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.
- 1.7.8 Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.
- 1.7.9 Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.

1.8 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.

1.9 SUPERVISION OF INSTALLATION & COMMISSIONING

Manufacturer of Battery 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 Battery manufacturer.

1.10 DRAWINGS/ DOCUMENTS

Bidder shall submit all necessary drawings and documents for approval.

However, Following drawing/documents are required for Manufacturing clearance:

- GA
- GTP
- 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.

PROJECT : 220kV GIS for 2x60 MW VYASI HEP VYASI, DISTT. DEHRADUN, UTTARAKHAND

CUSTOMER : UJVN LIMITED (UJVNL)

Technical Specification of 48V Battery Bank

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SN	ITEM	UNIT	QTY
A	Main Items		
1	48V, 200AH VRLA type Battery bank complete with rack assembly and all accessories	Set	1
B	Mandatory Spares		
2	Battery Cells	Nos.	4
3	Connector Bolts	Lot	1
4	Inter cell connectors	Nos.	10
5	Vent plugs/caps/hardware of each type	Lot	1
6	Electrolyte	Lot	1
C	Supervision of installation and commissioning of 48V VRLA Battery Bank	Lot	1

Note:

1	For SN 3 - 1 Lot is equivalent to	20 % of installed quantity
2	For SN 5,6 - 1 Lot is equivalent to	10 % of installed quantity

ANNEXURE- B

TECHNICAL REQUIREMENT OF PQR

Name of Project: - 220kV GIS at VYASI HEP

Name of Item : - 48V BATTERY BANKS

Sr. No	Description	Supporting Document to be attached								Reference of attached documents																
01	The bidder should have designed, manufactured, tested and supplied atleast 2 nos. of DC Batteries of the type being offered, having a capacity of atleast 200AH and these must be under successful operation for minimum two (2) years in power sector or industrial installations as on date of bid opening. #: satisfactory operation means certificate issued by End Customer/EPC client certifying the 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>ITEM S</th><th>QUANTI TY</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/ Tax invoice/ Material receipt at site/ lorry receipt details etc								Sr . No	ITEMS SUPPLIED TO	ORDER REFERENCE No. & DATE	ITEM S	QUANTI TY	ORDER FULLY EXECUTED.	STATUS, IF ORDER UNDER	REMARK									
Sr . No	ITEMS SUPPLIED TO	ORDER REFERENCE No. & DATE	ITEM S	QUANTI TY	ORDER FULLY EXECUTED.	STATUS, IF ORDER UNDER	REMARK																			

SECTION – 2

1.1 Special Design and Layout Conditions for 48V System

1.1.1 General

The 48V DC system shall consist of a battery, a battery charger having provision for boost & float charging and a main distribution panel. The 48V system will serve the consumers particularly in the communication and control system.

The AC power supply of 48V battery charger shall be taken from 415 & 240V, 50 HZ station service boards respectively and the chargers shall be so designed that they can give full charging currents within the voltage variation given on the 415V bus.

Each battery assembly shall be capable of supplying successfully 200 AH for the 48V system without any assistance from the charger and without its terminal voltage falling below 44V in case of 48V battery.

1.1.2 Basic Description of the Scheme

In case of 48 V DC systems, one charger complete with float charging and boost charging functions etc. is required.

In case of main AC failure during boost charging, the load shall be supplied instantaneously by the battery through the tap cell and subsequently the total battery shall be connected to the load through the DC contactor.

If float charger fails during boost charging, the boost charging is continued by boost charger and the load is supplied through the respective tap cell.

The battery will furnish practically all the heavy current demands required for operating contingencies such as failure of AC supply or when charger is under maintenance etc.

1.1.3 Standards

Unless otherwise stated hereafter, ratings, characteristics, tests and test procedures, etc. concerning the 48V 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 Batteries and Battery Racks

The following requirements shall be applicable to 48V DC batteries unless otherwise stated. The batteries shall be of the totally sealed maintenance free type.

Section-2 : Equipment Specifications

48V DC battery assembly shall consist of 24 battery cells. Battery bank capacity shall be 200AH at 10-hour discharge rate to 1.85 V per cell at 25°C.

The individual cells shall be furnished in completely closed transparent plastic containers with over pressure protection device. The polarity of the batteries shall be engraved and shall be easily legible.

Each battery assembly shall be complete with racks, flexible connections between the cells and a cable terminal box containing the battery DC MCCB (2 poles). Adequate alarm devices (with auxiliary contacts for remote indication) shall be provided with the battery DC MCCB in order to indicate the blow of a DC MCCB.

The battery racks shall be designed to withstand earthquake forces as laid down in the general technical specification without damage to the batteries. The batteries shall preferably be arranged in not more than two levels. The connecting points of the cells shall be easily accessible for the periodic checks of the cells voltage.

1.3 Battery Construction

The DC Batteries shall be VRLA (Valve Regulated Lead-Acid) type and shall be Normal Discharge type. These shall be suitable for a long life under continuous float operations and occasional discharges. Air-conditioning shall be provided in Battery room, the requirement of which has been specified elsewhere in the Technical Specification. The 48V DC system is +ve earth system.

1.3.1 Constructional Requirements

The design of battery shall be as per field proven practices. Partial plating of cells is not permitted. Paralleling of cells externally for enhancement of capacity is not permitted. Protective transparent front covers with each module shall be provided to prevent accidental contact with live module/electrical connections.

1.3.2 Containers

The container material shall have chemical and electro-chemical compatibility and shall be acid resistant. The material shall meet all the requirements of VRLA batteries and be consistent with the life of battery. The container shall be fire retardant and shall have an Oxygen Index of at least 28 %. The porosity of the container shall be such as not to allow any gases to escape except from the regulation valve. The tensile strength of the material of the container shall be such as to handle the internal cell pressure of the cells in the worst working condition. Cell shall not show any deformity or bulge on the sides under all working conditions. The container shall be capable of withstanding the rigours of transport, storage and handling. The containers shall be enclosed in a steel tray.

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1.3.3 Cell Covers

The cell covers shall be made of suitable material compatible with the container material and permanently fixed with the container. It shall be capable to withstand internal pressure without bulging or cracking. It shall also be fire retardant. Fixing of Pressure Regulation Valve & terminal posts in the cover shall be such that the seepage of electrolyte, gas escapes and entry of electro-static spark are prevented.

1.3.4 Separators

The separators used in manufacturing of battery cells, shall be of glass mat or synthetic material having high acid absorption capability, resistant to sulphuric acid and good insulating properties. The design of separators shall ensure that there is no misalignment during normal operation and handling.

1.3.5 Pressure Regulation Valve

Each cell shall be provided with a pressure regulation valve. The valve shall be self re-sealable and flame retardant. The valve unit shall be such that it cannot be opened without a proper tool. The valve shall be capable to withstand the internal cell pressure specified by the manufacturer.

1.3.6 Terminal Posts

Both the +ve and -ve terminals of the cells shall be capable of proper termination and shall ensure its consistency with the life of the battery. The surface of the terminal post extending above the cell cover including bolt hole shall be coated with an acid resistant and corrosion retarding material. Terminal posts or any other metal part which is in contact with the electrolyte shall be made of the same alloy as that of the plates or of a proven material that does not have any harmful effect on cell performance. Both +ve and -ve posts shall be clearly and unambiguously identifiable.

1.3.7 Connectors, Nuts & Bolts, Heat Shrinkable Sleeves

Where it is not possible to bolt the cell terminals directly to assemble a battery, separate non-corroding lead or copper connectors of suitable size shall be provided to enable connection of the cells. Copper connections shall be suitably lead coated to withstand corrosion due to sulphuric acid at a very high rate of charge or discharge.

Nuts and bolts for connecting the cells shall be made of copper, brass or stainless steel. Copper or brass nuts and bolts shall be effectively lead coated to prevent corrosion. Stainless steel bolts and nuts can be used without lead coating. All inter cell connectors shall be protected with heat shrinkable silicon sleeves for reducing the environmental impact including a corrosive environment.

Section-2 : Equipment Specifications

1.3.8 Flame Arrestors

Each cell shall be equipped with a Flame Arrestor to defuse the Hydrogen gas escaped during charge and discharge. Material of the flame arrestor shall not affect the performance of the cell.

1.3.9 Battery Bank Stand

All batteries shall be mounted in a suitable metallic stand/frame. The frame shall be properly painted with the acid resistant paint. The suitable insulation shall be provided between stand/frame and floor to avoid the grounding of the frame/stand.

1.3.10 Expected Battery Life

The battery shall be capable of giving 1200 or more charge/discharge cycles at 80% Depth of discharge (DOD) at an average temperature of 27° Celsius. DOD (Depth of Discharge) is defined as the ratio of the quantity of electricity (in Ampere-hour) removed from a cell or battery on discharge to its rated capacity. The battery sets shall have a minimum expected life of 20 years at float operation.

1.3.11 Routine Maintenance of Battery system

For routine maintenance of battery system, the contractor shall supply 1 set of following tools:

- a) Torque wrench.
- b) Cell test voltmeter (-3-0-+3) volts with least count of 0.01Volt.

1.4 Type Test of Battery

Bidder shall submit type test reportsof following tests as per IEC 60896-21 & IEC 60896-22, 2004. The type test reports shall be submitted in accordance with the requirements stipulated in Technical Specification

S.No.	Description of test
1	Gas emission
2	High current tolerance
3	Short circuit current and d.c. internal resistance
4	Protection against internal ignition from external spark sources
5	Protection against ground short propensity
6	Content & durability of required markings
7	Material identification
8	Valve operation
9	Flammability rating of materials
10	Inter-cell connector performance

Section-2 : Equipment Specifications

11	Discharge Capacity
12	Charge retention during storage
13	Float service with daily discharges for reliable mains power
14	Recharge behaviour
15	Service life at an operating temperature of 400 C for brief duration exposure time.
16	Impact of a stress temperature of 600 C for brief duration exposure time with 3h rate discharge test.
17	Abusive over-discharge
18	Thermal runaway sensitivity
19	Low temperature sensitivity
20	Dimensional sensitivity at elevated internal pressure and temperature
21	Stability against mechanical abuse of units during installation

Tests shall be conducted in accordance with IEC 60896-21 & IEC 60896-22, 2004

1.5 Bidder shall submit following documents :

- a) Data sheet
- b) GA of cell and layout drawing
- c) Discharge Data for 10 Hour, 8 Hour, 3 Hour, 2 Hour, 1 Hour, 15 Minutes and One Minute indicating capacity factors for end cell voltage of 1.85 V.
- d) Temperature correction factors
- e) Installation and commissioning Instructions
- f) O & M Manual

1.6 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. 48V DC Systems:

1.1 Shop Tests

Routine test and acceptance test on 48V battery bank 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 Nickel Cadmium/Lead acid batteries shall be performed as per IS-10918 and IS-8320.

- Physical examination
- Dimension, mass and layout
- Marking
- Polarity and absence of short circuit
- Air Pressure Test
- Ampere-Hour Capacity
- Crank ability(when applicable, excluding types L&M)
- Retention of charge
- Insulation resistance.

1.2 Field tests

All field tests including tests during installation, pre-commissioning, commissioning and field acceptance tests shall be conducted by contractor in presence of representative of employer. Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance test shall be submitted well in advance, at least six (6) months before start of relevant testing, for approval of the 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 batteries, power and control circuits against Earth,
- Adjustment of protection equipment,
- Resistance measurement of all major circuits,
- Other tests as suggested by the contractor.

PROJECT : 220kV GIS for 2x60 MW Vyasi HEP at Vyasi, Distt. Dehradun, Uttarakhand
CUSTOMER : UJVNL Ltd.

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Following acceptance tests, as applicable to the type of battery.

- Physical examination,
 - Polarity and absence of short circuit,
 - Testing of voltage uniformity,
 - Ampere-hour capacity,
- Insulation resistance test.

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
I)	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%

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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

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- 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.

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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.

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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	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.

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SECTION 5

**CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN
THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED**

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

BHEL ENQUIRY. NO:

BIDDER: OFFER REFERENCE:

A) TECHNICAL PARAMETERS-

S. No.	Parameters	Description	Confirmation	Remarks
1.	Applicable Standards	Latest IEC 60896-21 &22	Yes	
2.	Type of Battery	VRLA (Valve Regulated Lead Acid), Normal Discharge Type	Yes	
3.	Earthing	Suitability of offered batteries for respective systems - 48V DC System of +ve Earth type	Yes	
4	Construction	Offered Battery is – a) Not with partial plating of cells b) No external paralleling of cells for enhancement of capacity. c) With protective transparent front covers with each module to prevent accidental contact with live module/electrical connections	Yes	
5	Container	The offered battery containers shall be a) meeting all requirements of VRLA batteries. b) Fire retardant, acid resistant , chemical& electro-chemical compatible c) Enclosed in steel tray	Yes	
6	Cell Covers	Offered Cell covers shall be a) of material compatible with container material and permanently fixed with container b) fire retardant	Yes	
7	Separators	Offered separators used in the cells shall be a) glass mat or synthetic material with high acid absorption capability , resistant to sulphuric acid and good insulating properties.	Yes	
8	Pressure Regulation Valve	Offered Pressure regulation valve in each cell shall be a) self-resealable and flame retardant b) shall withstand the internal cell pressures	Yes	
9	Seismic factor	Battery racks designed to withstand	Yes	

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		earthquake forces of the area without damage to the batteries.		
10	Terminal Posts	Offered terminal posts shall be a) surface coated with an acid resistant and corrosion retarding material. b) Made of the same alloy as that of the plates or of a proven material that does not have any harmful effect of cell performance	Yes	
11	Connectors, Nuts , Bolts , Heat Shrinkable Sleeves	Offered intercell connector shall be a) Protected with heat shrinkable silicon sleeves Offered Nuts and bolts shall be a) Made of copper, brass or stainless steel b) Copper /brass nuts and bolts shall effectively lead coated Note- In cell assembly if direct bolting of cell terminals is not possible, a separate non-corroding lead or copper connectors (lead coated) of suitable size shall be used.	Yes	
12	Flame arrestors	Each of the offered cell is equipped with a flame arrestor	Yes	
13	Tap Cell arrangement	Tap cell arrangement provided in battery bank.	Yes	
14	Battery terminal	Suitable for 2 x 1Cx150 sqmm. cable	Yes	
15	Layout for Battery Bank	As per Clause-1.2.1 of Section-2	Yes	
16	Qualifying requirement	Documentary proof against the Technical Qualifying requirement mentioned in Annexure-B , has been attached along with offer.	Yes	
17	Number of cells in battery bank	48V battery bank : 24 (min.)	Bidder to specify	
18	Maintenance Equipment and accessories	In line with Section-I has been included in offer	Yes	
19	Type Test reports (TTR)	Reports of the tests conducted in line with IEC-60896-21 & 60896-22, earlier on identical or similar material are available (Test Reports are of the tests conducted after 08.05.2007)	Yes	
20	Validity of TTR	If type test reports are not acceptable to UJVNL/BHEL then above tests shall be conducted by the bidder free of cost	Yes	

Date:

Signature of the authorized representative of Bidder

Company Seal

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

DRG. NO.	1 200 00 196 77	REV.	04
			A

ITEM No	DESCRIPTION	APPROX. SIZE (mm)			WEIGHT (kg)	QUANTITY PER UNIT	TOTAL QUANTITY	REMARKS
		LENGTH	WIDTH	HEIGHT				
01	220V DC BATTERY CHARGERS	2400	800	2400	-	-	2	HPE
02	220V DC DISTRIBUTION BOARD	5400	1000	2400	-	-	1	HPE
03	INVERTOR	2000	1000	2000	-	-	2	HPE
04	AC DISTRIBUTION BOARD	1000	1000	2400	-	-	1	HPE
05	220V DC BATTERIES	5200	800	2000	-	-	2	HPE
06	48V DC BATTERIES	2000	1000	2000	-	-	1	HPE
07	48V DC BATTERIES CHARGERS	2000	1000	2000	-	-	1	HPE
08	48V DC DISTRIBUTION BOARD	2400	800	2400	-	-	1	HPE
09	220V DC DISTRIBUTION BOARD	2500	800	2400	-	-	2	TBG
10	415V AC DISTRIBUTION BOARD	5000	1200	2400	-	-	1	TBG

TABLE FOR DIMENSIONS OF EQUIPMENTS AT EL. 525.0M (TENTATIVE)

NOTES:

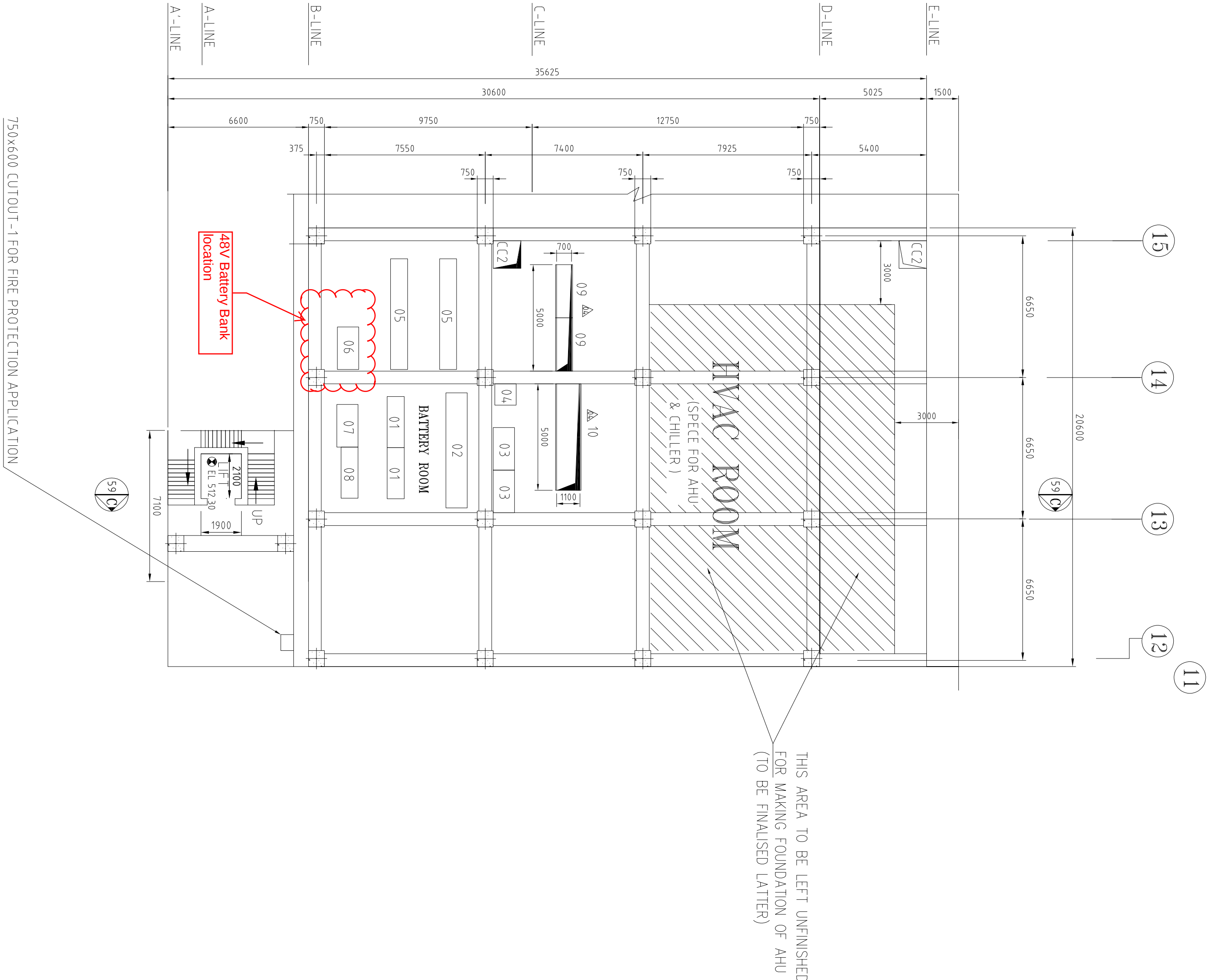
01. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES.
02. LIST OF EQUIPMENT & PANELS SHOWN ARE TENTATIVE & INDICATIVE ONLY
AND SHALL BE FINALISED DURING DETAIL DESIGN.
03. SIZES OF COLUMNS/BEAMS/SLABS ARE INDICATIVE ONLY. FOR DETAILS REFER
CIVIL CONSTRUCTION DRAWINGS.
04. DIMENSIONS ARE TENTATIVE. REFER EOT CRANE DRAWINGS NO. PE-06-407-501-A001,A002
FOR COMPLETE INCLUDING LOCATION OF CABIN, DSL AND STOPPER DETAILS.

REFERENCE DRAWINGS:

BHEL DRAWINGS: 1-200-00-186-51 TO 60

LEGENDS:-

- HW(S) CUTOUT FOR HVAC SUPPLY DUCT 2000x1000MM.
 HW(R) CUTOUT FOR HVAC RETURN DUCT 1500x1000MM.
 CC CUTOUT FOR CABLES/PIPES 2000x1000MM.
 CC1 CUTOUT FOR CABLES OF EQUIPMENTS 500x500MM.
 CC2 CUTOUT FOR CABLES OF EQUIPMENTS 1300x1300MM.
 CC3 CUTOUT FOR CABLES OF EQUIPMENTS 200x300MM.
 CC4 CUTOUT FOR CABLES OF EQUIPMENTS 1000x750MM.
 CC5 CUTOUT FOR CABLES OF EQUIPMENTS 3400x600MM.
 MH-1, MH-2, MAIN HOOK OF CRANES - 1 & 2.
 AH-1, AH-2, AUX. HOOK OF CRANES - 1 & 2.
 MRH-1, MONORAIL HOOK OF CRANES - 1



PLAN AT EL 540.00M

[illegible]