



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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TITLE 48V Battery Charger with Distribution Board		SIGN	<i>GV</i>	<i>MM</i>	<i>VK</i>	
		DATE	19.5.20			
		GROUP	TBEM			
CUSTOMER	UJVN LIMITED (UJVNL)					
PROJECTS	220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND					

CONTENTS

Section	Description	No. of Sheets
Section-1.	SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES	4
	ANNEXURE-1 TECHNICAL PRE-QUALIFYING REQUIREMENT	1
Section-2.	DETAILED TECHNICAL REQUIREMENTS – EQUIPMENT SPECIFICATION	10
Section-3.	PROJECT DETAILS AND GENERAL SPECIFICATION,	14
Section-4.	SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS#	--
Section-5.	CHECK LIST* (TO BE FILLED AT TENDER STAGE)	2
	ANNEXURE – A (SLD for 48V DC System)	1
	ANNEXURE – B (Battery Room Layout)	1
	ANNEXURE – C (Schedule Of Technical Deviation)	1
	(#To be Provided at Contract Stage)	
	(*Offers without filled Checklist shall not be evaluated)	

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

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch and supervision of installation & commissioning of **Float and Float cum Boost Battery Charger with Integral Distribution Board** complete in all respects for efficient and trouble-free operation.

Battery chargers shall be installed free floor standing separate steel cubicles. Dry type transformers and static type rectifiers shall be used. Battery chargers shall be fitted with all accessories including foundation bolts, fixing channels for mounting the charger on the floor.

This section covers the scope and quantities of 48V Battery charger. 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 : UJVNL Ltd.

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 SPECIFIC TECHNICAL REQUIREMENTS

Equipments and system shall be designed to meet the following major technical parameters as brought out hereunder. For detailed technical requirements, please refer Section-2.

Please refer attached drawing no. for Single Line Diagram

UJVNL/DEM/VYASI/DC/02	SLD FOR 48V DC SYSTEM
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1	Nominal Voltage Rating (V)	48 V
2	Rated Current Capacity	50 A
3	Voltage regulation in	
a	- float charging	±1%
b	- boost charging	±1%
4	Short Circuit Level	
a	A.C. (for 1 Sec.)	40 kA
b	D.C. (for 1 Sec.)	20kA
5	Ripple of Output Voltage (peak-peak)	
a	With battery connected	<1% RMS

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

CUSTOMER : UJVNL Ltd.

Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

Section-1: Scope, Specific Technical Requirements & Quantities

b	Without battery connected	<2% RMS
	Battery Data	
1	Rating	200 (AH)
2	Type of Battery	VRLA type
3	Volts per Cell	
a	Float Charging	2.13 – 2.27
b	Boost Charging	2.28 – 2.32
	System Condition	
1	3 phase A.C. supply	415 V - 50 Hz
2	1 phase A.C. supply	240 V - 50 Hz
3	Voltage Variation	± 10 %
4	Frequency Variation	± 5 %

1.3 BILL OF QUANTITIES

The following items are required for Vyasi S/s.

1.3.1 Main Items

S. No.	Details	Unit	Qty.
1.	48V, 50A Float and Float cum Boost Battery Charger with Integral Distribution Board complete in all respects	Set	1
2.	Temperature sensor with associated accessories & cables* in single length	Set	1
3.	Supervision of installation, testing and commissioning of 48V Float and Float cum Boost Battery charger with Integral Distribution board	Lot	1

1.3.2 Spare Items

S. No.	Details	Unit	Qty.
	Mandatory Spares- Battery Charger		
1.	Ammeter and Voltmeter of each type used	No.	1
2.	Shunt resistor of each type used in charger	No.	1
3.	Diode/Thyristor or module of each type used	No.	3
4.	Printed circuit cards of each type used	No.	2
5.	Semi conducting type fast fuse	No.	20
6.	Auxiliary fuse	No.	20
7.	Auto Transformer	No.	1
8.	Special Tools and Tackles	Set	1
	Mandatory Spares- Distribution Board		
9.	Circuit Breaker of each type and size used	No.	1
10.	Indicating lamps of each type	No.	2
11.	Control switch and supervision relay	No.	1
12.	Voltmeter	No.	1

*Distance from Battery to Battery Charger is approx. 15m. Length of wiring for temperature sensors between Battery & respective chargers may be provided accordingly. Cable to be provided in single length.

1.4 TECHNICAL PRE-QUALIFYING REQUIREMENT

Refer Annexure- 1

1.5 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 to BHEL.

1.6 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.

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

Section-1: Scope, Specific Technical Requirements & Quantities

- 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 SUPERVISION OF INSTALLATION, TESTING & COMMISSIONING

Bidder shall quote for the following supervision charges:

- Supervision of installation, testing and commissioning at site for offered Battery charger cum Distribution board.

The manufacturer will demonstrate that the chargers conform to the specification particularly regarding continuous rating, ripple free output, voltage regulation and load limiting characteristic after installation at site.

Note: All testing instruments required for testing & commissioning of battery chargers shall be brought to site by the supplier and after successful completion of tests, these instruments can be taken back.

1.9 DRAWINGS/ DATA SHEETS

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.

TECHNICAL PRE-QUALIFYING REQUIREMENT

Name of Project: - 220kV GIS at VYASI HEP

Name of Item : - 48V Battery Charger with Distribution Board

Sr. No	Description	Supporting Document to be attached	Reference of attached documents																
01	The bidder should have designed, manufactured, tested and supplied at least 2 nos. of Battery Chargers of the type being offered, having rating of 50A or more 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>ITEMS</th><th>QUANTITY</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	ITEMS	QUANTITY	ORDER FULLY EXECUTED.	STATUS, IF ORDER UNDER	REMARK									
Sr . No	ITEMS SUPPLIED TO	ORDER REFERENCE No. & DATE	ITEMS	QUANTITY	ORDER FULLY EXECUTED.	STATUS, IF ORDER UNDER	REMARK												

SECTION-2

1.1 Special Design and Layout Conditions

1.1.1 General

The 48V DC system shall consist of a battery, a battery charger having provision for boost & float charging and 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 415V/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

One charger complete with float charging and boost charging functions cum Distribution board 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.

Suitable interlocks, if any shall be provided between Charger and DCDB.

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 Cubicles

1.2.1.1 General

The cubicle assemblies shall be of metal enclosed, free floor standing type, of manufacturers 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 battery charger cubicle shall be divided into separate compartments for each of the battery charger and the respective main circuit breakers. 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 Battery charger and 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.

Section-2 Equipment Specifications

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 48V Battery Charger

- One cubicle for battery charger which shall at least accommodate the equipment listed below:
- Fully Automatic battery charger equipment, 48V DC, 50A including all protection relays viz under voltage, earth fault, over voltage as per single line diagram.
- Two Incoming three-phase Circuit Breaker.
- Two O/G DC MCCB.
- Voltmeters for the DC network.
- Ammeters for the DC charger current with shunt resistors.
- Necessary alarm indications.
- All necessary auxiliaries for control and supervisory circuits
- All secondary wiring, terminal blocks, labelling and nameplates, etc.
- All other necessary items not mentioned but necessary for reliable operation of the chargers in accordance of Technical specification.

1.3.2 DC Distribution Board

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

1.4 Battery Charger

Dry type transformers and static type rectifiers shall be used throughout.

Battery charger shall be suitable for trickle charging of battery bank and also for supplying the full DC load simultaneously.

The charger shall be completely equipped for a fully automatic and controlled charging and floating charge of the battery, and shall be of the constant voltage type with current limiting devices.

Complete control and supervision equipment such as circuit breakers, ammeter and voltmeters and alarm indicating devices shall be incorporated with charger.

The charger shall be capable of supplying the complete D.C load at their own without requiring loading of the battery and within tolerable voltage and ripple limits.

The charging equipment shall be delivered in cubicles, adjusted and ready for use.

Proposed location of equipment is shown in Battery Room Layout (Annexure-B).

- 1.4.1** The 48 V DC is +ve earthed. The Battery Chargers as well as their automatic regulators shall be of static type and shall be compatible with offered VRLA batteries. Battery charger shall be capable of continuous operation at the respective rated load in float charging mode, i.e. Float charging the associated Lead-Acid Batteries at 2.13 to 2.27 Volts per cell while supplying the DC load. The chargers shall also be capable of Boost charging the associated DC Battery at 2.28 to 2.32 volts per cell at the desired rate.

Charger shall regulate the float/boost voltage in case of prescribed temperature rise of battery as per manufacturer's recommendation to avoid thermal runaway. Necessary temperature sensors shall be provided in mid location of battery banks and shall be wired up to the respective charger for feedback control. The manufacturer shall demonstrate this feature during testing of each charger.

- 1.4.2** Battery Charger shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. When on automatic control mode during Float charging, the Charger output voltage shall remain within +1% of the set value, for AC input voltage variation of +10%, frequency variation of +5%, a combined voltage and frequency variation of +10%, and a DC load variation from zero to full load.
- 1.4.3** Battery Charger shall have a constant voltage characteristic throughout the range (from zero to full load) at the floating value of the voltage so as to keep the battery fully charged but without harmful overcharge.
- 1.4.4** Charger shall have load limiters having drooping characteristic, which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the Load limiter setting of the Charger. The Load-limiter characteristics shall be such that any sustained overload or short circuit in DC System shall not damage the Charger, nor shall it cause blowing of any of the Charger fuses. The Charger shall not trip on overload or external short circuit.

Section-2 Equipment Specifications

- 1.4.5** Uniform and step less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire float charging output range specified. Step less adjustments of the Load limiter setting shall also be possible from 80% to 100% of the rated output current for Charging mode.
- 1.4.6** During Boost Charging, the Battery Charger shall operate on constant current mode (when automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode.
- 1.4.7** The Charger output voltage shall automatically go on rising, when it is operating on Boost mode, as the Battery charges up. For limiting the output voltage of the Charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for Boost Charging mode.
- 1.4.8** The Charger manufacturer may offer an arrangement in which the voltage setting device for Float charging mode is also used as output voltage limit setting device for Boost charging mode and the Load-limiter of Float charging mode is used as current setting device in boost charging mode.
- 1.4.9** Suitable filter circuits shall be provided in all the chargers to limit the ripple content (Peak to Peak) in the output voltage to 1%, irrespective of the DC load level, when they are not connected to a Battery.
- 1.4.10 MCCB**
Battery Charger shall have 2 Nos. MCCBs on the input side to receive cables from two sources. Mechanical interlock should be provided such that only one shall be closed at a time. It shall be of P2 duty and suitable for continuous duty. MCCBs should have auxiliary contacts for annunciation.
- 1.4.11 Rectifier Transformer**
The rectifier transformer shall be continuously rated, dry air cooled (A.N) and of class F insulation type. The rating of the rectifier transformer shall have 10% overload capacity.
- 1.4.12 Rectifier Assembly**
The rectifier assembly shall be fully/half controlled bridge type and shall be designed to meet the duty as required by the respective Charger. The rectifier shall be provided with heat sink having their own heat dissipation arrangements with natural air cooling. Necessary surge protection devices and rectifier type fast acting HRC fuses shall be provided in each arm of the rectifier connections.
- 1.4.13 Instruments**
One AC voltmeter and one AC ammeter along with selector switches shall be provided for charger. One DC voltmeter and DC ammeter (with shunt) shall be provided for Charger. The instruments shall be flush type, dust proof and moisture resistant. The instruments shall have easily accessible means for zero adjustment. The instruments shall be of 1.5

accuracy class. In addition to the above a centre zero voltmeter with selector switch shall also be provided for charger for testing purpose.

1.4.14 Air Break Switches

One DC output switch shall be provided in charger. They shall be air break type suitable for 500 volts AC/ 250 DC. The contacts of the switches shall open and close with a snap action. The operating handle of the switch shall be fully insulated from circuit. 'ON' and 'OFF' position on the switch shall be clearly indicated. Rating of switches shall be suitable for their continuous load. Alternatively, MCCBs of suitable ratings shall also acceptable in place of Air Break Switch.

1.4.15 Fuses

All fuses shall be HRC Link type. Fuses shall be mounted on fuse carriers which are in turn mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type base. In such case one insulated fuse pulling handle shall be supplied for each charger. Fuse rating shall be chosen by the Bidder depending on the circuit requirement. All fuses in the chargers shall be monitored. Fuse failure annunciation shall be provided on the failure of any fuse.

1.4.16 Blocking Diode

Blocking diode shall be provided in the positive pole of the output circuit of each charger to prevent current flow from the DC Battery into the Charger.

1.4.17 Annunciation System

Audio-visual indications through bright LEDs shall be provided in all Chargers for the following abnormalities:

- a) AC power failure
- b) Rectifier/chargers fuse blown.
- c) Over voltage across the battery when boost charging.
- d) Abnormal voltage (High/Low)
- e) Any other annunciation if required.

Potential free NO Contacts of above abnormal conditions shall also be provided for common remote indication "CHARGER TROUBLE" in Owner's Control Board. Indication for charger in float mode and boost mode through indication lamps shall be provided for chargers. A potential free contact for float/boost mode shall be provided for external interlocks.

1.4.18 Name Plates and Marking

The name plates shall be white with black engraved letters. On top of each Charger, on front as well as rear sides, larger and bold name plates shall be provided to identify the Charger. Name plates with full and clear inscriptions shall also be provided on and inside of the panels for identification of the various equipments and ease of operation and maintenance.

1.4.19 Charger Construction

The Charger shall be indoor, floor-mounted, self-supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Chargers shall be fabricated from 2.0mm cold rolled sheet steel and shall have folded

Section-2 Equipment Specifications

type of construction. Removable gland plates for all cables and lugs for power cables shall be supplied by the Contractor. The lugs for power cables shall be made of electrolytic copper with tin coat. Power cable sizes shall be advised to the Contractor at a later date for provision of suitable lugs and drilling of gland plates. The Charger shall be tropicalized and vermin proof.

Ventilation louvers, if provided shall be backed with screens. All doors and covers shall be fitted with synthetic rubber gaskets. The chargers shall have hinged double leaf doors provided on front and on backside for adequate access to the Charger internals. All the charger cubicle doors shall be properly earthed. The degree of protection of Charger enclosure shall be at least IP-42 as per IS: 13947 Part I.

1.4.19.1. All the protective, control and supervisory equipment shall be mounted on the front door of the battery charger cubicle.

1.4.19.2. Charger shall be furnished completely wired upto power cable lugs and terminal blocks and ready for external connections. The control wiring shall be carried out with PVC insulated, 1.5 sq.mm. stranded copper wires. Control terminals shall be suitable for connecting two wires, with 2.5 sq.mm stranded copper conductors. All terminals shall be numbered for ease of connections and identification. Each wire shall bear a ferrule or tag on each end for identification. At least 20% spare terminals shall be provided for control circuits.

1.4.19.3. The insulation of all circuits, except the low voltage electronic circuits shall withstand test voltage of 2kV AC for one minute. An air clearance of at least ten (10) mm shall be maintained throughout for such circuits, right up to the terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

1.4.20 Painting

All sheet steel work shall be pre-treated, in tanks, in accordance with IS:6005. Degreasing shall be done by alkaline cleaning. Rust and scale shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be 'Class-C' as specified in IS:6005. Welding shall not be done after phosphating. The phosphating surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint of shade-692 (smoke grey) of IS:5 shall be applied, unless required otherwise by the Owner. The inside of the chargers shall be glossy white. Each coat of finishing synthetic enamel paint shall be properly staved. The paint thickness shall not be less than fifty (50) microns.

1.4.21 TESTS

1.4.21.1. Battery charger shall conform to all type tests as per relevant IS/IEC standard. Performance test on the Chargers as per Specification shall also be carried out on each Charger as per specification. Rectifier transformer shall conform to all type tests specified in IS: 4540 and short circuit test as per IS:2026. Following type tests shall be carried out for compliance of specification requirements:

- i) Voltage regulation test
- ii) Load limiter characteristics test
- iii) Efficiency tests

Section-2 Equipment Specifications

- iv) High voltage tests
- v) Temperature rise test
- vi) Short circuit test at no load and full load at rated voltage for sustained short-circuit.
- vii) Degree of protection test
- viii) Measurement of ripple by oscilloscope.
- ix) Temperature compensation feature demonstration

1.4.21.2. The bidder may be required to demonstrate to the OWNER that the Chargers conform to the specification particularly regarding continuous rating, ripple free output, voltage regulation and load limiting characteristic, before dispatch as well as after installation at site. At site the following tests shall be carried out:

- i) Insulation resistance test
- ii) Checking of proper annunciation system operation.

1.4.21.3. If Charger fails to meet the specified requirements, the bidder shall replace the same with appropriate Charger without affecting the commissioning schedule of the Sub-station, and without any extra cost to the OWNER.

1.4.21.4. The bidder shall present for inspection, the type and routine test certificates for the following components whenever required by the OWNER.

- (i) Switches.
- (ii) Relays/ MCCBs
- (iii) Instruments.
- (iv) DC fuses.
- (v) SCR.
- (vi) Diodes.
- (vii) Condensers.
- (viii) Potentiometers.
- (ix) Semiconductor
- (x) Annunciator.
- (xi) Control wiring
- (xii) Push buttons and contactors.

Makes of above equipment shall be subject to Owner's approval.

1.5 Inputs required for Substation Automation Purpose:

1.5.1 DIGITAL (Potential Free) INPUTS:

Battery Charger 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 equipment.

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) Charger: AC power failure
- ii) Charger: Rectifier / Charger fuse blown
- iii) Charger: Over Voltage across the battery when Boost charging
- iv) Charger: Abnormal Voltage (High / Low)
- v) Charger: Float Mode
- vi) Charger: Boost Mode
- vii) DCDB: DCDB E/F Alarm

1.5.2 ANALOGUE INPUTS:

Battery Charger 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 equipment.

These inputs shall be wired up to respective terminal blocks.

- i) DCDB: Incomer Battery Current
- ii) DCDB: DCDB Voltage

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 on Battery Chargers, 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 Battery Chargers shall be performed as per IEC-439 and IEC-146.

- Insulation Tests
- Light load and Functional test
- Checking of Auxiliary devices
- Checking the properties of control equipment.
- Checking the protective devices
- Protection against drooping characteristics
- Measurement of the inherent Over voltage regulation
- Measurement of Ripple voltage and Current
- Automatic change over Float to Boost charger and vice versa

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

- HV and IR test
- Scheme Checking

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 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 : UJVN LIMITED (UJVNL)
Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

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

PROJECT : 220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND
CUSTOMER : UJVN LIMITED (UJVNL)
Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

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 manufacturer'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.

PROJECT : 220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND
CUSTOMER : UJVN LIMITED (UJVNL)

Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

- 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.

PROJECT : 220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND
CUSTOMER : UJVN LIMITED (UJVNL)

Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

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.

PROJECT : 220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND
CUSTOMER : UJVNL LIMITED (UJVNL)
Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

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

The successful bidder shall have to extend all possible support like timely submission/re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer's approval.

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.

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

Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

SECTION 5

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN

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 qualifying 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: 48 V Battery Charger Cum Distribution Board

S.No.	Qualifying criteria	Documentary proof required	Yes/No
1	The bidder should have designed, manufactured, tested and supplied at least 2 nos. of Battery Chargers of the type being offered, having rating of 50A or more and these must be under successful operation# for minimum two (2) years in power sector or industrial installations as on date of bid opening	Documentary proof attached	

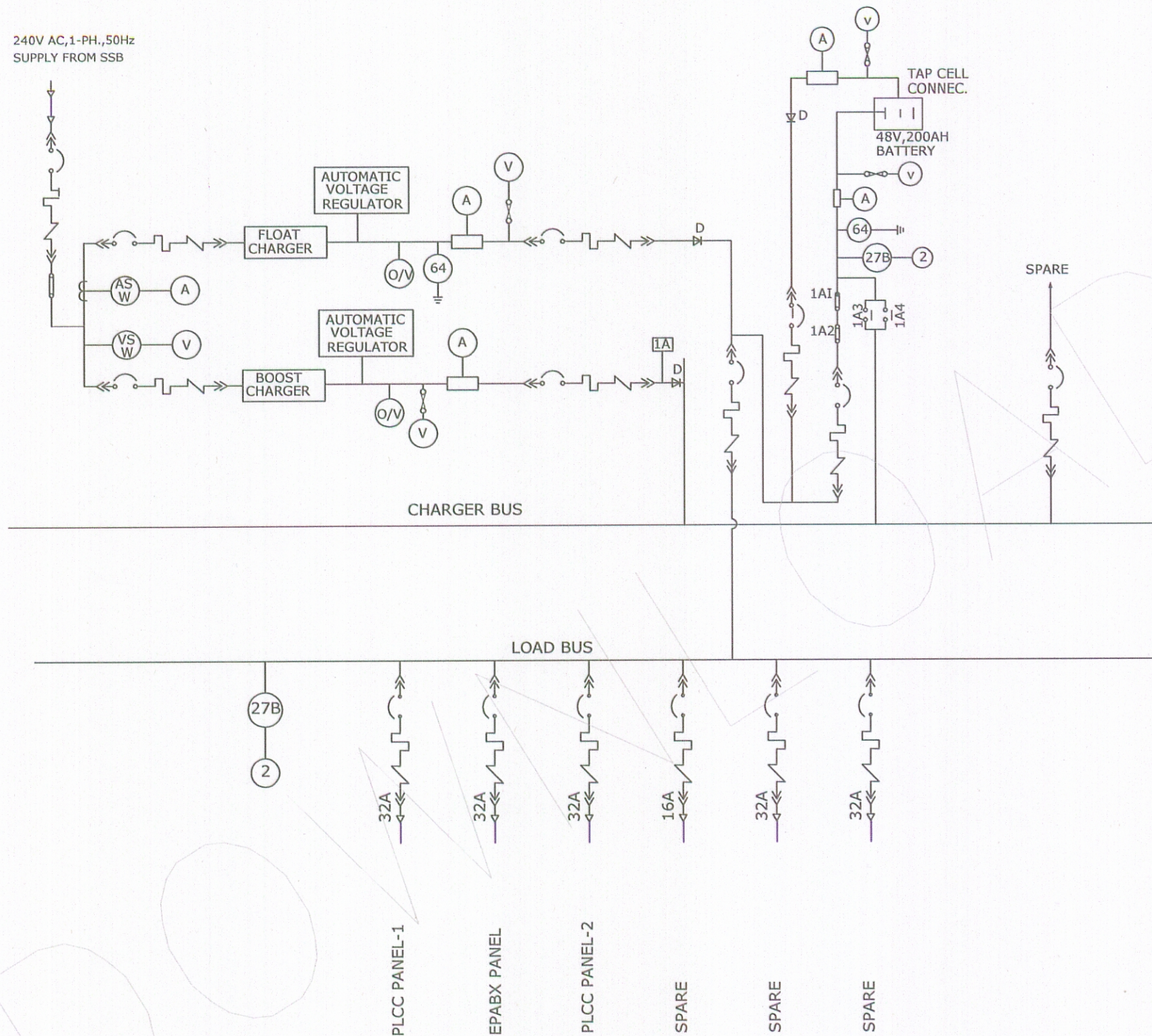
S. No.	Parameters	Data	Yes	Remarks
1.	Type of Battery Charger	a) Static Type with automatic regulators. b) Constant voltage type with current limiting devices. c) Compatible with VRLA Batteries	Yes	
2	BOQ	Prices quoted as per Section 1.3.1 and 1.3.2 of Section-1	Yes	
3	Float charging	Offered battery chargers are capable of continuous operation at respective rated load at 2.13 to 2.27 Volts per cell while supplying the DC Load	Yes	
4	Boost Charging	Offered Battery chargers are capable of boost charging associated DC battery at 2.28 to 2.32 Volts per cell at the desired rate	Yes	
5	Feedback control for Temperature sensors	The offered battery charger have provision for wiring temperature sensors which are located on battery bank for feedback control	Yes	
6	Demonstration of Feedback control	The manufacturer shall demonstrate the feedback control feature during testing of charger	Yes	

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

Technical Specification of 48V Battery Charger with Distribution Board

TB-398-316-021

7	Voltage and Current control	a) Offered battery charger shall be provided with facility for both automatic and manual control of the output voltage and current. b) Charger output voltage variation shall be within +/- 1%	Yes	
8	Step less adjustment of Load limiter setting	80% to 100% of rated output current for charging mode	Yes	
9	Ripple content in output voltage	Suitable filter circuits shall be provided in all chargers to limit the ripple (Peak to peak) content in output voltage to 2% irrespective of DC Load level when not connected to battery	Yes	
10	Rectifier Transformer	Dry air cooled (A.N), Class F insulation type and shall have 10% overload capacity	Yes	
11	Tap Cell Arrangement	In case of failure of Float charger during boost charging, boost charging continues and the load is supplied through respective tap cell.	Yes	
12	Remote Indication	I.) Provision of Potential free NO contacts for following abnormalities – a) AC Power Failure b) Rectifier /chargers fuse blown c) Over voltage across the battery when boost charging d) Abnormal Voltage (High/Low) e) Any other annunciation (as recommended by manufacturer) II) Potential free contact for Float / boost modes provided	Yes	
13	Charger construction	In line with Section-2	Yes	
14	Type tests for Battery charger with Distribution board	Shall be in line with Section-1.4.21 of Section-2 (Tests conducted after 08.05.2007)	Yes	
15	Type test reports	If the submitted type test reports submitted are not acceptable to UJVNL/BHEL, the tests shall be conducted without any cost implication to BHEL.	Yes	



TENDER DRAWING NOT
FOR CONSTRUCTION
DRAWING SUBJECT TO CHANGE
DURING DETAILED ENGINEERING

NOTES:-

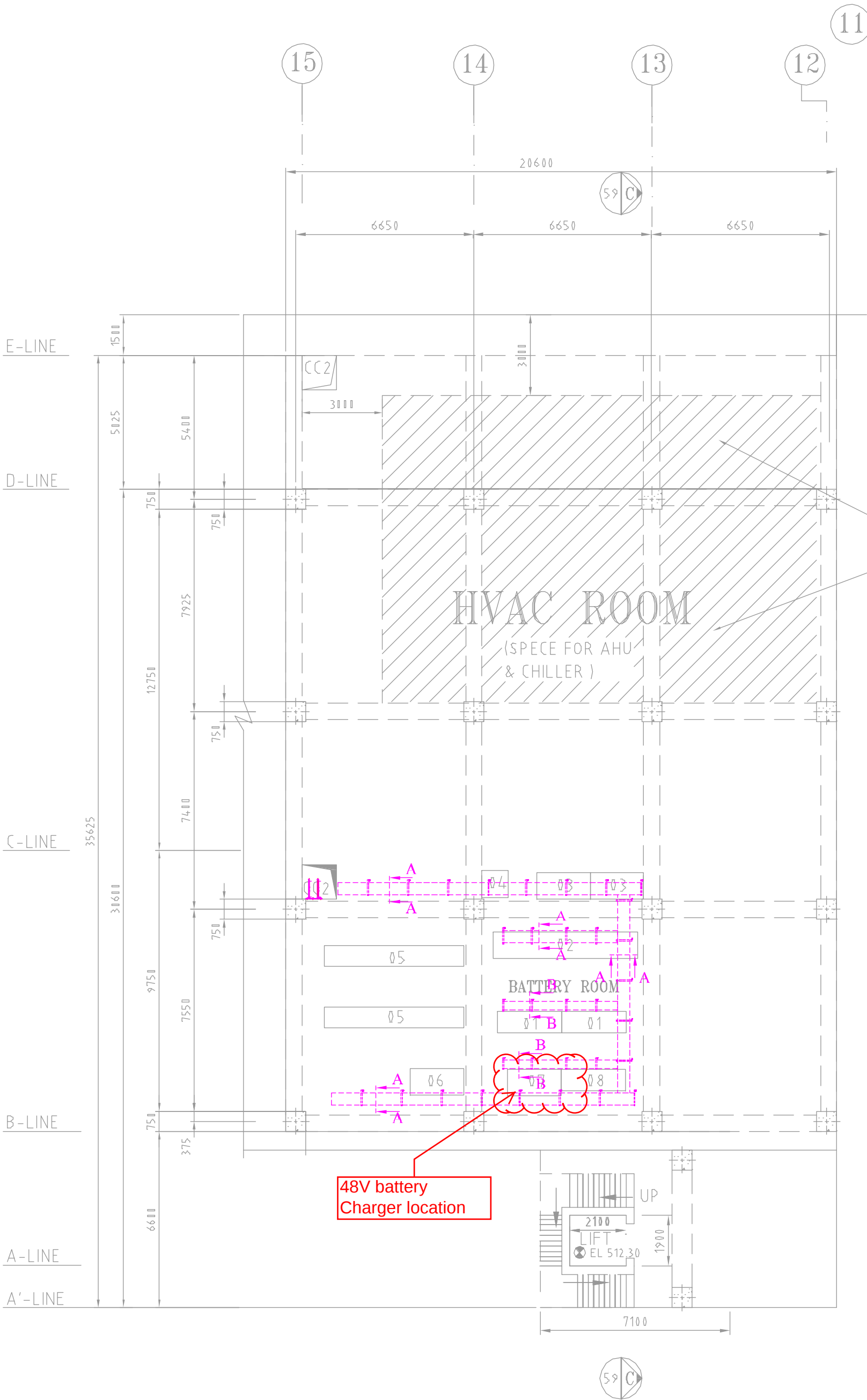
1. NOS. AND RATINGS OF FEEDERS ARE INDICATIVE ONLY AND SHALL BE DETERMINED BY THE CONTRATOR DURING DETAILED ENGINEERING SUBJECT TO APPROVAL OF THE EMPLOYER.

UTTARAKHAND JAL VIDUT NIGAM LIMITED 		
Project: VYASI HYDROELECTRIC PROJECT, UTTARAKHAND (2X60 MW)		
Title: SINGLE LINE DIAGRAM 48V DC SYSTEM		
Drawn MDA	Recommended GSDM	Approved SDT
Date 30.06.2009	Drawing no UJVNL/DEM/VYASI/DC/02	Rev.
KAYVIAT INTERNATIONALS PROJECTS CONSULTANTS PVT. LTD.		

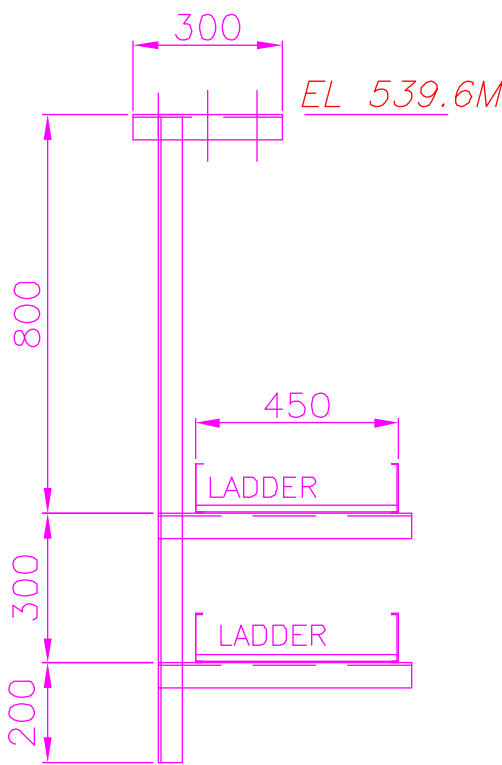
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

INVENTORY NO. SIGN. & DATE REF. DRG. NO.

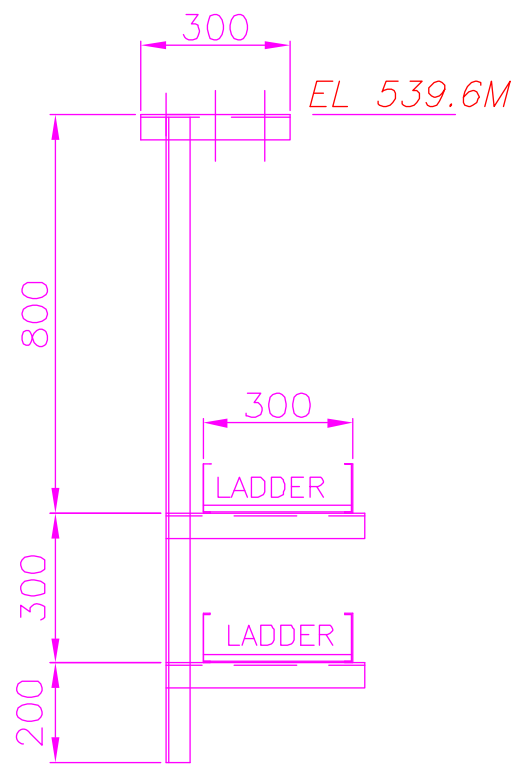
20
REV. NO. 1
22 961 00 002 77
DRG. NO.



PLAN AT EL 540.00M



SECTION A-A



SECTION B-B

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

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

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-DG-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:-

- HV(S) CUTOUT FOR HVAC SUPPLY DUCT 2000x1000MM.
- HV(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

PROJECT	2X60MW – VYASI HYDROELECTRIC PROJECT, UTTARAKHAND										
COSTUMER	 UJVN LIMITED										
CONSULTANT	—										
 भारत हेवी इलेक्ट्रिकल्स लिमिटेड, भोपाल Bharat Heavy Electricals Limited, Bhopal				NAME		SIGN		DATE		NO. OF VAR.	
				DRWN		NARESH		17/02/19			
				CHKD		VKG		17/02/19			
				APPD		RMP		17/02/19			
INFORMATION				DEPT		HPE		UNTOL.		DIMS. GR.	
				CODE		415					
DRAWING								SCALE		WEIGHT(kg)	
ION OF PRINTS				TITLE		CABLE TRAY LAYOUT PLAN AT EL 540.00M		DRAWING NO.		REV.	
								02920057001		00	
								SHEET NO. 07		NO. OF SHEETS. 07	

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