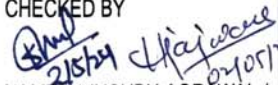
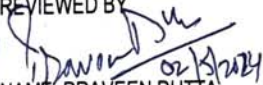


	5 X 800 MW YADADRI TPS PRE-QUALIFICATION REQUIREMENTS FOR DC BATTERY CHARGER – FGD & OFFSITE AREAS	PE-PQ-417-508-E002B
		REVISION NO. 00 DATE 02/05/2024
		SHEET NO. 1 OF 1

ITEMS: SCR based full wave fully Controlled 220V DC battery charger, Battery Fuse Box and Discharge Resistor, Rating 170A and above SCOPE: Supply : YES; Erection & Commissioning : NO; Supervision of Erection & Commissioning : YES;	
1	Vendor should be designer & manufacturer of the applicable type of Battery charger.
2	Availability of type test certificates conducted at independent Lab or witnessed by third party as per IS/ International standards for the applicable type of Battery charger.
3	In-house capability to carry out all routine and acceptance tests as per IS/ International standards for the applicable type of Battery charger.
4	Minimum two (2) nos. purchase orders for the applicable type of battery charger shall be submitted which should not be more than five (5) years old from the date of techno-commercial bid opening for establishing continuity in business.
5	The Bidder/ Sub Vendor should have manufactured and supplied at least two (2) numbers of Static Automatic Voltage Regulator type Battery Chargers of 170A or above, at least one (1) each at two (2) different industrial installations, which should have been in successful operation for at least two (2) years prior to the date of 17.10.2017. NOTE: Two different installations mean two different project sites or two different contracts.

Notes:

1. Consideration of offer shall be subject to customer's approval of bidders, if applicable.
2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
4. After satisfactory fulfillment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.
5. Cl. No. 5 is as per TSGENCO provenness requirement.

PREPARED BY  NAME: ANSHIKA DALAL DESIGNATION: ENGR	CHECKED BY  NAME: KHUSHBU AGRAWAL / NN JAJWARE DESIGNATION: SR. MGR	REVIEWED BY  NAME: PRAVEEN DUTTA DESIGNATION: AGM	APPROVED BY  NAME: DEBASISA RATH DESIGNATION: GM
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**TELANGANA STATE POWER GENERATION
CORPORATION LIMITED**

5 X 800 MW YADADRI TPS

VOLUME – II

**TECHNICAL SPECIFICATION FOR
*220V DC BATTERY CHARGER- FGD &
OFFSITE AREAS***

SPECIFICATION NO: *PE-TS-417-508-E002B*



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UTTAR PRADESH, INDIA – 201301**

273930/2024/PS-PEM-EL

	DOCUMENT TITLE		SPECIFICATION NO. PE-TS- 417-508-E002B
	TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER		VOLUME II
			SECTION I
			REVISION 0
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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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**TECHNICAL SPECIFICATION FOR
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1.0 SCOPE OF ENQUIRY

- 1.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing, delivery to site and Supervision of E&C of **220V DC BATTERY CHARGER** conforming to this specification.
- 1.2 General technical requirements of the **220V DC BATTERY CHARGER** are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I & Data Sheet - A.
- 1.3 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.
- 1.4 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

- 3.1 Technical /Quality/ Inspection:

S. No.	Reference clause No. of Section II (if any)	Specific Requirement/ Change
1	10.3 The details of Type tests to be conducted as per Section-I of specification	Details of Type tests shall be as per Section-II & QAP.

4.0 TEST

All tests as per the specification, QAP and relevant standards shall be carried out. Charges for these shall be deemed to be included in the quoted price.

5.0 DRAWINGS REQUIRED ALONG WITH TECHNICAL OFFER

- Unpriced Price Schedule as enclosed with NIT with "Quoted" word against items with bidder's signature and company stamp.
- A copy of the sheet "Compliance certificate" with bidder's signature and company stamp.
- "Deviation Schedule" with "NO DEVIATION" and bidder's signature and company stamp.

6.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED AFTER PLACEMENT OF ORDER

Documents shall be submitted after placement of order for BHEL & customer's approval as per the schedule specified below:

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BHEL Drawing No.	Drawing Title	Vendor Sub (Days)*	Bhel comment (Days)	Vendor Sub (Days)#	Bhel and Customer comment/approval (Days)
Primary Documents					
PE-V0-417-508-E201B	TDS FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E202B	GA AND INTERNAL LAYOUT DRAWING FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E203B	SCHEMATIC/ POWER CIRCUIT DIAGRAM FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E204B	BOM WITH MAKE OF COMPONENTS FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E211B	SIZING CALCULATION OF TRANSFORMER, RECTIFIER, THYRISTOR, FILTER AND FUSE FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E921B	QUALITY PLAN FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E217B	LIST OF MANDATORY SPARES FOR BATTERY CHARGER \$\$	21	9	7	18
PE-V0-417-508-E205B	CIRCUIT DIAGRAM AND GA OF BATTERY FUSE BOX	21	9	7	18
PE-V0-417-508-E206B	CIRCUIT DIAGRAM AND GA OF BATTERY DISCHARGE PANEL	21	9	7	18
Secondary Documents					
PE-V0-417-508-E218B	TYPE TEST CERTIFICATES FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E215B	LIST OF E & C SPARES FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E207B	OPERATIONAL WRITE UP FOR BATTERY CHARGER	21	9	7	18
PE-V0-417-508-E219B	O&M MANUAL FOR BATTERY CHARGER	within 30 days of issuance of MDCC			

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DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
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NOTES :

- a) * 1st submission within indicated days from date of purchase order
- b) # Submission (within indicated days) after incorporating all BHEL comments
- c) \$\$ Primary document for delivery of Mandatory Spares only and not to be linked with Main charger supply.
- d) Primary documents shall be considered for Delay analysis and secondary documents shall be for engineering completion purpose.

3.03.00 Battery Charger

3.03.01 General

- a) All chargers shall be solid-state type with full wave, fully controlled, bridge configurations.
- b) The charger shall be provided with (but not limited to) microprocessor based automatic voltage control, current limiting circuitry, smoothing filter circuit and soft-start feature, under/ over voltage protection and earth fault detection.
- c) Voltage/current control shall be step less, smooth and continuous. Voltage control shall be possible either in “Auto” mode or in “Manual” mode. An “Auto-Manual” selector switch shall be provided for this purpose.
- d) The charger shall be self-protecting against all AC and DC transients and steady state abnormal currents and voltages.
- e) Charger AC input and DC output shall be electrically isolated from each other and also from panel ground.
- f) Isolation shall also be provided between power and control circuits.
- g) Radio frequency suppressor/screening shall be provided with the charger to limit the noise level/interference to radio and other communication equipment to be installed in the same building.

3.03.02 Construction

- a) The charger shall comprise a continuous line up of free-standing, floor mounted sheet steel panels, with access from both from front as well as from rear.
- b) The panel shall conform to the degree of protection IP 42. Minimum thickness of sheet metal used shall be 2 mm for load bearing members and 1.6 mm for non-load bearing members.
- c) Access doors shall be with concealed hinges and neoprene gaskets. Ventilating louvers shall be covered with fine wire mesh. Door over 600 mm width shall be of double-leaf design.
- d) All indicating instruments, control switches etc. shall be flush mounted on the front face of the panels. However, potentiometer shall be provided inside the panel. Nameplates of approved size and type shall be provided for all circuits and devices both at front & inside of the panel.
- e) All bus bar and bus connections shall be of high conductivity copper and adequately sized to limit the maximum temperature within the permitted value. All bus connection shall be silver plated.
- f) Heat-shrinkable insulating sleeves shall be provided for bus bars. All bus connections shall be color coded for easy identification.
- g) Bus bars shall be supported and braced to withstand the stress due to maximum short circuit current and also to take care of any thermal expansion.

3.03.03 Charger Equipment

- a) All power diode and control rectifiers shall be silicon type. Rectifier transformer shall be resin impregnated in vacuum, dry type, double wound with copper conductor and Class-F insulated with temperature rise limited to Class-B having off-circuit tap $\pm 2.5\%$ on primary side. LC filter suppressor shall be provided in the output to minimize ripple content and to keep the value within the specified limit.
- b) The diode & bridge elements shall be liberally sized for forward current, minimum momentary overloads & voltage spikes. The current & peak inverse voltage (PIV) should be chosen accordingly. Wherever necessary power semiconductor device shall be provided with over current and over temperature protection by using special fuses.

Blocking diodes shall be fully rated and shall have redundancy so that failure of a single diode shall not incapacitate the system in any way.

- c) Isolating switches shall be heavy duty, load break type, operated by an external handle with provision for padlocking in ON & OFF position.
- d) AC Changeover switch shall be 3 position, 4 pole, load break type with 2 NO + 2 NC auxiliary contacts. The switch shall be installed in such a manner that the operating handle shall be accessible only after opening the front door.
- e) Double pole, double throw DC switch shall be load break type with 2 NO + 2 NC auxiliary contacts.
- f) Control switches shall be dust protected, heavy duty, switchboard type complete with escutcheon plates. Contacts shall be silver plated, rated 10A at operating voltage.

Selector switch shall be maintained contact, lockable stay-put type with knob handle. Meter selector switch shall be four-position type.

Ground fault detection switch shall be three-position type spring return to neutral.

- g) Push button shall be heavy duty, shrouded, push to actuate type with colored button and inscription plate. Each push button shall have 2 NO + 2 NC contacts, rated 10A at 240V AC and 5.0A at 220V DC.
- h) Contactor shall be air-break type with hand reset type thermal overload relays having in built temperature compensator and single phase preventor. Contactor duty class shall be AC-3.
- i) Fuses shall be HRC type, mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board. Kick-off fuses (trip fuses) with alarm contacts shall be provided for all DC fuses. Semi conducting device fuses shall be fast-acting. All upstream fuses shall be properly coordinated with corresponding downstream fuses.
- j) Indicating lamps shall be clustered of LEDs suitable for the duty involved. The body shall be made of polycarbonate Unbreakable lens. LEDs shall be protected by inbuilt fuse with surge suppressor or leakage voltage glow protection. Both lamps and lens shall be replaceable from front.

- k) Ground fault relay shall be provided to detect DC system groundleakage current.
- l) Switch fuse shall be provided to receive incoming AC supply.

3.03.03 Alarms

- a) Solid-state, audio visual annunciation system shall be provided for battery chargers. Annunciation system shall operate on 220V DC.
- b) One (1) minimum twelve-points alarm facia shall be provided on float-cum- boost charger panel, complete with proper actuating devices, circuitry, legends, push buttons (Accept, Reset and Test) and hooter.
- c) The arrangement shall be such that on occurrence of a fault the corresponding window will light up and stays lighted until the fault is cleared and reset button is pressed.
- d) Each time a window lights up, a master relay will get energized to provide group alarm signals for Owner/Purchaser's remote panel.
- e) The alarm shall be compatible with central DCS/SCADA

3.03.04 Transducers

Each battery charger shall be provided with one (1) no. voltage transducer and one (1) no. current transducer for monitoring the DC output. Transducer shall have 4-20mA dual output.

Charger panel shall be provided with the following transducers:

- a) DC voltage transducer at each charger output.
- b) DC current transducer at each charger output.
- c) DC voltage transducer at battery output.

3.03.05 Controls

The following (but not limited to) manual controls shall be provided on the front of each charger panel:

- a) Charger ON/OFF push button.
- b) Selection of float or boost charge in case of float-cum-boost charger.
- c) Voltage setters for setting the output of float/ equalizing / boost charge. Setting shall be independent of each other so that setting of one voltage shall not require resetting other.
- d) Ground fault detection switch with indicating lamps.
- e) Current limit setter/ charging rate.

- f) Under/Over voltage relay including battery earth fault monitoring relay.
- g) Acknowledge-Reset-Test push buttons for annunciation system. The color of reset buttons shall be BLACK.

3.03.06 Wiring/Cabling

- a) The panels shall be completely wired-up. All wiring shall be routed through wiring troughs.
- b) Wiring shall be done with flexible, 1100V grade, fire resistance PVC insulated switchboard wires with stranded copper conductors of 2.5 mm² for control and current circuits and 1.5 mm² for voltage circuits.
- c) Each wire shall be identified, at both ends, with interlocking type permanent markers bearing wire numbers as per Bidder's Wiring Diagrams. AC / DC wiring shall have separate color-coding.
- d) Wire termination shall be made with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.
- e) All spare contacts of relays, timers, auxiliary switches and other devices shall be wired up to the terminal block.
- f) Gland plate shall be of 4 mm thick, non-magnetic material and suitable for single-phase cable entry from bottom. Cable terminal board with cable lugs and double compression cable glands shall be provided in each panel for termination of incoming and outgoing cable.

3.03.07 Terminal Block

- a) 1100V grade, multi way terminal block complete with mounting channel, binding screws and washers for wire connections and marking strip for circuit identification shall be provided for terminating the panel wiring. Terminals shall be stud type, suitable for terminating 2 nos. 2.5 mm² stranded copper conductor and provided with acrylic insulating cover.
- b) Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished. Separate terminal blocks shall be used for AC/ DC wiring termination.
- c) Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- d) Terminal blocks used for interface with DDCMIS via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.

3.03.08 Grounding

- a) The charger panels shall have fully rated ground bus with two ground terminals, one at each end.
- b) Each terminal shall comprise two-bolt drilling with G.I. bolts, nuts and bimetallic washers for connecting to 50x6 mm G.I. flat. Ground bus shall be bolted to the panel structures, effectively grounding the entire assembly. The cases of meters, relays and switching devices shall be grounded through sheet steel structure.

- c) Wherever, the schematic diagrams indicate a definite ground at the panel, a single wire for each circuit thus grounded shall be run independently to the ground bus and connected thereto.

3.03.09 Tropical Protection

- a) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.
- b) Screens of corrosion resistant material shall be furnished on all ventilating louvres to prevent the entrance of insects.

3.03.10 Painting

- a) The sheet metal of the panels shall be thoroughly cleaned by chemical agents (7-tank process) as required to produce a smooth clean surface free of scales, grease and rust.
- b) Both interior and exterior surfaces of the panels shall be powder coated and finished with two (2) coats of paints of approved shades.
- c) The paint shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or removed by abrasion due to normal handling.
- d) Sufficient quantity of touch up paint shall be furnished for application after installation at site.

3.03.11 Nameplate

- a) Name plate shall be provided for each panel and for each equipment/device mounted on it.
- b) The material shall be anodized aluminum/ lamicoid, 3mm thick, with white letter on black background.
- c) Name plate shall be held by self-tapping screws. The size of name plates shall be approximately 20mm x 75mm for equipment and 40mm x 150mm for panels.
- d) Name plates for panels shall be provided both on the front, rear and also inside the panels.
- e) Control and meter selection switches shall have integral nameplates. Nameplates for all other devices shall be located below the respective devices both inside and outside the panel.
- f) Instrument and devices mounted on the face of the panels shall also be identified on the rear with the instrument / device number. The number may be painted on or adjacent to the instrument or device case.
- g) Caution notice of suitable metal plate shall be affixed at the back of each panel.
- h) Bus bar clamp-on sensor, maximum DC current: 50A

PACKING SPECIFICATION FOR BATTERY CHARGER

CHARGER shall be despatched in "Crate Packing" using wood.

1.0 PREPARATION OF PACKING CASES:**1.1 DIMENSIONS:**

- 1.1.1 Minimum number of planks shall be used for a shook.
- 1.1.2 Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm
- 1.1.3 Horizontal, vertical, diagonal planks shall be given for binding
- 1.1.4 Width of binding planks shall be minimum 100mm
- 1.1.5 Distance between any 2 binding planks shall be less than 750mm
- 1.1.6 Diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- 1.1.7 Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- 1.1.8 Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

1.2 JOINTING OF PLANKS:

Single length planks shall be used for cubicles whose overall length is less than 2400 mm. For cubicles of length more than 2400 mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

1.3 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

1.4 OTHER MATERIALS**1.5.1 NAILS**

Nails of suitable dia and length shall be used for joining the planks.

1.5.2 BLUE NAILS

If applicable, these shall be used for nailing bituminized Kraft paper/hessian cloth to the planks.

1.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The material shall be free from rust. If sufficient nailing is done for bigger boxes, strapping need not be done.

1.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

1.5.5 BRACKETS

Brackets of suitable dimension shall be used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of suitable thickness. The brackets shall be of "L" shape. Two holes shall be provided towards the end of each side for screwing /nailing.

1.5.6 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM(colourless) Multi Layered Cross Laminated Polyethylene Film shall be used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

1.5.6 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir.

1.5.7 FASTENERS

Bolts, double nuts, spring washers will have to be used to hold the job to the bottom plank of the box so that there shall be no jerk on the CHARGER during transit.

1.5.8 PACKING SLIP:

Packing slip kept in the polyethylene bag shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder shall be nailed to front / rear of case.

1.5.9 MARKING PLATE:

Marking on the packing case shall be done as per the manufacturer standard.

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TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER- FGD & OFFISTE AREAS

5 X 800 MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-508-E002B

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SECTION C

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DATASHEET-A

Sr. No.	PARAMETER	UNIT	VALUE
1.0	Power Supply & fault level details		
1.1	Rated AC voltage & variation	V, %	415 V, -15% to +10%, 3Ph- 3 Wire # Systems.
1.2	Frequency & variation	Hz, %	50Hz, +3% to -5%
1.3	Rated DC voltage & variation	V, %	220 V, 187 V to 242V
1.4	Fault current of 415V system	kA	50 kA for 1 sec.
1.5	Fault current of DC system limited upto (max)	KA	25 KA for 1 sec.
1.6	Type of battery		Lead Acid Plante (SLD- Annexure II) Stage-1 : 860AH Stage-2 : 645AH
2.0	Charger current rating		
2.1	Float charger	A	i) 60A – Stage 1 ii) 50A – Stage 2
2.3	Float-cum-boost charger	A	i) 170A – Stage 1 ii) 130A – Stage 2
2.4	Portable single cell boost charger	A	i) 165A- Stage 1 ii). 125A- Stage 2
3.0	Type of cooling		Natural cooled
4.0	Ripple content of charger		
4.1	RMS	%	
4.2	Peak to peak	%	± 1%
5.0	Degree of Protection (DOP)		
5.1	Rectifier transformer cubicle		IP-42
5.2	Control cubicle		IP-42
6.0	Constructional features		
6.1	Panel sheet thickness/ material	mm	Min. 1.6mm Cold rolled sheet steel for panel fabrication with folded type construction and min. 2.0mm Cold rolled sheet steel for panel frame.

6.2	Paint shade		Opaline Green shade 275 of IS-5 – for Exterior & Semi glossy white for interior.
6.3	Cable gland plate thickness/ material	mm	3 mm, nonmagnetic type of 4mm for DC cables
6.4	Gasket thickness/ material	mm	3 mm / Rubber
6.5	a) Cable size from charger to DCDB b) Cable size from battery to Fuse Box c) Cable size from Fuse Box to DCDB d) Cable Size For Charger AC Incomer		Actual cable size and number of runs shall be informed during detailed engineering.
7.0	Type Tests		
7.1	Type tests to be conducted for this contract, despite availability of valid & acceptable test certificates	Yes/ No	YES, As per Section – C/Quality plan. Heat Run test to be conducted on all chargers including single cell boost charger
8.0	Earthing		
8.1	Grounding terminal size/ no. for each charger		50X6 MM./ 2 nos
8.2	Grounding terminal size/ no. for each fusebox		50X6 MM./ 2 nos
8.3	Grounding terminal size/ no. for each discharge resistor		50X6 MM./ 2 nos
9.0	Mandatory Spares		
9.1	Mandatory Spares to be quoted for this contract	Yes/ No	Yes
9.2	If yes, list of mandatory spares		As per BOQ cum unpriced schedule enclosed with NIT
10.0	E & C Spares		
10.1	E & C Spares to be quoted for this contract	Yes/ No	Yes

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TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER – FGD & OFFSITE AREAS

5 X 800 MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-508-E002B

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SECTION C

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10.2	If yes, list of E & C Spares		Asper BOQ cum unpriced schedule enclosed with NIT
11.0	Special tools & tackles		
11.1	Special tools & tackles to be quoted for this contract	Yes/ No	Yes (if applicable)
11.2	If yes, list of Special tools & tackles		Bidder to furnish lists.
12.0	Battery Fuse Box	Fuses as per Load Duty Cycle for both Positive and Negative Pole shall be provided. Also Construction shall be same as Charger Panel and Battery Fuse Box shall be wall-mounted type. Minimum rating of Battery Fuse Box shall be as indicated in the BOQ cum price schedule. Facility shall be provided for local and remote metering of battery trickle charging current.	
11	Discharge Resistor Panel	a) Portable type battery discharge resistor panels with resistance material Copper Nickel alloy shall be supplied with shunt suitable for 10 hrs with Degree of Protection IP20. Discharge rate (C10 rate) as per battery capacities indicated in the BOQ cum price schedule (Sheet 1 of 2). b) Cooling of discharge resistor shall be air/fan cooled. c) Construction shall be same as Charger panel. Handle and wheel arrangement shall be provided for easy movement. d) Control - Using rotary switches for step control of current against falling voltage with ON-OFF facility..	
12	Fuse	Type- HRC Rupturing capacity – 50kA (AC) & 40kA (DC) Standard applicable- IS-13703	
13	Min. margin on components (Rectifier transformer, contactor, fuse, MCB, switch etc.)	Min. 15% above calculated rating on transformer % min 25% on other components.	

Notes :

i) BHEL will provide 3 PH-3 wire power Supply. Further distribution for single Phase shall be created by Bidder.

ii) Min cable size and Nos. indicated. Nos. may increase during detailed engineering.

iii) Actual rating of Battery fuse box and discharge resistor panel shall be selected by the bidder based on load duty cycle (Annexure-II).



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Sr. No.	PARAMETER	UNIT	VALUE
1.0	Manufacturer's Name		
2.0	Design ambient temperature		
3.0	Charger Rating & Type		
4.0	Charger rated output current:		
4.1	Trickle charging mode		
4.2	Boost charging mode		
5.0	Load limiter current setting range (Trickle mode)		
6.0	Automatic voltage regulator (Trickle mode)		
6.1	Type		
6.2	% Stabilization of the output DC voltage		
6.3	Voltage setting range		
6.4	Walk in time of Automatic Voltage Regulator		
6.5	Time taken to stabilize voltage for under shoot & overshoot		
7.0	Manual voltage regulator (Trickle mode)		
7.1	Type		
7.2	Voltage setting range		
8.0	Boost charging		
8.1	Current setting range		
8.2	Voltage limit setting range		
9.0	Rectifier assembly		
9.1	Type of semi-conductor material		
9.2	Rated direct current per cell (Average)		
9.3	SCR Rating Selected		
9.4	Heat sink for SCR		
9.5	Rated direct voltage		
9.6	Rated input voltage		
9.7	Type of connections of rectifier element		
9.8	Standard applicable		
9.9	Ripple content		

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Sr. No.	PARAMETER	UNIT	VALUE
10.0	Rectifier transformer		
10.1	Type		
10.2	Rated KVA & % impedance		
10.3	Input line winding connection in vector representation		
10.4	Cell winding connection in vector representation		
10.5	1 min. power frequency withstand voltage (kV)		
10.6	Standard applicable		
11.0	Charger full load Efficiency at nominal input & output voltage & current		
12.0	Power factor at nominal input & output voltage & current		
13.0	Instrument		
13.1	Manufacturer		
13.2	Type		
13.3	AC voltmeter range		
13.4	DC voltmeter range		
13.5	DC Ammeter range		
13.6	Dial size		
13.7	Accuracy class as per IS		
14.0	Contactor		
14.1	Manufacturer		
14.2	Type		
14.3	Rated voltage		
14.4	Rated current		
14.5	No. of power contact		
14.6	No. type and rating of Aux. Contacts		
14.7	Operating coil voltage		
14.8	Drop-out voltage		
15.0	Thermal over load relay		
15.1	Manufacturer		



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Sr. No.	PARAMETER	UNIT	VALUE
15.2	Tripping current range		
15.3	Whether single phasing protection provided		
15.4	Standard applicable		
16.0	Air - break switches (both DC & AC side)		
16.1	Manufacturer		
16.2	Type		
16.3	Rated voltage		
16.4	Rated current		
16.5	Type & material of contacts		
16.6	Standard applicable		
17.0	Output fuse		
17.1	Manufacturer		
17.2	Type		
17.3	Rupturing capacity (both AC & DC)		
17.4	Standard applicable		
18.0	Painting		
18.1	Paint shade		
18.2	Painting process		
19.0	Degree of Protection (DOP)		
19.1	Rectifier transformer cubicle		
19.2	Control cubicle		
20.0	Earthing busbar size & material		
21.0	Charger dimension: (approx.) [L x W x H]		
22.0	Sheet thickness (mm) / material		
23.0	Cable gland plate thickness		
24.0	Gasket material		
25.0	Charger weight (Kg.)		

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SECTION-II

STANDARD TECHNICAL SPECIFICATION



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1.0 INTRODUCTION

This specification covers the design, manufacture, assembly, testing, packing and despatch of Battery charger (Float/Boost/Float cum Boost), Discharge Resistor, Battery Fuse Box complete in all respects with all components, fittings and accessories for efficient and trouble-free operation. The charger shall be connected either with Ni-Cd or Lead-acid type battery as applicable. In this specification though erection & commissioning is not included in vendor's scope, the vendor shall still not absolved of his responsibility of establishing the correctness of equipment at site.

2.0 CODES AND STANDARDS

The equipment shall generally conform to IS. Unless otherwise specified, the latest revisions of codes/ standards specified in Annexure-I enclosed are applicable.

3.0 OPERATIONAL REQUIREMENTS

- 3.1 Under normal conditions, when the AC supply is healthy at the battery charger input terminals, the float charger shall feed the continuous DC loads, while the boost charger shall remain off. Over and above the continuous DC loads the float charger shall also supply the necessary trickle charge to the battery, to keep the later in fully ready condition for being available during AC supply failure at charger terminals. Also some of the impulse loads of duration less than a minute for which the response of the charger is poor, shall be supplied by the associated battery in the DC system. This impulse discharge, shall, however, be continuously replenished by the float charger, unless the discharge is of considerable magnitude, in the event of which the boost charger shall be deployed.
- 3.2 The float charger shall withstand momentary supply failure due to changeover on AC supply feeding bus and continue to operate on float mode satisfactorily on restoration of AC supply to charger.
- 3.3 The DC system shall be ungrounded and shall float with respect to the ground potential when healthy.
- 3.4 After the batteries are boost charged and operation is changed to float mode, the voltage impressed on the loads shall not exceed float charge voltage.
- 3.5 The charger shall be designed to operate at an ambient air temperature of 50°C. It will be located indoor but in a hot, humid and tropical atmosphere.
- 3.6 The voltage at load terminal will not exceed the limits of +10% and -15% of nominal system voltage for DC system.

4.0 BATTERY CHARGERS

- 4.1 The battery chargers shall be self-regulating, natural/forced air cooled (as per Sec-I/Datasheet-A), static type/microprocessor based composed of silicon controlled rectifiers (SCRs) connected in three phase full wave full control bridge circuit.
- 4.2 Each charger circuit shall be provided with its own AC input voltmeter with voltmeter selector switch, DC voltmeter & ammeter, battery DC output ammeter & voltmeter, battery charging current ammeter, control switches, rectifiers, Auto/ Manual voltage regulators, load limiting device, etc. as required for the successful operation of the DC system.



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- 4.3 The charger shall have auto voltage regulators to enable step less, smooth and continuous voltage control. The chargers shall have the effective current limiting feature and smoothing filters to minimise harmonics, radio frequency transients, electromagnetic transients, etc.
- 4.4 The battery chargers as well as their automatic regulators shall be of static type/ microprocessor based, the battery chargers shall be capable of continuous operation at the respective rated load in float charging mode i.e. trickle charging the associated DC batteries while supplying the DC loads.
- 4.5 The battery chargers shall have a selector switch for selecting the battery-charging mode i.e. float or boost charging.
- 4.6 The battery chargers shall be provided with facility for both automatic and manual control of output voltage and current. The selector switch will select the mode of output voltage/current control, whether automatic or manual. Necessary provisions shall be provided to avoid current/voltage surges of harmful magnitude/nature, which may arise during changeover from auto to manual mode or vice versa under normal operating condition.
- 4.7 Soft start feature shall be provided to build up the voltage to the set value slowly within 15 seconds. The chargers shall have load limiters, 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 characteristic 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. After clearance of fault, the charger voltage shall build-up automatically when working in automatic mode.
- 4.8 When on automatic control mode during float charging, the charger output voltage shall remain within $\pm 1\%$ of the set value for AC input voltage variation of $\pm 10\%$ and a continuous DC load variation from zero to full load. Uniform and step less adjustment of voltage setting (in both auto/manual modes) shall be provided on the front of the charger panel covering the entire float charging output range specified. Step less adjustment of the load limiter setting shall also be provided from 80% to 100% of the rated output current for float charging mode.
- 4.9 During boost charging, the battery chargers shall operate on constant current mode (when automatic regulator is in service). The boost charging current can be adjusted continuously over a range of 50% to 100% of the rated output current for boost charging mode. The charger output voltage shall automatically go on rising, when operating in boost mode, as the battery charges up. For limiting the output voltage of 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. All voltage and current setting potentiometers shall be Vernier type/screw type. If setting of the upper limit in the output range is possible manually via the controller interface as per bidder's design, then separate potentiometer is not required.
- 4.10 Energising the charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of voltage setting. The time taken to stabilise within specified limits shall be less than 15 seconds.
- 4.11 Momentary output voltage of the Charger, without the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice versa. Output voltage shall return to, and remain, within the limits specified as mentioned elsewhere in less than 2 seconds after the above mentioned change.



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- 4.12 In case of float-cum-boost charger, manufacturer shall 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 the float charging mode is also used as boost charging current setting device.
- 4.13 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 fluctuation even when they are not connected to a battery.
- 4.14 Wherever two incoming AC power source for particular charger (if applicable as per project specific requirement) is envisaged then suitable automatic changeover arrangement/scheme shall be provided between two AC power source.
- 4.15 Ni-Cd Batteries shall be Trickle charged at 1.4 to 1.42 Volts per cell. Chargers shall be capable of boost charging the associated D.C. Battery at 1.53 to 1.7 Volts per cell in 8-10 hours. Lead Acid Batteries shall be Trickle charged at 2.23 to 2.25 Volts per cell. Chargers shall also be capable of boost charging the associated D.C. Battery at 2.3 to 2.89 Volts per cell in 8-10 hours. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C. For the type of battery for the project, kindly refer Datasheet-A.

5.0 DESCRIPTION OF EQUIPMENT

5.1 Rectifier assembly

Rectifier assembly shall be full wave bridge, twelve (12) pulse type (for charger rating 300A and above) and designed to meet the duty as required by the respective charger. The rectifier cells shall be provided with their own heat dissipation arrangement with natural air-cooling for upto 400A rating chargers. However, the rectifier cells shall be provided with their own heat dissipation arrangement with forced air-cooling for above 400A rating chargers and fan shall be temperature rise controlled with 100% standby redundancy. The rectifier shall utilise diodes / thyristors and heat sinks to carry 200% of the load current continuously and the temperature of the heat sink shall not be permitted to exceed 85°C absolute, duly considering the maximum charger panel inside temperature. Adequate snubber circuit shall be provided for the safety of thyristors, etc. The successful bidder shall furnish calculations to show what maximum junction temperature will be and what the heat sink temperature will be when operating at 200% and 100% load current continuously duly considering the maximum surrounding air temperature for these devices inside the charger panel at air ambient temperature of 50°C outside the panel. Necessary surge protection devices and rectifier type fast acting HRC/Semiconductor fuses shall be provided in each arm of the rectifier connections. Heat run test for other charger components shall be carried out at 100% of rated current.

5.2 Rectifier transformer and Chokes

The rectifier transformer & chokes shall be dry and air cooled (AN) type. The rating of the rectifier transformers & chokes shall correspond to the rating of the associated rectifier assembly and shall be **copper** wound. The rectifier transformers & chokes shall have Class-F insulation with temperature rise limited to Class-B insulation value. The rectifier transformer sizing shall be done considering suitable factors for voltage drop, regulation, effect of harmonics, conversion factors etc. to arrive final selected rating of rectifier transformer. The successful bidder shall furnish calculations for rectifier transformer sizing for approval.

5.3 Blocking Diode

Blocking Diode shall be provided in the output circuit of each charger to prevent current flow from the DC battery into the charger. The successful bidder shall furnish calculations to show what



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maximum heat sink temperature will be when operating at 100% load current continuously duly considering the maximum surrounding air temperature for these devices inside the charger panel at air ambient temperature of 50°C outside the panel.

5.4 Voltage regulators

- 5.4.1 The float charger shall have both auto and manual voltage regulation arrangements. The voltage regulator shall have auto/manual option and be of static type. A selector switch for selection of the mode of voltage regulation shall be provided. AVR time constant shall not exceed 0.5.
- 5.4.2 The boost charger shall have auto/manual voltage regulation arrangement. The voltage adjustment shall be uniform and step less throughout the voltage variation range. The regulator shall be of static type. The boost charger shall be designed to charge the fully discharged battery to fully charged condition in 8 hrs.

Voltage regulators of Float/Boost Charger as part of controller are also acceptable. However, end user/customer requirement as specified in Sec-I will prevail.

5.5 Printed Circuit Boards (PCB)

PCB shall be made of glass epoxy of 1.6 mm thick, fire resistant, bonded with 99.8% pure copper foil, free of wrinkles, blisters, scratches and pinholes. The contact surface of the edge connectors of PCBs shall be plated with hard gold to a minimum thickness of 5 microns. The component identification shall be printed on PCB by Silk screen method. All PCBs shall be tropicalized and masked. The above requirement is indicative. Manufacturer standard design meeting high quality standards and performance are also acceptable.

5.6 Control and Selector Switches

The control and selector switches shall be of rotary stay put type with escutcheon plates showing functions and positions. The switches shall be of sturdy construction and suitable for mounting on panel front. The switches shall have shrouded live parts and sealed contacts against dust ingress. Auto/normal switch shall be of lockable type in either position. The contact ratings shall be at least the following:

- Make and carry continuously 10A
- Breaking current at 220V DC 0.5A (inductive)
- Breaking current at 240V AC 5.0A at 0.3 p.f.

5.7 Indicating Lamps

To indicate AC supply availability, three indicating lamps shall be provided. The indicating lamp shall be suitable for panel mounting, cluster type LED and capable of clear status indication under normal room illumination. The lamp covers shall be preferably screw type, unbreakable and moulded from heat resistant material.

5.8 Instruments

For all chargers, DC ammeter, DC voltmeter and AC voltmeter shall be provided in 96 x 96 mm² size with 0.5 accuracy class conforming to IS-1248. The instruments shall be flush mounted type, dust proof, moisture resistant and have easy accessible means for zero adjustment. Meters shall have 4 digit-7 segment LED/LCD display and RS 485 Serial Bus port for remote communication.

5.9 Relays

The relays shall be enclosed in flush or semi flush dust tight cases finished with dull black enamel paint. Relays shall have self-contained test facilities and provisions for removing relay mechanism for inspection and maintenance.



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5.10 Transducers

Transducers shall be panel-mounting type and suitable for operating temperatures from 0 to 55°C. Transducer output shall be used for remote display at DDCMIS. Transducers shall be provided in charger panel for DC battery voltage, charger output voltage and charger output current. The transducer shall have the following features:

- Input/ output with galvanic isolation
- Auxiliary voltage – 220V DC
- 4-20 mA independent dual output
- Accuracy class 0.5 or better
- Short circuit and over current protection

5.11 Contactors

All battery chargers shall have an AC contactor on the input side. It shall be of air break type and suitable for continuous duty. The operating coil shall be rated for 415 V/400V/380V as per project requirement. The DC contactors shall be single/double pole air break type and suitable for continuous duty.

5.12 Thermal overload relay

A thermal overload relay with single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input, which will trip the contactor. Thermal overload relay part of controller/designed with control cards are also acceptable.

5.13 Air break switches / MCCB

All chargers shall have AC input and DC output switches of air break, single throw, load break and fault make type or MCCB type as per project requirement. The contacts of the switches shall open and close with a snap action. The switches/MCCB shall be rated for 120% of the maximum continuous load. The 'ON' and 'OFF' position of the switch/MCCB shall be clearly indicated. The operating handle of the switches/MCCB shall be fully insulated from circuit and shall be effectively earthed.

Incoming/outgoing supply shall be MCCB or SFU as per project specific requirement specified in Section-I/datasheet-A of the specification.

5.14 Fuses

Incoming/outgoing power supply fuses shall be of HRC cartridge fuse link type. Fuses shall be mounted on fuse carriers, which are mounted on fuse base. Wherever, it is not possible to mount fuses on fuse carriers, fuses shall be directly mounted on plug-in type bases. In such cases one insulated fuse pulling handle shall be supplied for each charger. Kick-off fuses (trip fuses) with alarm contacts shall be provided for all DC fuses. The fuses shall be suitable for applicable fault level. For electronic circuits, high speed semiconductor fuses may be used.

5.15 Variable Metallic Resistor (Discharge Resistor)

Variable metallic resistors and shunt suitable for carrying out discharge tests (5-hour discharge rate for Ni-Cd battery and 10-hour discharge rate for Lead Acid battery) on the batteries shall be supplied. The Discharge resistor unit shall be of robust assembly consisting of Copper-Nickel Alloy /FeCrAl/ Ni-chrome /Punched Steel Grid elements as per project specific requirement. The Discharge Resistor fan shall be designed to allow rapid, forced cooling of resistor bank.

5.16 Battery fuse box / MCCB Box

Battery fuse / MCCB of adequate rating meeting the load duty cycle shall be supplied. Suppliers have to furnish DC fuse/MCCB characteristics in support of the rating selected for the Battery



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Fuse Box. Battery fuse box / MCCB Box shall have suitable termination arrangement for terminating the incoming & outgoing cables informed during detailed engineering stage. Suitable cable lugs & glands have to be supplied with the equipment which shall be in Battery Charger Vendor scope.

MCCB or SFU as per project specific requirement specified in Section-I/Datasheet-A of the specification.

5.17 Panel Construction

The charger panels housing all the equipment shall be indoor, floor mounting, air natural cooled, self-supporting sheet metal enclosed cubicle type. The charger panel and its frame shall be fabricated from 1.6 and 2.0 mm cold rolled sheet steel respectively and have folded type construction. The bidder shall also supply necessary base frames, anchor bolts and hardware. Removable undrilled gland plates of at least 3.0 mm thick sheet steel and lugs for all cables shall be provided. The lugs for cables shall be made of electrolytic tinned copper. The gland plate shall be of adequate size for accommodating requisite number of cable glands for power and control cables. The charger shall be tropicalized and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All door and covers shall be fitted with synthetic rubber/Neoprene gaskets. The panels shall have hinged double leaf doors provided on front and backside for adequate access of charger terminals. All the charger cubicle doors shall be properly earthed. The panels shall comply with at least degree of protection IP-42. Incoming and outgoing cables shall enter from bottom. Suitable cable terminal board with copper cable lugs and double compression brass nickel-plated cable glands shall be provided (which shall be in Battery Charger Vendor scope) in each panel for incoming and outgoing cables.

5.18 Electronic equipment shall be of modular design consisting of plug-in modules in standard 19 inches' metallic racks with metallic card guides. The card should be provided with proper handles. Card to card wiring shall be through mother board. Unplanned jumpering and track modifications shall not be allowed. Mechanical interlocks to prevent wrong insertion of cards shall be provided. Each card shall have its junction and test points identified. Maintenance aids such as extension printed wiring boards and jumper leads shall be provided. Non modular design is also acceptable.

5.19 The layout of charger components shall be such that their heat losses do not give rise to excessive temperature within the charger panel surface. Location of the electronic modules will be such that temperature rise of the location, in no case, shall exceed 10°C over ambient air temperature outside the charger.

5.20 All the charger panels shall be provided with an illuminating lamp, a 5 Amp socket and space heaters with thermostat. Toggle switches and fuses shall be provided separately for each of the above fittings. Space heaters "ON" indication shall be provided. Two separate grounding pads shall be provided for each panel.

5.21 Locking facility

Locking facility shall be provided as follows:

For locking float/boost selector switch in the float position only. This shall be used for having key mechanical interlock between float/boost selector switch and isolator in DCDB.

The charger enclosure door-locking requirement shall be met by the application of padlocks. Padlocking arrangement shall allow ready insertion of the padlock shackle but shall not permit excessive movement of the locked parts with the padlock in position.



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5.22 Control wiring

Each panel shall be furnished completely factory wired upto power cable lugs and terminal blocks ready for external connections. The power wiring shall be carried out with 1.1kV grade, PVC insulated cables conforming to IS-1554 (Part-1). The control wiring shall be of 1.1kV grade, 1 core stranded copper wire with colour coded PVC insulation having identification ferrules at both terminal and device end for each wire. Wires shall conform to IS-694 and minimum size of the wire shall not be less than 2.5 mm². The control wiring terminating at electronic card shall not be less than 1.0 mm². The control terminal shall be suitable for connecting two wires with 2.5 mm² stranded copper conductors. All terminals shall be numbered for ease of connections and identification.

Power & control wiring within the panel shall be kept separate. Any terminal or metal work, which remains alive at greater than 415V, when panel door is opened, shall be fully protected by shrouding.

An air clearance of at least 10mm shall be maintained throughout all circuits, except low voltage electronic circuits, right upto the terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

5.23 Terminal Blocks

Terminal blocks for all the chargers shall meet the following requirements:

- Terminal block shall be 1.1kV grade, minimum 10A rated, one piece moulded complete with insulating barrier, clip on type terminals, washers, nuts and identification strip etc. It shall be similar to Klippon type RSF with insulating material of melamine or equivalent. Marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. Terminal blocks for CT & VT secondary leads shall be provided with links to facilitate testing, isolation, star/delta and earthing. Terminal blocks for CT secondary shall have the short-circuiting facility.
- At least 20% spare terminals for external connections shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.
- There shall be minimum clearance of 250mm between the terminal blocks and the cable gland plate and 150mm between two rows of terminal blocks.

5.24 Cable Lugs

Heavy duty bolt-on termination tinned copper lugs of compression type shall be used in the Charger for power cable termination. The supply of tinned copper cable lugs for power cables forms part of the supply of equipment. Cable lugs shall comply with IS-8309.

5.25 Cable Glands

The supply of cable glands forms part of the supply of equipment. Cable glands shall conform to BS-6121. Cable glands shall be of double compression type.

5.26 Panel Earthing

Charger panels shall have fully rated GI ground bus with two ground terminals, one at each end of the panel. Each ground terminal shall have two bolt drillings with GI bolts and nuts suitable for connection to purchaser's ground conductor.



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6.0 ANNUNCIATION SYSTEM

6.1 Visual indication shall be provided to indicate the operating conditions of the charger by the means of indicating lamps/LED or annunciation facia windows as per EEUA-45D, arranged on the top of the charger panels for following faults:

- a) AC supply failure
- b) AC input fuse failure (separate for FCBC/Float/Boost)
- c) AC Under voltage/Overvoltage
- d) Rectifier fuse failure
- e) Charger failure
- f) Surge circuit fuse failure
- g) Filter fuse failure
- h) Blocking Diode failure
- i) Load limiter operated
- j) Charger trip/over loaded
- k) Battery on boost
- l) Charger earth fault
- m) Battery fuse blown
- n) Boost Bus Overvoltage
- o) DC system under voltage/over voltage

Potential free 'NO' contacts of all above conditions shall be provided for following remote alarms in the DDCMIS:

- q) Battery fuse fails
- r) Battery on boost
- s) Charger over load
- t) Charger trouble (this being a group alarm initiated by any of the faults of charger other than charger over load).

6.2 Suitable potential free contacts for remote indication of above abnormal conditions shall be provided. Multiplication relays, if required, shall be included in the panel. Indications for charger input supply healthy, charger in FLOAT mode and charger in BOOST mode shall be provided.

7.0 NAME PLATE AND MARKING

The name plates shall be made of non-rusting metal / 3 ply Lamicoid and shall have black back ground with white engraved letters and secured by screws. These shall be provided near top edge on the front as well as on rear side of charger. Name plates with full and clear inscriptions shall also be provided on and inside the panels for identification of the various equipment.

8.0 PAINTING

After fabrication, all surfaces shall be cleaned and pre-treated as per IS:6005. Two coats of lead oxide primer (anti-corrosive) shall be applied after the pre-treatment. Two coats of powder painting with shade no. RAL-7032 or paint shade approved by customer shall be applied for complete panel. Thickness of paint shall be min. 40-50 microns. Protecting peelable compound shall be provided on outside finished surface to protect the painted surface during transportation and site handling.



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9.0 PERFORMANCE GUARANTEE

The bidder shall guarantee that chargers offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. If the equipment fails to meet the requirement, the supplier shall replace it with appropriate equipment free of cost without affecting the schedule.

10.0 INSPECTION & TESTING

10.1 The bidder shall confirm compliance to Quality plan enclosed with Section-I of specification. The Quality plan shall be subject to BHEL/ customer approval after award of contract without any commercial or delivery implication. Inspection shall be carried out as per BHEL/ customer approved Quality plan.

10.2 All equipment to be supplied shall be of type-tested quality. The bidder shall furnish all type test reports for BHEL/ customer approval. The Type tests should have been carried out within last seven years on the equipment similar to those proposed to be supplied under this contract and the tests should have been either conducted at an independent laboratory or should have been witnessed by a client/ government agency. In absence of such type tests reports or in case such reports are not found to be meeting the specification/ standards requirements, vendor shall conduct all such type tests without any commercial/ delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval. Charges for carrying out all type tests are deemed to be included in the charger price.

10.3 The details of additional Type Tests to be conducted (as per project specific requirement) shall be as per Section-I/BOQ-Cum-Price Schedule of specification.

10.4 The bidder shall furnish following Type Tests reports for each type & rating of battery charger:

- i) Temperature rise test for 8 Hrs at rated voltage and current at input and output of charger. Necessary input power source of required capacity as per charger rating along with DC load bank shall be arranged by vendor during Inspection/testing at works.
- ii) Insulation resistance test
- iii) High voltage test on power & control circuits except low voltage electronic circuit
- iv) Ripple content test at no load, half and full load
- v) Automatic voltage regulation operation test at specified AC supply variations at no load, half and full load
- vi) Load limiter operation test.
- vii) Efficiency and power factor measurement.
- viii) Input and output surge withstand capacity test. Surge voltage as per ANSI-C37.90a shall be applied for a period of not less than 2 seconds at the following points of the charger operating at 50°C at full load:
 - a) Across each AC input phases
 - b) Across AC input line to ground



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- c) Across DC output terminals
- d) Across each DC output terminal to ground

The charger shall not exhibit any component damage and there shall be no deterioration in performance of the charger.

- ix) Environmental Tests: Steady state performance tests (temperature rise test at full load & load limiter operation test) shall be carried out before & after the following tests.

- a) Soak test: The electronic modules shall be subject to continuous operation for a minimum period of 72 hours. During last 48 hours, the ambient temperature shall be maintained at 50°C. The 48-hour test period shall be divided into 4 equal 12 hour segments. The input voltage during each 12 hours shall be nominal voltage for 11 hours followed by 110% of nominal voltage for 30 minutes, followed by 90% of nominal voltage for 30 minutes.

- b) Degree of protection test

- x) Complete physical examination

- xi) Dynamic response test

Overshoot / undershoot in output voltage of the charger corresponding to sudden change in load from 100% to 20% and from 20% to 100%.

10.5 Rectifier transformers shall be subjected to following routine test as per IS: 11171:

- a) Measurement of DC winding resistance
- b) Measurement of voltage ratio and check of voltage vector relationship
- c) Measurement of impedance of voltage (principal tapping), short-circuit impedance and load loss
- d) Measurement of no-load loss (iron loss) and current
- e) Separate-source voltage withstand test
- f) Insulation resistance test
- g) Induced overvoltage withstand test
- h) High voltage Test

10.6 Following routine tests are to be performed on all battery chargers:

- i) Complete physical examination.
- ii) Insulation resistance test.
- iii) High voltage (power frequency) test.
- iv) Ripple content test at no load, half and full load.
- v) AVR operation test at specified AC supply variation at no load, half and full load.
- vi) Load limiter operation test.



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- vii) Checking of proper operation of annunciation system.
- viii) Dynamic response test
Overshoot / undershoot in output voltage of the charger corresponding to sudden change in load from 100% to 20% and from 20% to 100%.
- ix) Burn in test shall be carried out on all electronic modules or panels with modules. During the test the panel / module shall be subjected to ambient temperature of 50°C for 48 hours in energised condition. The temperature rise inside the cubicle shall not exceed 10°C during the test.
- x) Degree of protection test
The charger shall be checked for gasket arrangement as per the drawings.
- xi) Efficiency and power factor measurement.
- 10.7 Following routine tests shall be carried out on annunciation system:
- Annunciation assembly and module shall be functionally tested as per EEUA-45D.
 - Burn in test as specified above in cl. No. 10.5 (ix) above.
- 10.8 All material used for the construction of the equipment / items shall be new and shall be in accordance with the requirements of this specification. Materials utilised shall be those, which have established themselves for use in such applications.
- 10.9 All acceptance and routine tests as per relevant standards and specification, shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the charger price.
- 11.0 DOCUMENTATION
- 11.1 Documents to be submitted by the Bidder along with the bid:
- Clause wise deviation if any in the enclosed format as per NIT.
 - Unpriced Price Schedule (as per NIT) with "quoted" word against line item with bidder's signature and company stamp.
 - Compliance Sheet(Sec-I) with bidder's signature and company stamp.
- 11.2 Over and above the documents mentioned in 11.1, the following minimum documents are to be submitted after the award of the contract for purchaser's approval:
- Brief write-up on the working of the system offered along with Installation, operation and maintenance manual for the battery charger, battery fuse and variable metallic resistor and shunt.
 - Data Sheet-C
 - General arrangement drawing showing the battery charger, Fuse Box & discharge resistor.
 - Wiring diagram.
 - Quality plan.



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- 6) Transformers KVA and voltage rating calculation.
- 7) Thyristors rating, heat sink and fuse co-ordination calculation.
- 8) Blocking Diode rating & heat sink calculation.
- 9) Filter circuit calculation.
- 10) AC power consumption in float mode & boost mode.
- 11) List of make of major components.
- 12) Test certificates as required/ type test procedures
- 13) Field quality plan. Bidder shall furnish field quality plan detailing out the specific quality control procedure covering receipt of material/equipment and handling at site, storage, erection, commissioning, post commissioning etc.
- 14) List of E&C Spares
- 15) List of Mandatory Spares (If Applicable)

11.3 Instruction Manuals

Instruction manuals for the installation, operation and maintenance of battery charger, battery fuse and variable metallic resistor and shunt to be supplied at least two months before the date of despatch of equipment.

The installation and maintenance manual of battery charger, battery fuse and variable metallic resistor and shunt shall contain the following.

- A) General description giving type and rating of equipment.
- B) Technical data.
- C) Salient constructional details.
- D) Instruction to be followed on receipt at site.
- E) Erection procedures and checks (handling at site, erection, pre-commissioning).
- F) Commissioning procedures and site tests.
- G) Routine, periodic and preventive inspection and maintenance procedures.
- H) Safety rules.
- J) Possible faults, their causes and remedies.
- K) Catalogues, literature and drawings.
- L) Outline dimension drawings showing constructional features, relevant cross sectional views and earthing details, operator oriented description of equipment and accessories.
- M) Operating procedures, maintenance procedures & precautions to be taken during operation and maintenance work.

12.0 SPARES

12.1 Bidder to furnish the E & C spares as per BOQ-Cum-Price Schedule.



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13.0 TOOLS AND TACKLE

Tools & tackle, which are essential to facilitate assembly, adjustments, maintenance & dismantling of equipment shall be provided as part of equipment supplied. The above tools shall be supplied along with the initial consignment of equipment so as to be available prior to erection but may not be used for erection purposes.

14.0 AS-BUILT DRAWINGS

Though only supply of equipment is under bidder's scope, bidder may note that all as-built correction (as given by purchaser to vendor) shall have to be incorporated in the originals by the vendor and copies of the as-built corrected drawings / documents as per requirement shall be submitted by the vendor.

15.0 STATUTORY AND REGULATORY REQUIREMENTS

Statutory and regulatory requirements as per IE rule 1956 with amendment-3 rule 1986, rules Nos. 35, 42, 50 & 51 shall be adhered to.

16.0 PACKING:

Refer ANN-III for standard packing specification. However, manufacturer's standard packing method equivalent/superior to as mentioned in Ann-III are also acceptable.



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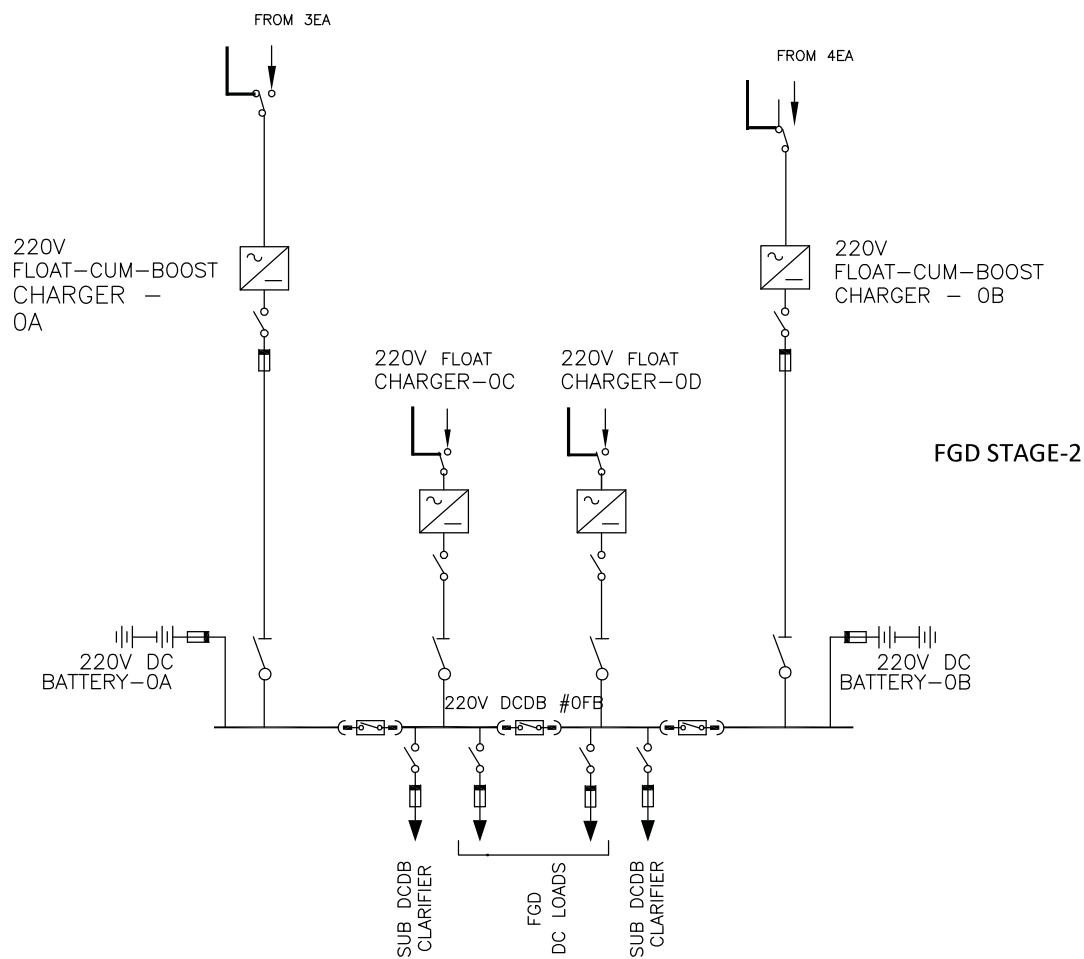
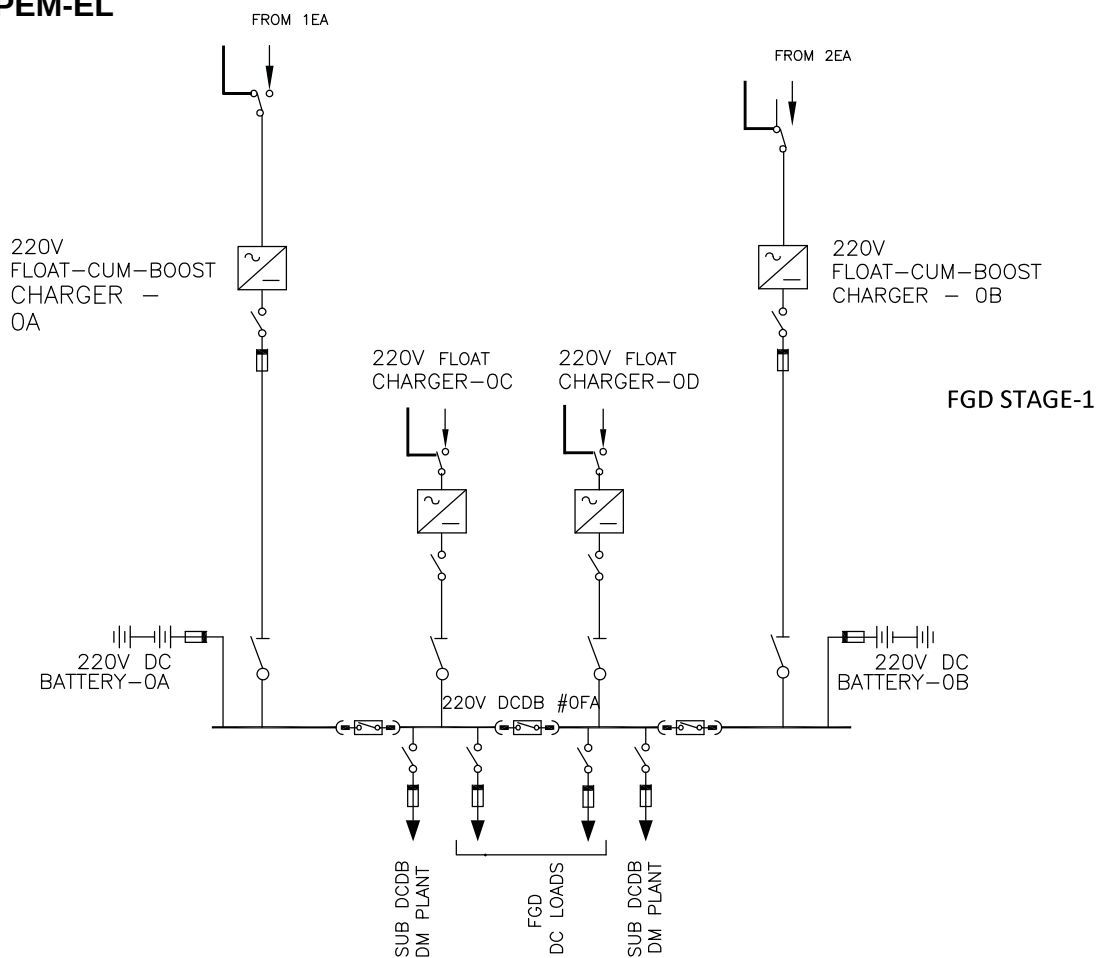
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ANNEXURE-I

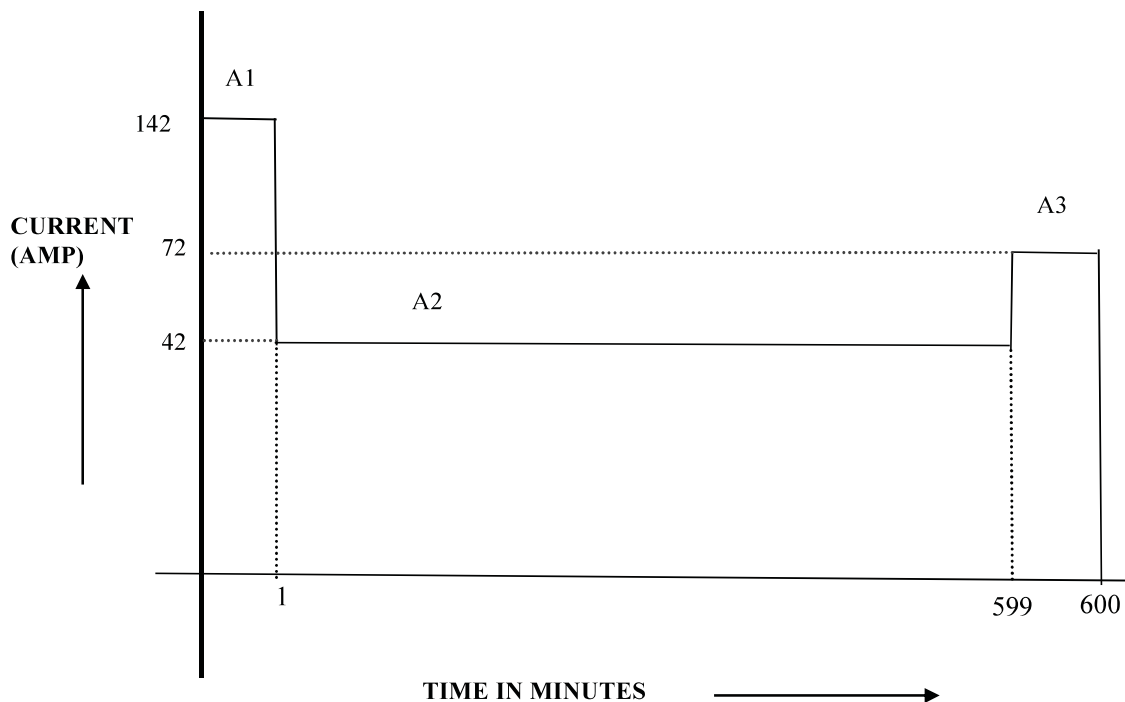
LIST OF APPLICABLE STANDARDS

- | | |
|--|-----------------|
| 1. GUIDE FOR SURGE WITHSTAND CAPABILITY TESTS | ANSI-C 37.90a |
| 2. COLOURS FOR READY MIX PAINTS | IS-5 |
| 3. PVC INSULATED CABLE FOR WORKING VOLTAGE 1100V | IS-694 |
| 4. INDICATING ANALOGUE ELECTRICAL MEASURING INSTRUMENTS | IS-1248 |
| 5. DOP FOR LV SWITCHGEAR AND CONTROL GEAR | IS-13947 PART-1 |
| 6. SPECIFICATION FOR LV SWITCHGEAR AND CONTROL GEAR | IS-13947 |
| 7. ELECTRICAL RELAYS FOR POWER SYSTEM PROTECTION | IS-3231 |
| 8. APPLICATION GUIDE FOR ELECTRICAL RELAYS FOR AC SYSTEM | IS-3842 |
| 9. MONO CRYSTALLINE SEMICONDUCTOR RECTIFIER CELLS & STACKS | IS-3895 |
| 10. MONO CRYSTALLINE SEMICONDUCTOR RECTIFIER ASSEMBLIES & EQUIPMENT | IS-4540 |
| 11. CODE OF PRACTICE FOR PHOSPHATING OF IRON & STEEL | IS-6005 |
| 12. SAFETY CODE FOR SEMICONDUCTOR RECTIFIER EQUIPMENT | IS-6619 |
| 13. CONTROL SWITCHES (SWITCHING DEVICES FOR CONTROL AND AUXILIARY CIRCUITS INCLUDING CONTACTOR RELAYS) FOR VOLTAGE UPTO 1000V AC OR 1200V DC | IS-6875 |
| 14. ENVIRONMENTAL TESTING FOR ELECTRONIC & ELECTRICAL ITEMS | IS-9000 |
| 15. LV FUSE FOR VOLTAGES BELOW 1000V AC OR 1500V DC | IS-13703 |
| 16. PERFORMANCE REQUIREMENT FOR ALARM ANNUNCIATION SYSTEM | EEUA-45D |
| 17. POWER TRANSFORMERS | IS-2026 |
| 18. DRY TYPE TRANSFORMER | IS-11171 |
| 19. INDIAN ELECTRICITY RULES & INDIAN ELECTRICITY ACTS | |

NOTE: Equipment complying to other internationally accepted standards such as IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the bidder shall clearly indicate the standards adopted, furnish a copy in English of the latest revision of the standards along with copy of all official amendments and revisions and shall clearly bring out the salient features for comparison.



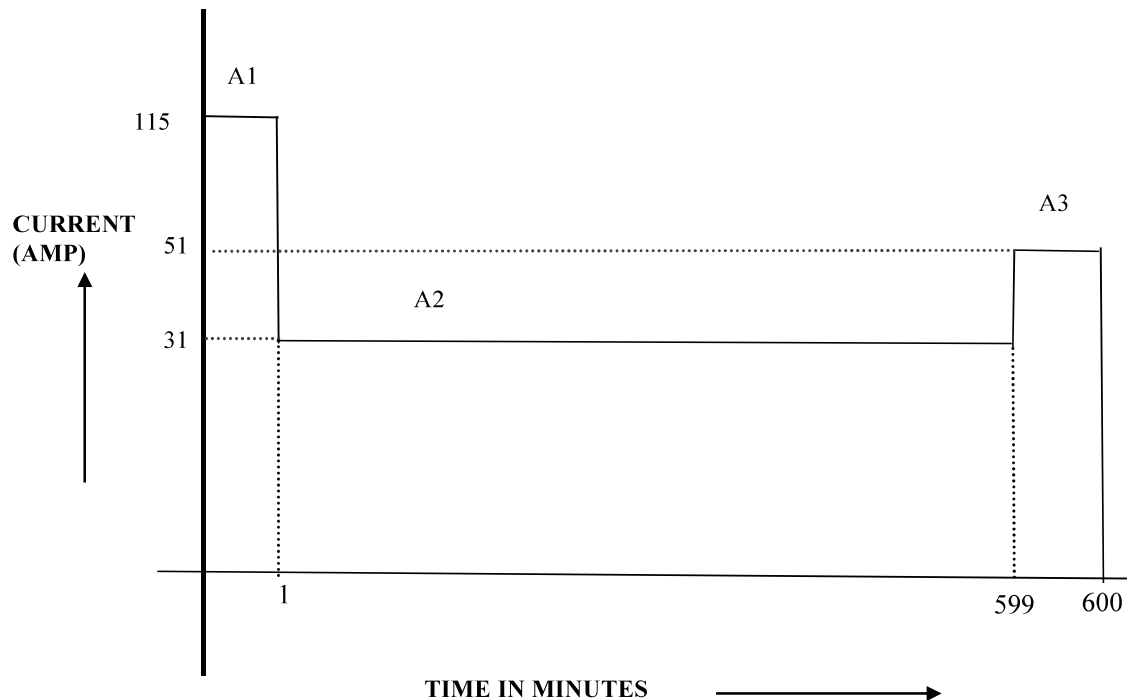
ANNEXURE-III (a)
LOAD DUTY CYCLE - STAGE 1



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|-------------------|
| 1. AGEING FACTOR | : 1.25 |
| 2. MIN.ELECTROLYTIC TEMP. | : 7 °C |
| 3. END CELL VOLTAGE | : 1.80 V PER CELL |
| 4. TEMPERATURE CORRECTION FACTOR | : As per IEEE 485 |
| 5. DESIGN MARGIN | : 20% |
| 6. NO. OF CELLS | : 108 |

ANNEXURE-III (b)

LOAD DUTY CYCLE – STAGE 2**FACTORS TO BE CONSIDERED FOR BATTERY SIZING:**

- | | |
|----------------------------------|-------------------|
| 1. AGEING FACTOR | : 1.25 |
| 2. MIN.ELECTROLYTIC TEMP. | : 7 °C |
| 3. END CELL VOLTAGE | : 1.80 V PER CELL |
| 4. TEMPERATURE CORRECTION FACTOR | : As per IEEE 485 |
| 5. DESIGN MARGIN | : 20% |
| 6. NO. OF CELLS | : 108 |

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ANNEXURE-IV

SUB-VENDOR LIST

ITEM/SERVICE DESCRIPTION	SL NO.	VENDOR CODE	VENDOR NAME	ADDRESS	PHONE	REMARKS
AC CONTACTORS	1	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com	
AC CONTACTORS	2	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
AC CONTACTORS	3	E1144	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	TAKEN OVER BY SCHNEIDER
AC CONTACTORS	4	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
AC CONTACTORS	5	B04	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000	
AC LOAD BREAK SWITCH	1	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
AC LOAD BREAK SWITCH	2	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
AC LOAD BREAK SWITCH	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com	
AC LOAD BREAK SWITCH	4	E1076	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687	
AC LOAD BREAK SWITCH	5	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
AC MCCB	1	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
AC MCCB	2	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
AC MCCB	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com	
AC MCCB	4	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
AC MCCB	5	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
AC MCCB	6	C02	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300	
AIR CIRCUIT BREAKER	1	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
AIR CIRCUIT BREAKER	2	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.com	
AIR CIRCUIT BREAKER	3	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
AIR CIRCUIT BREAKER	4	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
AIR CIRCUIT BREAKER	5	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
AUXILIARY RELAYS	1	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
AUXILIARY RELAYS	2	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
AUXILIARY RELAYS	3	E1075	JYOTI LTD.	JYOTI LIMITED, E&CS DIVISION,3/15, BIDC, GORWA,VADODARA - 390 016, E-MAIL ID: ECS@JYOTI.COM	Ph. No.:+91-265-2281214 , Fax No.:+91-265-2281214	

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AUXILIARY RELAYS	4	E1099	OEN INDIA LTD	29/1479, VYTILLA, COCHIN - 682 019 KERALA, INDIA	Phone : +91 484 2301132, 2303709 Fax : +91 484 2302287, 0124-2842000, 9873424331 amit.bhadauria@siemens. com	
AUXILIARY RELAYS	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens. com	
BIMETAL RELAYS	1	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
BIMETAL RELAYS	2	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
BIMETAL RELAYS	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens. com	
BIMETAL RELAYS	4	E1144	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH II, GURGAON-122002	0124-3940400	TAKEN OVER BY SCHNEIDER
CABLE GLANDS	1	E1201	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Mr. Vijay Mohan Sood +91)-(120)-2525694 +91)-(120)-3052594 +91)-(11)-22287155	
CABLE GLANDS	2	E1017	ARUP ENGG & FOUNDARY WORKS	391/119, PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	033 2473 0850	
CABLE GLANDS	3	E1206	BALIGA LIGHTING EQPT.PVT.LTD.	63A, CP RAMASWAMY ROAD, ALWARPET, P.B.No 6910, CHENNAI-600018	44-24995505, 22680990-4	
CABLE GLANDS	4	E1036	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	91-022-26852961/62/63 comet@vsnl.net	
CABLE GLANDS	5	DW08	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022- 29270876/ 91-22-28324829 / 66919034 devang@electromacgland s.com	
CABLE GLANDS	6	E1044	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	91-33-2480161/62/63/64 Fax : 91-33-2485766	
CABLE GLANDS	7	I01	INCAB	HARE STREET, KOLKATA, WEST BENGAL-700001	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022- 29270876/ 022-29270878	
CABLE LUGS	1	E1040	DOWELLS	47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	033 2282 2540	
CABLE LUGS	2	E1149	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001		
D.C. MCCB	1	C02	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300	
D.C. MCCB	2	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
D.C. MCCB	3	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
D.C. MCCB	4	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens. com	
EARTH LEAKAGE CB	1	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
EARTH LEAKAGE CB	2	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens. com	
EARTH LEAKAGE CB	3	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	

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EARTH LEAKAGE CB	4	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
EARTH LEAKAGE CB	5	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
EARTH LEAKAGE CB	6	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
EARTH LEAKAGE CB	7	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222	
EARTH LEAKAGE CB	8	E1088	MDS SWITCHGEAR LTD	314-317SHAH NAHAR ESTATE	011 - 25793021	
EARTH LEAKAGE CB	9	E1120	S&S POWER SWITCHGEAR LTD,	NEW NO. 67, OLD NO. 19, DR. RANGA ROAD, MYLAPORE, CHENNAI - 600004	044 - 24988056, 044 - 24988057, 044 - 24988058	
DC CONTACTORS	1	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
DC CONTACTORS	2	E1030	BHEL (BHOPAL)	HEAVY ELECTRICAL PLANT		
DC CONTACTORS	3	E1044	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	91-22-28324829 / 66919034 devang@electromacglands.com	
DC CONTACTORS	4	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
DC CONTACTORS	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
DC CONTACTORS	6	E1144	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	TAKEN OVER BY SCHNEIDER
DC CONTACTORS	7	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
CONTROL SWITCHES/ SELECTOR SWITCH	1	E1076	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687	
CONTROL SWITCHES/ SELECTOR SWITCH	2	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
CONTROL SWITCHES/ SELECTOR SWITCH	3	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479000	
CONTROL SWITCHES/ SELECTOR SWITCH	4	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
CONTROL SWITCHES/ SELECTOR SWITCH	5	SRC01	M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213		
CONTROL SWITCHES/ SELECTOR SWITCH	6	RE05	RECOM PVT. LTD.	M/S RECOM PVT. LTD.,16A , 2ND FLOOR A, WING RAJ INDUSTRIAL COMPLEX, MILITARY ROAD , MAROL ANDHERI (EAST),MUMBAI ,MAHARASHTRA STATE : 400059	Mr. Chandrashekar Kamath (MD) : 09820249503	
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	1	E1009	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	2	E1066	INDCOIL	PLOT NO. A- 150/ 151, 23RD U ROAD, WAGLE ESTATE, THANE WEST, CST RD, FRIENDS COLONY, HALLOW PUL, KURLA WEST, MUMBAI, MAHARASHTRA 400070	Phone:022 2583 8305	
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	3	K18	KAPPA ELECTRICALS	KAPPA ELECTRICALS, KAPPA CONSOLIDATED PVT. LTD., 14, CART TRACK ROAD, MADUVANKARAI, CHENNAI - 600 042, INDIA.	PHONE: +91 - 44 - 22454709, 22454516, 22450794, 22450795 FAX: +91 - 44 - 22351662, 22451693 E-MAIL: info@kappaelectricals.co	

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CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	4	E1082	LOGICSTAT	B-160, INDUSTRIAL AREA, C BLOCK RD, OKHLA I, OKHLA INDUSTRIAL AREA, NEW DELHI, DL 110020	011 2681 0032	
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	5	E1106	PRECISE ELECTRICALS	47A-49A,CHAKALA ROAD ANDHERI(E),MUMBAI-99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433	
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	6	E1128	UNILEC ENGINEERS PVT. LTD.	PLOT NO: R-247, T.T.C. INDUSTRIAL AREA, M.I.D.C , RABALE, NAVI MUMBAI- 400 701 INDIA	+91-22- 27607787 / 27607927 +91-22- 27607997	
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	7	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtekelectricals.com, sales@newtekelectricals.com	FOR CONTROL TRANSFORMER ONLY
LT- CURRENT TRANSFORMER	1	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
LT- CURRENT TRANSFORMER	2	E1009	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
LT- CURRENT TRANSFORMER	3	E1066	INDCOIL	PLOT NO. A- 150/ 151, 23RD U ROAD, WAGLE ESTATE, THANE WEST, CST RD, FRIENDS COLONY, HALLOW PUL, KURLA WEST, MUMBAI, MAHARASHTRA 400070	Phone:022 2583 8305	
LT- CURRENT TRANSFORMER	4	K18	KAPPA ELECTRICALS	KAPPA ELECTRICALS, KAPPA CONSOLIDATED PVT. LTD., SOUTHERN ELECTRIKS 14, CART TRACK ROAD, MADUVANKARAI, CHENNAI - 600 042, INDIA.	PHONE: +91 - 44 - 22454709, 22454516, 22450794, 22450795 FAX: +91 - 44 - 22351662, 22451693 E-MAIL: mira@kappaelectricals.co	
LT- CURRENT TRANSFORMER	5	E1104	PRAGATI ELECTRICALS	280/3,II POKHRAN RD	5341779,5427041	
LT- CURRENT TRANSFORMER	6	E1106	PRECISE ELECTRICALS	47A-49A,CHAKALA ROAD ANDHERI(E),MUMBAI-99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433	
LT- CURRENT TRANSFORMER	7	E1128	SILKAANS ELECT.MFG.CO.PVT.LTD	PLOT NO: R-247, T.T.C. INDUSTRIAL AREA, M.I.D.C , RABALE, NAVI MUMBAI- 400 701 INDIA	+91-22- 27607787 / 27607927 +91-22- 27607997	
LT- CURRENT TRANSFORMER	8	E1111	PRAYOG ELECTRICALS PVT. LTD.	GROUND FLOOR, THAKORE INDUSTRIAL COMPUND, STATION ROAD, VIDYA VIHAR (W), NATHANI ROAD , OPP. AMIBIKA TEMPLE,MUMBAI Mumbai - 400086, Maharashtra, India	91-22- 25164288/25133146 Mr. P. U. PATWARDHAN (MANAGING DIRECTOR)	
LT- CURRENT TRANSFORMER	9	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
LT- CURRENT TRANSFORMER	10	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtekelectricals.com, 0124-2842000, 9873424331 amit.bhadauria@siemens.com	
LT- POTENTIAL TRANSFORMER	1	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA		
LT- POTENTIAL TRANSFORMER	2	E1009	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
LT- POTENTIAL TRANSFORMER	3	E1066	INDCOIL	PLOT NO. A- 150/ 151, 23RD U ROAD, WAGLE ESTATE, THANE WEST, CST RD, FRIENDS COLONY, HALLOW PUL, KURLA WEST, MUMBAI, MAHARASHTRA 400070	Phone:022 2583 8305	
LT- POTENTIAL TRANSFORMER	4	K18	KAPPA ELECTRICALS	KAPPA ELECTRICALS, KAPPA CONSOLIDATED PVT. LTD., SOUTHERN ELECTRIKS 14, CART TRACK ROAD, MADUVANKARAI, CHENNAI - 600 042, INDIA.	PHONE: +91 - 44 - 22454709, 22454516, 22450794, 22450795 FAX: +91 - 44 - 22351662, 22451693 E-MAIL: mira@kappaelectricals.co	
LT- POTENTIAL TRANSFORMER	5	E1104	PRAGATI ELECTRICALS	280/3,II POKHRAN RD	5341779,5427041	
LT- POTENTIAL TRANSFORMER	6	E1106	PRECISE ELECTRICALS	47A-49A,CHAKALA ROAD ANDHERI(E),MUMBAI-99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433	

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LT- POTENTIAL TRANSFORMER	7	E1128	SILKAANS ELECT.MFG.CO.PVT.LTD	PLOT NO: R-247, T.T.C. INDUSTRIAL AREA, M.I.D.C , RABALE, NAVI MUMBAI- 400 701	+91-22- 27607787 / 27607927 +91-22- 27607997	
LT- POTENTIAL TRANSFORMER	8	E1111	PRAYOG ELECTRICALS PVT. LTD.	GROUND FLOOR, THAKORE INDUSTRIAL COMPUND, STATION ROAD, VIDYA VIHAR (W), NATHANI ROAD , OPP. AMBIKA TEMPLE,MUMBAI Mumbai - 400086,	91-22- 25164288/25133146 Mr. P. U. PATWARDHAN	
LT- POTENTIAL TRANSFORMER	9	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtelectri	
DC SWITCH	1	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
DC SWITCH	2	E1076	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687	
DC SWITCH	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.	
FUSE BASE	1	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222	
FUSE BASE	2	G01	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
FUSE BASE	3	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
FUSE BASE	4	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
FUSE BASE	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 :amit.bhadauria@siemens	
FUSE BASE	6	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
FUSE BASE	7	S02	SPACEAGE SWITCHGEARS LTD.	68 & 13-A INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD GURGAON, HARYANA-122001	0124-2302711, 4085091	
FUSE BASE	8	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH- II, GURGAON-122002	0124-3940400	
FUSE BASE	9	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
FUSE BASE	10	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
HRC FUSES	1	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222	
HRC FUSES	2	G01	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
HRC FUSES	3	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
HRC FUSES	4	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
HRC FUSES	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 :amit.bhadauria@siemens	
HRC FUSES	6	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
HRC FUSES	7	S02	SPACEAGE SWITCHGEARS LTD.	68 & 13-A INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD GURGAON, HARYANA-122001	0124-2302711, 4085091	
HRC FUSES	8	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH- II, GURGAON-122002	0124-3940400	
HRC FUSES	9	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
HRC FUSES	10	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
INTERPOSING RELAY	1	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
INTERPOSING RELAY	2	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
INTERPOSING RELAY	3	E1075	JYOTI LTD.	JYOTI LIMITED, E&CS DIVISION,3/15, BIDC, GORWA,VADODARA - 390 016, E-MAIL ID: ECS@JYOTI.COM	Ph. No.:+91-265-2281214 , Fax No.:+91-265-2281214	
INTERPOSING RELAY	4	E1099	OEN INDIA LTD	29/1479, VYTILLA, COCHIN - 682 019 KERALA, INDIA	Phone : +91 484 2301132, 2303709 Fax : +91 484 2302287.	

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INTERPOSING RELAY	5	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.	
INDICATING LAMPS	1	B04	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000	
INDICATING LAMPS	2	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	6832259,6918834-37	
INDICATING LAMPS	3	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
INDICATING LAMPS	4	E1153	VAISHNO(HOTLINE SWGR.& CONTROL)	G-19, SECTOR - 11, NOIDA - 201301, UTTAR PRADESH, INDIA	8377805157 9818338922	
INDICATING LAMPS	5	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	9818338922	
INDICATING LAMPS	6	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.	
INDICATING LAMPS	7	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
MCB	1	E1088	MDS SWITCHGEAR LTD	314-317SHAH NAHAR ESTATE	011 - 25793021	
MCB	2	E1068	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222	
MCB	3	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
MCB	4	E1120	S&S POWER SWITCHGEAR LTD,	NEW NO. 67, OLD NO. 19, DR. RANGA ROAD, MYLAPORE, CHENNAI - 600004	044 - 24988056, 044 - 24988057, 044 - 24988058	
PROTECTION - RELAYS (PNUEMATIC)	1	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.	
PROTECTION - RELAYS (PNUEMATIC)	2	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
PROTECTION - RELAYS (PNUEMATIC)	3	A35	GE-MULTILINE, GE INDIA INDUSTRIAL PVT. LTD.	NO. 90- B, ELECTRONICS CITY, HOSUR ROAD, BENGALURU - 560016, KARNATAKA	(080) 41314617, 9945478935	
PROTECTION - RELAYS (PNUEMATIC)	4	SC01	SCHWEITZER ENGG. LAB (SEL)	406, BHIKAJI CAMA BHAVAN, BHIKAJI CAMA PLACE, BHIKAJI CAMA PLACE, MOHAMMADPUR, RK PURAM, NEW DELHI. DL 110066	011 4152 7899	
PROTECTION - RELAYS (PNUEMATIC)	5	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
PROTECTION - RELAYS (PNUEMATIC)	6	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
PROTECTION - RELAYS (PNUEMATIC)	7	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
PROTECTION - RELAYS (PNUEMATIC)	8	C01	AVK-SEG & CONTROLS(I) LTD	C-60,NOIDA PHASE-II	6918834-37	
PROTECTION - RELAYS (NUMERICAL)	1	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.	
PROTECTION - RELAYS (NUMERICAL)	2	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
PROTECTION - RELAYS (NUMERICAL)	3	A35	GE-MULTILINE, GE INDIA INDUSTRIAL PVT. LTD.	NO. 90- B, ELECTRONICS CITY, HOSUR ROAD, BENGALURU - 560016, KARNATAKA	(080) 41314617, 9945478935	
PROTECTION - RELAYS (NUMERICAL)	4	SC01	SCHWEITZER ENGG. LAB (SEL)	406, BHIKAJI CAMA BHAVAN, BHIKAJI CAMA PLACE, BHIKAJI CAMA PLACE, MOHAMMADPUR, RK PURAM, NEW DELHI, DL 110066	011 4152 7899	
TERMINAL BLOCKS	1	C01	WAGO-CONTROLS	C 27, GREATER NOIDA, SECTOR 58, C BLOCK, SECTOR 58, NOIDA, UTTAR PRADESH 201307	0120-2580409/10	
TERMINAL BLOCKS	2	E1038	CONNECT WELL	309A/4, 3RD FLOOR, KALKAJI, OKHLA IND AREA PH-2, GOVINDPURI, NEW DELHI, DL 110019	9811881085 09871419996 011-65908877	
TERMINAL BLOCKS	3	E1047	ELMEX CONTROLS PVT. LTD.	12,G.I.D.C.ESTATE,MUKARPURA ROAD,VADODARA-390010	9374631074	
TERMINAL BLOCKS	4	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
TERMINAL BLOCKS	5	E1142	TECHNOPLAST	OPP.I.M.INTER COLLEGE, BEGUM SARAI KHURD ROAD, AMROHA - 244221, U.P.	PH:- 05922 264006 CELL NO:- 9012676000, 9319520799, 9319582467 TEL:- +912066745000 Awasthi(09971119006) Tel: ++91 20 6674 5103.	
TERMINAL BLOCKS	6	PME-01	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115		

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TERMINAL BLOCKS	7	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
TIMERS - PNEUMATIC	1	B04	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000	
TIMERS - PNEUMATIC	2	G01	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000	
TIMERS - PNEUMATIC	3	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
TIMERS - PNEUMATIC	4	E1144	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	TAKEN OVER BY SCHNEIDER
TIMERS - PNEUMATIC	5	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
TIMERS - PNEUMATIC	6	E01	ELECTRONIC AUTOMATION PVT. LTD.	20, KHB INDUSTRIAL AREA YELAHANKA BANGLORE-560064	080 -28567561 / 080 -28567562 / 080 -42802345	
TIMERS - ELECTRONIC	1	E1050	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060	
TRANSDUCERS	1	E1021	AUTOMATIC ELECTRIC LTD.	ADDRESS : 96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
TRANSDUCERS	2	E1202	SOUTHERN TRANSDUCERS	INTERTECH B-83, FLATTED FACTORY COMPLEX, NEAR MODI MILLS, OKHLA, NEW DELHI-110020	Mr. Gurmohit Singh 011-41020365 / 9891402128	
ENERGY METER (ANALOG)	1	B07	BHEL (EDN)	MYSORE ROAD, BANGALORE-560026	080-26998500	
ENERGY METER (ANALOG)	2	E1129	SIMCO ENGG. LTD	NO. 126, K ROAD, TIRUCHIRAPPALLI -620001, TAMIL NADU	Mr. Madaswamy Muthu +(91)-(431)-4046223 +(91)-(431)-4046210 marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064	
ENERGY METER (ANALOG)	3	R01	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064	
ENERGY METER (ANALOG)	4	E1009	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
ENERGY METER (ANALOG)	5	CON1	CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, UGURGAON 122001 HARYANA, INDIA.	4268899, 9910695701	
ENERGY METER (DIGITAL)	1	CON1	CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, UGURGAON 122001 HARYANA, INDIA.	4268899, 9910695701	
ENERGY METER (DIGITAL)	2	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtekelectri	
AMMETER	1	E1009	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
AMMETER	2	R01	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064	
AMMETER	3	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtekelectri	
VOLTMETER	1	E1009	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482	
VOLTMETER	3	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtekelectri	
MPCB	1	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
MPCB	2	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
MPCB	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens	
MPCB	4	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
MPCB	5	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
MPCB	6	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
MULTIFUNCTION METER	1	CON1	CONZERVE SYSTEMS PVT. LTD./ SCHNEIDER ELECTRIC INDIA PVT.	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, GURGAON 122001 HARYANA, INDIA.	4268899, 9910695701	TAKEN OVER BY SCHNEIDER
MULTIFUNCTION METER	2	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtekelectri	

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RCCB	1	C01	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29	
RCCB	2	S03	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400	
RCCB	3	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadoria@siemens.	
RCCB	4	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
RCCB	5	L01	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59	
RCCB	6	C02	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300	
VAF METER (DIGITAL)	1	NK09	M/s Newtek Electricals	M-90, M.I.D.C, Waluj, Aurangabad 431136, Maharashtra, India	Tel/Fax: +91 240 2551555 E-mail: mkt.north@newtelectri	

MANUFACTURING QUALITY PLAN									
ITEM: 220V & 48V BATTERY CHARGER		QIP NO.: C3/VADADRI/SO/01		PROJECT: YADADRI STIPP (5 X 800 MW)		CUSTOMER: TSGENCO			
SUB-SYSTEM: 400-KV SWITCHYARD		REVISION NO.: 01		DATE: 01-02-2022		CONSULTANT: TATA Consulting Engineers Pvt Ltd			
CLASS		QUANTITY OF CHECK		PAGE: 1 of 12		MATERIAL SUPPLIER: BHFL			
4	TYPE OF CHECK	M	N	6	7	8	ACCEPTANCE NORMS		
							FORMAT OF RECORD	AGENCY	REMARKS
							M	N	

1.0 RAW MATERIAL												
1.1	M.S Sheet (CRCA)	1) Grade	MA	Chemical/ Mechanical	100%			IS-513	Manufacturer's Drg.	Manufacturer's TC	P	-
		2. Thickness & Finish	MA	Physical	1 Sample/ lot	1 Sample/ lot	1 Sample/ lot	Approved drg/ doc	Approved drg/ doc	Inspection Report	V	P
1.2	Powder Paint	Shade	MA	Visual	1 Sample/ lot	1 Sample/ lot		Shade Card (IS-5)	Approved drg/ doc	-do-	P	-
2.0 BOUGHT OUT ITEMS												
2.1	Power Switches, MCCB, Timer, Contactor & Relay	1) Type, Rating 2) Mechanical Operation/ Functional check	MA	Visual	100%	100%	100%	Approved drg/ doc	Approved drg/ doc	Manufacturer's TC	V	V
			MA	Visual	100%			Manufacturer's std.	Manufacturer's std.	-do-	P	V
2.2	MCCB, Push Buttons, HRC fuse, Terminal blocks, control & selector switches, Semiconductor Fuses, Heaters, Thermostat, Lamps, Plug in socket, Exhaust Fans, Heat Sink	1) Type, Rating 2) Continuity test	MA	Visual	100%			Approved drg/ doc	Approved drg/ doc	-do-	P	V
			MA	Electrical	100%			Manufacturer's std.	Manufacturer's std.	-do-	P	V
2.3	Rectifier Bridge Element	1) Type, Rating	MA	Visual	100%	100%	100%	Approved drg/ doc	Approved drg/ doc	Manufacturer's TC	V	P
2.4	Digital Multi-Function Meters	1) Type, Rating 2) Calibration Certificate 3) Routine TC	MA	Visual	100%	100%	100%	Approved drg/ doc	Approved drg/ doc	Manufacturer's TC	V	P
			MA	Visual	100%			-do-	-do-	-do-	V	V
			MA	Electrical	100%	100%	100%	-do-	-do-	-do-	V	V
2.5	PVC Insulated Electric Cable	1) Type, size	MA	Visual	100%		At Random	Approved drg/ doc	Approved drg/ doc	Inspection Report	V	P
										Wires conform to IS 694	V	V

LEGEND: RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.									
M=MANUFACTURER/SUB-SUPPLIER'S TSGENCO/TSGENCO NOMINATED AGENCY									
P=PERFORM WITNESS AND V=VERIFICATION AS APPROPRIATE									
CIP SHALL IDENTIFY IN COLUMN "N" AS "W"									
APPROVAL BY CUSTOMER									

CHIEF ENGINEER
Thermal Projects Construction
TSGENCO, Vijayawada
Khairatabad, Hyderabad - 82.

**Thermal Projects Construction,
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad - 82.**

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MANUFACTURING QUALITY PLAN										PROJECT: YADADRI STPP(5 X 800 MW)			
ITEM: 220V & 48V BATTERY CHARGER										CUSTOMER: TSGENCO			
SUB-SYSTEM: 400KV SWITCHYARD										CONSULTANT: TATA Consulting Engineers Pvt Ltd			
CLASS										DATE: 01-02-2022			
TYPE OF CHECK										PAGE: 4 of 12			
QUANTITY OF CHECK										REFERENCE DOCUMENTS			
M										N			
CLASS										ACCEPTANCE NORMS			
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MANUFACTURING QUALITY PLAN											PROJECT: YADADRI - STPP (5 X 800 MW)			
ITEM: 220V & 48V BATTERY CHARGER											CUSTOMER: TSGENCO			
SUB-SYSTEM: 400KV SWITCHYARD											CONSULTANT: TATA CONSULTING ENGINEERS PVT LTD			
CLASS											REV. NO.: 01			
TYPE OF CHECK											DATE: 01-02-2022			
QUANTUM OF CHECK											PAGE: 5 of 12			
M											REFERENCE DOCUMENTS			
N											ACCEPTANCE NORMS			
4											8			
7											9			
6											10			
5											11			
3											12			
2											13			
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COMPONENTS & OPERATIONS											CHARACTERISTICS			
NO											15			
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3.0											3.1			
IN PROCESS INSPECTION											16			
Enclosure Fabrication											17			
1) Dimensional checks											18			
2) Diagonal (Skewness)											19			
3) Straightness											20			
4) Welded joints											21			
5) Deburring & Finishing of welded joints											22			

MANUFACTURING QUALITY PLAN											
ITEM: 220V & 48V BATTERY CHARGER				PROJECT: YADADRI STPP (5 X 800 MW)				CUSTOMER: TSGENCO			
SUB SYSTEM: 400KV SWITCHYARD				QIP NO.: CP/YADADRI/SYD/01				CONSULTANT: TATA Consulting Engineers Pvt Ltd			
CLASS				DATE: 01-02-2022				MAIN SUPPLIER: BHEL			
TYPE OF CHECK				PAGE: 9 of 11				DOC REF: TSGM MDP YADADRI-BATCHG			
QUANTITY OF CHECK				REFERENCE DOCUMENTS				ACCEPTANCE NORMS			
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5.				7.				9.			
3.				6.				10.			
2.				11.							
1.											
3.1				1) Dimension of Enclosure				MA			
3.2				2) Degreasing				MA			
3.3				3) Water rinsing				MA			
3.4				4) Derusting				MA			
3.5				5) Water rinsing				MA			
3.6				6) Phosphating				MA			
3.7				7) Water rinsing				MA			
3.8				8) Hot-Chromating				MA			
3.9				9) Sealing (if used)				MA			
3.10				1) Shade, Thickness & Finish				MA			
3.11				2) Adhesion check by cross hatch method				MA			
3.12				1) Electronic cards fittings				MA			
3.13				2) Mechanical interlock				MA			
3.14				3) Correctness of electronic components				MA			

LEGEND: RECORDS IDENTIFIED WITH "TICK" WILL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** MANUFACTURER/SUB SUPPLIER NOT TSGENCO/TSGENCO NOMINATED AGENCY

P-PERFORM W/ WITNESS AND V- VERIFICATION AS APPROPRIATE

CHP SHALL IDENTIFY IN COLUMN "N" AS "V"

APPROVAL BY CUSTOMER

CHIEF ENGINEER

Thermal Projects Construction

TSGENCO, Vidyut Soudha,

Khairatabad, Hyderabad - 82.

MANUFACTURING QUALITY PLAN												
ITEM: 220V & 48V BATTERY CHARGER			QIP NO.: C9/YADADRI/STP/01			PROJECT: YADADRI STP(1.5 X 800 MW)						
SUB-SYSTEM: 400kV SWITCHYARD			REVISION NO.: 01			CUSTOMER: TSGENCO						
CLASS			DATE: 01-02-2022			CONSULTANT: TATA Consulting Engineers Pvt Ltd						
TYPE OF CHECK			PAGE: 7 of 12			MAIN SUPPLIER: BHFL						
QUANTITY OF CHECK			REFERENCE DOCUMENTS			DOC REF.: TROM-MOP-YADADRI-BATCHING						
M			N			FORMAT OF AGENCY						
4.			5.			RECORD						
3.			6.			9.						
2.			7.			11.						
3.5	Assembly of Components & Modules	4) Jumpers/ track modification 5) Finish of electronic cards 6) Environmental check on cards to remove cards with infant mortal components	MA	Visual	100%	Random	Manufacturer Drg.	No unplanned jumpers / track modification No dry soldering Manufacturer Std.	-do- -do- -do-	V P P	P - -	V
3.6	Wiring	1) Transformer & choke 2) Mounting of components such as switches, rectifiers, stack fuses, meter & contactor 3) Minimum clearance between busbar 4) Electronic cards location inside the panels 1) Bunching 2) Marking 3) Ferruling	MA	Visual	100%	-	Manufacturer Drg.	Manufacturer Drg. -do- IS-13947 Temp. rise of the location should not exceed 10°C over ambient during heat run test Manufacturer Drg. -do- -do-	In-process insp. report -do- -do- In-process Insp. Report -do- do-	P P P P P P P	- - - - - - -	- - - V - - -

LEGEND : RECORDS IDENTIFIED WITH "TICK" (V) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

•• M: MANUFACTURER/SUB-SUPPLIER TSGENCO/TSGENCO NOMINATED AGENCY

PERFORM W.W.TENESS AND V. VERIFICATION AS APPROPRIATE

CHP SHALL IDENTIFY IN COLUMN "N" AS "W"

APPROVAL BY CUSTOMER

CHIEF ENGINEER

T.ormal Projects Construction

TSGENCO, Vidyut Soudha,

Khairatabad, Hyderabad - 82.

MANUFACTURING QUALITY PLAN									
ITEM: 220V 4 ARV BATTERY CHARGER		UP NO.: CP/VADADR/503/01		PROJECT: VADADRI STPP (5 X 800 MW)		CUSTOMER: TGENCO		CONSULTANT: TATA Consulting Engineers Pvt Ltd	
SUB-SYSTEM: 400KV SWITCHWARD		REVISION NO.: 01		DATE: 01-07-2022		MAIN SUPPLIER: BHEL		DOC REF.: TBOM-ADP-VADADRI-BATCHG	
CLASS		QUANTITY OF CHECK		REFERENCE DOCUMENTS		ACCEPTANCE NORMS		FORMAT OF RECORD	
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3.7		Finishing of Equipment		1) Proper pasting of gasket 2) Earthing busbar		100%		100%	
4.0		FINAL INSPECTION		1) Dimensional & sheet thickness 2) Gen arrangement & Bill of Material (BOM) 3) Aesthetic, skewness, Straightness, Door alignment, Labels etc. 4) Provision of lifting arrangement 5) Proper earthing 6) Gasketing (Check with 1mm wire) 7) Gland plate arrangement 8) Mounting arrangement		100%		100%	
4.1		Overall		1) Dimensional & sheet thickness 2) Gen arrangement & Bill of Material (BOM) 3) Aesthetic, skewness, Straightness, Door alignment, Labels etc. 4) Provision of lifting arrangement 5) Proper earthing 6) Gasketing (Check with 1mm wire) 7) Gland plate arrangement 8) Mounting arrangement		100%		100%	
3.7		Finishing of Equipment		1) Proper pasting of gasket 2) Earthing busbar		100%		100%	
4.0		FINAL INSPECTION		1) Dimensional & sheet thickness 2) Gen arrangement & Bill of Material (BOM) 3) Aesthetic, skewness, Straightness, Door alignment, Labels etc. 4) Provision of lifting arrangement 5) Proper earthing 6) Gasketing (Check with 1mm wire) 7) Gland plate arrangement 8) Mounting arrangement		100%		100%	
4.1		Overall		1) Dimensional & sheet thickness 2) Gen arrangement & Bill of Material (BOM) 3) Aesthetic, skewness, Straightness, Door alignment, Labels etc. 4) Provision of lifting arrangement 5) Proper earthing 6) Gasketing (Check with 1mm wire) 7) Gland plate arrangement 8) Mounting arrangement		100%		100%	

Revision Number / Change Description
in column 10 & 11 (If any change is made)

Signature of the Engineer
Responsible for the Quality Control

LEGEND: RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M MANUFACTURER/SUPPLIER N TGENCO/TSGENCO NOMINATED AGENCY
P PERFORMER WILL NEED AND V VERIFICATION AS APPROPRIATE
CIPD SHALL IDENTIFY IN COLUMN "N" AS "W"

APPROVED BY SUPPLIER
CHIEF ENGINEER

Thermal Projects Construction
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad - 82

MANUFACTURING QUALITY PLAN											
ITEM: 220V & 48V BATTERY CHARGER				QIP NO.: QP/ADAOR/STD/01				PROJECT: YADADRI STPH (5 X 800 MW)			
SUB-SYSTEM: 400KV SWITCHYARD				REVISION NO.: 01				CUSTOMER: TSGENCO			
CLASS				DATE: 01-02-2022				CONSULTANT: TATA Consulting Engineers Pvt Ltd			
TYPE OF CHECK				PAGE: 9 of 12				MAIN SUPPLIER: BHFL			
CHECK				REFERENCE DOCUMENTS				DOX REF.: 130VA-MDP-YADADRI-BATCHIS			
CLASS				ACCEPTANCE NORMS				FORMAT OF AGENCY			
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9) Wiring quality	MA	Visual	100%	Rando m	-do-	-do-	-do-	V	P	W	
10) Paint shade, Adhesion & thickness check	MA	Visual	100%	Rando m	Approved drg/ doc & Shade Card (IS-5)	Approved drg/ doc & Shade Card (IS-5)	-do-	V	P	W	
11) Door Functioning	MA	Operation	100%	Rando m	Approved drg/ doc	Approved drg/ doc	-do-	V	P	W	
12) Mounting & Proper Fixing of components	MA	Visual	100%	Rando m	-do-	-do-	-do-	V	P	W	
13) Smooth operation of Switches, Pushbutton etc.	MA	Operation	100%		-do-	-do-	-do-	V	P	W	
14) Alarm & Protection	CR	Elect	100%		-do-	-do-	-do-	V	P	W	
4.2 Electrical Testing	MA	Electrical	100%	100%	Approved drg/ doc	The panel module shall be subjected to ambient temp of 50deg. C for 48 hours in engirised condition.	Inspection Report	V	P	V	Burn in test to be performed before offering for inspection
2) AVR operation test with input voltage variation of +/- 10%, frequency variation and combined voltage frequency variation.											
a) No Load	MA	Electrical	100%	100%	Approved drg/ doc	Approved drg/ doc	Inspection Report	V	P	W	

Revision: 01/2022 / Disputes: 01/2022 / Project Manager: (01/2022)

LEGEND: RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

•• MANUFACTURER/SUB-SUPPLIER N: TSGENCO/TS GENCO NON NATED AGENCY

P: PERFORM WITHIN 55 AND V: VERIFICATION AS APPROPRIATE

SUP SHALL IDENTIFY IN COLUMNS "4" AND "9"

APPROVAL BY CUSTOMER

CHIEF ENGINEER

Thermal Projects Construction

GENCO, Vidyut Soudha,

Khairatabad, Hyderabad - 82.

MANUFACTURING QUALITY PLAN												PROJECT: YADADRI STPP(5 X 800 MW)			
ITEM: 220V & 48V BATTERY CHARGER												CUSTOMER: TSCENCO			
SUB-SYSTEM: 48V SWITCHWARD												CONSULTANT: TATA CONSULTING ENGINEERS PVT LTD			
CLASS												DATE: 01.02.2022			
TYPE OF CHECK												DOC RFS: TCM WOP YADADRI BATCHG			
QUANTUM OF CHECK												FORMAT OF			
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Realized Engineer / Dispute Settlement

in accordance with (1) Dispute Settlement

(2) Dispute Settlement

Signature

Stamp

LEGEND: RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

•• M: MANUFACTURER/SUB-SUPPLIER NOT TSCENCO/TSCENCO NOMINATED AGENCY

P: PERFORM W/INNESS AND V: VERIFICATION AS APPROPRIATE

CHP SHALL IDENTIFY IN COLUMN "N" AS "W"

APPROVAL BY CUSTOMER

Signature

Stamp

CHIEF ENGINEER

Thermal Projects Construction

TSGENCO, Vidyut Soudha,

Khairatabad, Hyderabad - 82.

PROJECT: YADADRI SIPPI (5 X 800 MW)

CUSTOMER: TSGENCO

CONSULTANT: TATA Consulting Engineers Pvt Ltd

MAIN SUPPLIER: BH&I

DOC REF.: TBCM-MOP-YADADRI-BATCH

FORMAT OF RECORD

REMARKS

ITEM: 220V & 48V BATTERY CHARGER

REV. NO.: 01

DATE: 01-02-2022

PAGE: 11 of 12

REFERENCE DOCUMENTS

ACCEPTANCE NORMS

CLASS

TYPE OF CHECK

QUANTUM OF CHECK

6

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Sl. NO	COMPONENTS & OPERATIONS	CHARACTERISTICS	MA	Electrical	100%	100%	Approved drg/ doc	Functional	Inspection Report	V	P	W
	5) Control circuit & charger status indication test		MA	Electrical	100%	100%		Refer Remarks	-do-	V	P	W
	6) Load Limiter Operation		MA	Electrical	100%	100%	-do-			V	P	W
	7) Dynamic response test		MA	Electrical	100%	100%	Approved drg/ doc (Also Refer Remarks)	Output Voltage should stabilize within 2 sec.	-do-	V	P	W
	8) Input AC current measurement test		MA	Electrical	100%	100%	Approved drg/ doc	Approved drg/ doc	-do-	V	P	W
	9) Insulation Resistance (IR) Test		MA	Electrical	100%	100%	IS-13947	IS-13947	-do-	V	P	W
	10) High Voltage (H.V) Test		MA	Electrical	100%	100%	IS-13947	Charger should be able to withstand 2.5kV for 1 min.	-do-	V	P	W
	11) Efficiency and power factor measurement		MA	Electrical	100%	100%	IS-4540	Approved drg/ doc	-do-	V	P	W

Revision 01/2024 / Dipak Sengupta

By: [Signature]

For: [Signature]

LEGEND: RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION

✓ M: MANUFACTURER / SUB-SUPPLIER / TSGENCO / TSGENCO NUNIMATED AGENCY

P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE

CRP SHALL IDENTIFY IN COLUMN "N" "PS" "W"

APPROVAL BY CUSTOMER

CHIEF ENGINEER

Thermal Projects Construction

TSGENCO, Vidyut Soudha,

Khairatabad, Hyderabad - 82.

MANUFACTURING QUALITY PLAN										
ITEM: 220V & 48V BATTERY CHARGER			PROJECT: YADADRI STPP (5 X 800 MW)							
SUB-SYSTEM: 400KV SWITCHYARD			CUSTOMER: TSGENCO							
CLASS			CONSULTANT: TATA Consulting Engineers Pvt Ltd							
TYPE OF CHECK			MAN SUPPLIER: MHFL							
QUANTITY OF CHECK			DOC REF.: FROM TADP: YADADRI BATCHING							
CLASS			FORMAT OF RECORD							
TYPE OF CHECK			AGENCY							
QUANTITY OF CHECK			REMARKS							
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IEEMA/PVC/BTR-CHRG/2023

Effective from: 1st January 2023

PRICE VARIATION CLAUSE FOR BATTERY CHARGER EQUIPMENT

The price quoted/confirmed is based on the cost of raw materials/components, the wholesale price index numbers and labour cost as on the date of quotation and the same is deemed to be related to prices of raw materials, index numbers for wholesale prices and all India average consumer price index number for industrial workers as specified in the price variation clause given below. In case of any variation in these prices and Index numbers, the price payable shall be subject to adjustment up or down in accordance with the following formulae:

(A) Conventional Battery Charger

$$P = \frac{P_0}{100} \left(12 + 28 \frac{C}{C_0} + 25 \frac{ES}{ES_0} + 8 \frac{AL}{AL_0} + 8 \frac{ER}{ER_0} + 7 \frac{EP}{EP_0} + 12 \frac{W}{W_0} \right)$$

(B) Modular Battery Charger

$$P = \frac{P_0}{100} \left(11 + 15 \frac{C}{C_0} + 17 \frac{ES}{ES_0} + 4 \frac{AL}{AL_0} + 32 \frac{ER}{ER_0} + 8 \frac{EP}{EP_0} + 13 \frac{W}{W_0} \right)$$

(C) Electric Vehicle Charger

$$P = \frac{P_0}{100} \left(11 + 14 \frac{C}{C_0} + 12 \frac{ES}{ES_0} + 2 \frac{AL}{AL_0} + 35 \frac{ER}{ER_0} + 12 \frac{EP}{EP_0} + 14 \frac{W}{W_0} \right)$$

Wherein,

- P = Price payable as adjusted in accordance with the above formula.
 P₀ = Price quoted/confirmed.
 C₀ = Price of CC copper rods (refer notes)
 This price is as applicable for the month, **ONE** month prior to the date of tendering.
 ES₀ = Price of CRGO Electrical Steel Lamination (refer note)
 This price is as applicable for the month, **ONE** month prior to the date of tendering.
 AL₀ = LME CSP Average of Aluminium (refer notes)
 This price is as applicable for the month, **ONE** month prior to the date of tendering.
 ER₀ = IEEMA's Banker's selling rate of exchange between foreign currency prevailing on the Banker's first working day, **ONE** month prior to the date of tendering (refer notes)
 EP₀ = Wholesale Price Index Number (WPI) of Electronic PCB/ Micro Circuits (refer notes)
 This price is as applicable for the month, **THREE** months prior to the date of tendering.

Page 1 of 3



Indian Electrical & Electronics Manufacturer's Association
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 India W www.ieema.org

IEEMA/PVC/BTR-CHRG/2023**Effective from: 1st January 2023**

W_0 = All India average consumer price index number for industrial workers, as published by the Labour Bureau, Ministry of Labour, Govt. of India (Base: 2016 = 100)

This index number is as applicable for the month, **THREE** months prior to the date of tendering.

For example, if the date of tendering falls in June 2023, the applicable price of Copper (C_0), Aluminium (AL_0), CRGO Electrical Steel Lamination (ES_0) and Exchange Rate (ER_0) should be for the month of May 2023, and wholesale price index numbers for 'Electronic PCB/ Micro Circuits' (EP_0) and all India average consumer price index number (W_0) should be for the month of March 2023.

The above prices and indices are as published by IEEMA vide circular reference number IEEMA(PVC)/BTR/(R-1)/_/_ **ONE** month prior to the date of tendering.

C = Price of CC copper rods (refer notes)
 This price is as applicable for the month, **ONE** month prior to the date of delivery.

ES = Price of CRGO Electrical Steel Lamination (refer note)
 This price is as applicable for the month, **ONE** month prior to the date of delivery.

AL = LME CSP Average of Aluminium (refer notes)
 This price is as applicable for the month, **ONE** month prior to the date of delivery.

ER = IEEMA's Banker's selling rate of exchange between foreign currency prevailing on the Banker's first working day, **TWO** month prior to the date of delivery (refer note)

EP = Wholesale Price Index Number (WPI) of Electronic PCB/ Micro Circuits
 This price is as applicable for the month, **THREE** months prior to the delivery (refer note)

W = All India average consumer price index number for industrial workers, as published by the Labour Bureau, Ministry of Labour, Govt. of India (Base: 2016 = 100)

This index number is as applicable for the month, **THREE** months prior to the date of tendering.

For example, if the date of delivery falls in August 2023, the applicable price of Copper (C), Aluminium (AL) and CRGO Electrical Steel Lamination (ES) should be for the month of Jul 2023 and Exchange Rate (ER) should be for the month of Jun 2023, and wholesale price index numbers for 'Electronic PCB/ Micro Circuits' (EP) and all India average consumer price index number (W) should be for the month of May 2023.



BOQ - STAGE 1
5X800 MW YADADARI TPS : BATTERY CHARGER FOR FGD & OFFSITE AREAS
Refer Technical spec No. PE-TS-417-508-E002B

S. No.	Item code	Item Description	Unit	Quantity	Unit Ex-Works price (Rs.)	Total Ex-Works price (Rs.)	Freight Charges (...% on Quoted Ex-works) Rs.	GST@.....% (on Total Quoted Ex-works + Freight Charges (if applicable)) Rs.	TOTAL FOR Site Price (Rs.)
1	508-12010-A	220V FLOAT-CUM-BOOST CHARGER, 220V DC, 170A	NOS	2					
2	508-12007-A	220V FLOAT CHARGER, 220V DC, 60A	NOS	2					
3	508-12930-A	BATTERY FUSE BOX	NOS	4					
4	508-12027-A	PORTABLE SINGLE CELL BOOST CHARGER, 220V DC, 165A	NOS	1					
5	508-12005-A	DISCHARGE RESISTOR	NOS	2					
6	508-12006-A	E & C SPARES							
6.1		E & C SPARES FOR FLOAT CUM BOOST CHARGER	SET	8					
6.1.1		FUSE LINK WITHOUT HOLDER							
a		AC I/P HRC FUSE LINK	NOS	8					
b		GLASS FUSE	NOS	8					
c		CONTROL HRC FUSE LINK	NOS	8					
d		RECTIFIER FUSE LINK	NOS	8					
e		FILTER CAPACITOR FUSE LINK	NOS	8					
f		DC O/P FUSE LINK	NOS	8					
6.1.2		INDICATING LAMP							
a		AC I/P LAMP RED COLOR	NOS	8					
b		AC I/P LAMP YELLOW COLOR	NOS	8					
c		AC I/P LAMP BLUE COLOR	NOS	8					
d		DC O/P LAMP	NOS	8					
7	508-12020-A	SUPERVISION OF E&C (Including Tests on all battery chargers to be carried out at Site on completion of E & C and immediately prior to putting in service)							
7.1		LUMP SUM CHARGES PER VISIT FOR ENGINEER (EXCEPT DAILY CHARGES)	VISIT	2			NA		
7.2		LUMP SUM DAILY CHARGES FOR ENGINEER	DAYS	10			NA		
8	508-12000-B	MANDATORY SPARES							
8.1		MANDATORY SPARES FOR FLOAT CUM BOOST CHARGER (STAGE-1) AT BOQ S. NO. 1	SET	1					
a		FUSE & FUSE LINKS	SET 1 SET refers to 100% of total quantity for each type & rating of fuses used in the system	2					
b		ELECTRONIC MODULE / PCB / CARD	NOS (of each type used in the system)	2					
c		SCR OF EACH TYPE AND RATING	NOS	8					
d		BLOCKING DIODE OF EACH TYPE AND RATING	NOS	8					
e		AUX TRANSFORMER (CONTROL TRF)	SET	4					
f		INDICATING LAMP	NOS	10					
8.2		OPTIONAL ITEMS							
a		MICRO CONTROLLER	NOS	1					
b		FUSE (HSR)	NOS	1					
c		RELAY BOARD	NOS	1					
d		DC CONTACTOR	NOS	1					

NOTES :

- 1) AMOUNT PAYABLE FOR ENGINEER PER VISIT TO SITE = VISIT CHARGES AS PER SL. NO. 7.1 ABOVE + (DAILY CHARGES AS PER SL. NO. 7.2 ABOVE X NO. OF DAYS AT SITE) (TO BE CERTIFIED BY BHEL SITE).
- 2) THE VISIT CHARGES SHALL BE INCLUSIVE OF CHARGES OF AIR FARE/TRAIN FARE , BOARDING/LODGING, LOCAL CONVEYANCE, MEDICAL , INSURANCE ETC.
- 3) SITE VISIT CHARGES SHALL BE APPLICABLE FOR ANY VISIT MADE BY VENDOR AT SITE AFTER RECEIVING THE INSTRUCTION FROM BHEL FOR DEPUTATION OF VENDOR REPRESENTATIVE. THE VISIT CAN BE CALLED FOR SUPERVISION OF COMMISSIONING & TESTING ETC.
- 4) ALL CABLE GLANDS & LUGS AT CHARGER, FUSE BOX & DISCHARGE RESISTOR END ARE IN BIDDER'S SCOPE.
- 5) OPTIONAL ITEMS SHALL NOT BE CONSIDERED FOR PRICE BID EVALUATION.

BOQ - STAGE 2
5X800 MW YADADARI TPS : BATTERY CHARGER FOR FGD & OFFSITE AREAS
Refer Technical spec No. PE-TS-417-508-E002B

S. No.	Item code	Item Description	Unit	Quantity	Unit Ex-Works price (Rs.)	Total Ex-Works price (Rs.)	Freight Charges (...% on Quoted Ex-works) Rs.	GST@.....% (on Total Quoted Ex-works + Freight Charges (if applicable)) Rs.	TOTAL FOR Site Price (Rs.)
1	508-12011-A	220V FLOAT-CUM-BOOST CHARGER, 220V DC, 130A	NOS	2					
2	508-12008-A	220V FLOAT CHARGER, 220V DC, 50A	NOS	2					
3	508-12001-A	BATTERY FUSE BOX	NOS	4					
4	508-12028-A	PORTABLE SINGLE CELL BOOST CHARGER, 220V DC, 125A	NOS	1					
5	508-12005-A	DISCHARGE RESISTOR	NOS	2					
6	508-12006-A	E & C SPARES							
6.1		E & C SPARES FOR FLOAT CUM BOOST CHARGER	SET	8					
6.1.1		FUSE LINK WITHOUT HOLDER							
a		AC I/P HRC FUSE LINK	NOS	8					
b		GLASS FUSE	NOS	8					
c		CONTROL HRC FUSE LINK	NOS	8					
d		RECTIFIER FUSE LINK	NOS	8					
e		FILTER CAPACITOR FUSE LINK	NOS	8					
f		DC O/P FUSE LINK	NOS	8					
6.1.2		INDICATING LAMP							
a		AC I/P LAMP RED COLOR	NOS	8					
b		AC I/P LAMP YELLOW COLOR	NOS	8					
c		AC I/P LAMP BLUE COLOR	NOS	8					
d		DC O/P LAMP	NOS	8					
7	508-12020-A	SUPERVISION OF E&C (Including Tests on all battery chargers to be carried out at Site on completion of E & C and immediately prior to putting in service)							
7.1		LUMP SUM CHARGES PER VISIT FOR ENGINEER (EXCEPT DAILY CHARGES)	VISIT	2			NA		
7.2		LUMP SUM DAILY CHARGES FOR ENGINEER	DAYS	10			NA		
8	508-12000-B	MANDATORY SPARES							
8.1		MANDATORY SPARES FOR FLOAT CUM BOOST CHARGER (STAGE-2) AT BOQ S. NO. 1	SET	1					
a		FUSE & FUSE LINKS	SET 1 SET refers to 100% of total quantity for each type & rating of fuses used in the system	2					
b		ELECTRONIC MODULE / PCB / CARD	NOS (of each type used in the system)	2					
c		SCR OF EACH TYPE AND RATING	NOS	8					
d		BLOCKING DIODE OF EACH TYPE AND RATING	NOS	8					
e		AUX TRANSFORMER (CONTROL TRF)	SET	4					
f		INDICATING LAMP	NOS	10					
8.2		OPTIONAL ITEMS							
a		MICRO CONTROLLER	NOS	1					
b		FUSE (HSR)	NOS	1					
c		RELAY BOARD	NOS	1					
d		DC CONTACTOR	NOS	1					

NOTES :

- 1) AMOUNT PAYABLE FOR ENGINEER PER VISIT TO SITE = VISIT CHARGES AS PER SL. NO. 7.1 ABOVE + (DAILY CHARGES AS PER SL. NO. 7.2 ABOVE X NO. OF DAYS AT SITE) (TO BE CERTIFIED BY BHEL SITE).
- 2) THE VISIT CHARGES SHALL BE INCLUSIVE OF CHARGES OF AIR FARE/TRAIN FARE , BOARDING/LODGING, LOCAL CONVEYANCE, MEDICAL , INSURANCE ETC.
- 3) SITE VISIT CHARGES SHALL BE APPLICABLE FOR ANY VISIT MADE BY VENDOR AT SITE AFTER RECEIVING THE INSTRUCTION FROM BHEL FOR DEPUTATION OF VENDOR REPRESENTATIVE. THE VISIT CAN BE CALLED FOR SUPERVISION OF COMMISSIONING & TESTING ETC.
- 4) ALL CABLE GLANDS & LUGS AT CHARGER, FUSE BOX & DISCHARGE RESISTOR END ARE IN BIDDER'S SCOPE.
- 5) OPTIONAL ITEMS SHALL NOT BE CONSIDERED FOR PRICE BID EVALUATION.