

**3 X 660 MW NTPC NABINAGAR (NPGCPL) FGD PACKAGE,
4 X 250 MW NTPC NABINAGAR (BRBCL) FGD PACKAGE,
NTPC KORBA FGD PACKAGE,
NTPC RAMAGUNDAM FGD PACKAGE,
2 X 250 MW NTPC NSPCL BHILAI FGD PACKAGE**

VOLUME – II

**TECHNICAL SPECIFICATION FOR
*220V DC BATTERY CHARGER***

SPECIFICATION NO: *PE-TS-457-508-E002*



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

	DOCUMENT TITLE		SPECIFICATION NO. PE-TS- 457-508-E002
	TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER		VOLUME II
			SECTION I
			REVISION 0 DATE: 24.09.2020
	SHEET 1 of 1		

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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



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER

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VOLUME II

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SECTION –I

SPECIFIC TECHNICAL REQUIREMENTS

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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	Section II clause 11.9	All routine & acceptance test to be performed as per QAP NO 0000-999-QOE-S-005.Charges for carrying out these routine & acceptance tests are deemed to be included in the charger price.

4.0 TYPE TEST

- 4.1 Successful bidder shall submit the reports of all the type tests as listed in this specification and carried out within last ten years from the date as given below for various projects:

- 1) 3 X 660 MW NTPC NABINAGAR (NPGCL) FGD PACKAGE: 22.12.2017
- 2) 4 X 250 MW NTPC NABINAGAR (BRBCL) FGD PACKAGE: 22.12.2017
- 3) NTPC KORBA FGD PACKAGE: 14.02.2019
- 4) NTPC RAMAGUNDAM FGD PACKAGE: 14.02.2019
- 5) 2 X 250 MW NTPC NSPCL BHILAI FGD PACKAGE: 04.12.2018

These reports should be for the test conducted on the equipment similar (same rating of battery charger) to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent lab or should have witnessed by a client.

5.0 DRAWINGS REQUIRED ALONG WITH TECHNICAL OFFER

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

84904/2020/PS-PEM-EL



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6.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED AFTER PLACEMENT OF ORDER

Schedule of drawing & documents to be submitted is part of **NIT**

**ANNEXURE-A**

**LOT-3 PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(3)-9**

NTPC-FCM-EE		CLAUSE NO.		TECHNICAL REQUIREMENTS			
				BATTERY CHARGER			
1.00.00		CODES AND STANDARDS					
1.01.00		All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of techno-commercial bid. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards and codes.					
		ANSI-C 37.90a		Guide for surge withstand capability tests			
		IS:5		Colours for ready mix paints.			
		IS : 694		PVC Insulated Cable for working voltages upto and including 1100 V.			
		IS : 1248		Specification for Direct acting indicating analogue electrical measuring instruments.			
		IS:13947 Part-1		Degree of protection provided by enclosures for low voltage switch gear and control gear.			
		IS : 13947		Specification for low voltage switch gear and control gear			
		IS : 3231		Electrical relays for power system protection.			
		IS : 3842		Application guide for Electrical relays for AC System			
		IS : 3895		Mono-crystalline semi-conductor Rectifier Cells and Stacks			
		IS : 4540		Mono crystalline semi-conductor Rectifier assemblies and equipment.			
		IS:6005		Code of practice for phosphating of Iron and Steel.			
		IS:6619		Safety Code for Semi-conductor Rectifier Equipment.			
		IS:6875		Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto 1000 V AC or 1200 V DC.			
		IS : 9000		Basic environmental testing procedures for electronic and electrical items.			
		IS:13703		Low voltage fuses for voltages not exceeding 1000 V AC or 1500 V DC.			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9		SUB-SECTION II-E-17 BATTERY CHARGER		PAGE 1 OF 13	

CLAUSE NO.		TECHNICAL REQUIREMENTS		एन टी पी सी NTPC	
1.02.00	EEUA-45D	Performance requirements for electrical Alarm Annunciation System			
		Indian Electricity Rules			
		Indian Electricity Act.			
	Equipment complying with 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 standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.				
2.00.00	EQUIPMENT DESCRIPTION				
2.01.00	PART-I BATTERY CHARGER FOR LEAD ACID PLANTE TYPE BATTERY				
	(a.) The Battery Chargers as well as their automatic regulators shall be of static type. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC lead-acid Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 2.25 Volts per cell. All chargers shall also be capable of Boost Charging the associated D.C. Battery at 2.3 to 2.7 Volts per cell at the desired rate. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C. (b.) All Battery Chargers shall have provision to receive two input supplies along with suitable automatic changeover between the sources. (c.) Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging. (d.) All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means 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. (e.) Soft start feature shall be provided to build up the voltage to the set value slowly within fifteen 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				
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NTPS-PPM-EL	CLAUSE NO.	TECHNICAL REQUIREMENTS	एन टी पी सी NTPC
		characteristic shall be such that any sustained overload or short circuit in DC system shall neither 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. (f.) When on automatic control mode during Trickle charging, the Charger output voltage shall remain within +/-1% of the set value for AC input voltage variation of +/-10%, frequency variation of +3/-5%, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and step-less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations(w.r.t. temperature) as suggested by the respective battery manufacturer. Step-less adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode. (g.) During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type. (h.) Energizing the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilize, to within the specified limits as mentioned elsewhere, shall be less than fifteen seconds. (i.) 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. (j.) The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit setting device for	
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9	SUB-SECTION II-E-17 BATTERY CHARGER	PAGE 3 OF 13

I/P-S-P/E-M-E-L		CLAUSE NO.		TECHNICAL REQUIREMENTS			
2.02.00		Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device. (k.) 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, even when they are not connected to a battery. (l.) The DC System shall be ungrounded and float with respect to the ground potential when healthy.					
		PART-II BATTERY CHARGER FOR NICKEL-CADMIUM TYPE BATTERY (a.) The Battery Chargers as well as their automatic regulators shall be of static type. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC Nickel-Cadmium Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 1.4 to 1.42 Volts per cell. All chargers shall be capable of Boost Charging the associated D.C. Battery at 1.53 to 1.7 Volts per cell at the desired rate. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C. (b.) All Battery Chargers shall have provision to receive two input supplies along with suitable automatic changeover between the sources. (c.) Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging. (d.) All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means 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. (e.) Soft start features shall be provided to build up the voltage to the set value slowly within fifteen 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.					
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I/P S-P E M-E L	CLAUSE NO.	TECHNICAL REQUIREMENTS		
		(f.) When on automatic control mode during Trickle charging, the Charger output voltage shall remain within +/-1% of the set value for AC input voltage variation of +/-10%, frequency variation of +3 to -5%, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and stepless adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations(w.r.t. temperature) as suggested by the respective battery manufacturer. Stepless adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode. (g.) During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type. (h.) Energising the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilise, to within the specified limits as mentioned elsewhere shall be less than fifteen seconds. (i.) 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. (j.) The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit setting device for Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device. (k.) 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, even when they are not connected to a battery.		
	LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9	SUB-SECTION II-E-17 BATTERY CHARGER	PAGE 5 OF 13

I/PS-PEM-EL		CLAUSE NO.		TECHNICAL REQUIREMENTS			
		2.03.00		(I.) The DC System shall be ungrounded and float with respect to the ground potential when healthy.			
		2.04.00		Printed Circuits Boards (PCB)			
		2.05.00		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 the PCBs shall be plated with hard gold to a minimum thickness of 5 microns. Component identification shall be printed on PCB by silk screen method. All PCBs shall be tropicalised and masked.			
		2.06.00		CONTACTORS			
		2.07.00		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 Volts AC.			
		2.08.00		Thermal Overload Relay			
		2.09.00		A thermal overload relay incorporating a distinct single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input. The relay shall trip the above contactor.			
		2.10.00		Rectifier-Transformers and Chokes			
		2.11.00		The rectifier transformer and chokes shall be dry and air cooled (AN) type. The rating of the rectifier-transformers and chokes shall correspond to the rating of the associated rectifier assembly. The rectifier-transformers and chokes shall have class-F insulation with temperature rise limited to class-B insulation value.			
		2.12.00		Rectifier Assembly			
		2.13.00		The rectifier assembly shall be full wave bridge type 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 up to 400A rating chargers. However, the rectifier cells shall be provided with their own heat dissipation arrangement along with forced air cooling for above 400A rating chargers and fan shall be temperature controlled with 100% standby redundancy. The rectifier shall utilise diodes/thyristors and heat sinks rated 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. The Contractor shall submit 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 assuming air ambient temperature of 50°C outside the panel. Necessary surge protection devices and rectifier type fast acting fuses shall be provided in each arm of the rectifier connections.			
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NTPC-FCM-EL		NTPC	
CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.08.00	DIGITAL INDICATING INSTRUMENTS Digital indicating instruments with built in communication port for remote data transfer shall be provided for all chargers. The instruments shall indicate DC current, DC voltage & AC voltage and instrument shall be 96 x 96 mm², with display accuracy 0.5%, 4 digit-7 segment LED/LCD display and RS 485 Serial Bus port.		
2.09.00	AIR BREAK SWITCHES All Chargers shall have AC input and DC output switches of air break, single throw, load break and fault make type. The contacts of the switches shall open and close with a snap action. Switches shall be rated for 120% of the maximum continuous load. 'ON' & 'OFF' position of the switch shall be clearly indicated.		
2.10.00	CONTROL AND SELECTOR SWITCHES Control and selector switches shall be of rotary stayput type with escutcheon plates showing the functions and positions. The switches shall be of sturdy construction and suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred. The contact ratings shall be atleast the following: (a.) Make and carry continuously – 10 Amps. (b.) Breaking current at 220 V DC – 0.5 Amp. (inductive) (c.) Breaking current at 240 V AC – 5 Amp. At 0.3 p.f.		
2.11.00	FUSES Fuses shall be of HRC cartridge fuse link type. Fuses shall be mounted on fuse carriers which are mounted on fuse bases. 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 D.C. fuses.		
2.12.00	Indicating Lamps Three (3) indicating lamps shall be provided to indicate A.C. supply availability. The indicating lamp shall be of panel mounting, filament type low wattage or LEDs and capable of clear status indication under the normal room illumination. The lamps shall be provided with series resistors (non-hygroscopic) preferably built in the lamp assembly and replaceable from front. The lamp covers shall be preferably screwed type, unbreakable and moulded from heat resistant material		
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I/PS-PEM-EL		TECHNICAL REQUIREMENTS			
2.13.00	Blocking Diode Blocking diode shall be provided in the output circuit of each Charger to prevent current flow from the D.C. Battery into the Charger.				
2.14.00	Annunciation System Visual indications through indicating lamps/LEDs or annunciation fascia shall be provided in all Chargers for the following: (a.) A.C. supply failure (b.) Rectifier fuse failure (c.) Surge circuit fuse failure (d.) Filter fuse failure (e.) Load limiter operated (f.) Charger trip (g.) Battery on Boost Potential free NO contacts of all above conditions shall be provided for following remote alarms in the PLC/DCS: (a) Battery on Boost (b) Charger trouble (this being a group alarm initiated by any of the faults other than 'Battery on Boost')				
2.15.00	Name Plates 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 equipments.				
3.00.00	CONSTRUCTION				
3.01.00	The Chargers shall be indoor, floor mounted, self supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Charger shall be fabricated using cold rolled sheet steel shall not less than 1.6 mm and shall				
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NTPS-PEM-EL		CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
3.02.00	have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the Contractor. The lugs for cables shall be made of electrolytic copper with tin coat. Cable sizes shall be advised to the Contractor at a later date for provision of suitable lugs and gland plates. The Charger shall be tropicalised and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with synthetic rubber gaskets. The Chargers shall have hinged double leaf doors provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed. The degree of protection of Charger enclosure shall be atleast IP-42.						
	All indicating instruments, control & selector switches and indicating lamps shall be mounted on the front side of the Charger. Design of panels shall be based on the following dimensions.						
	1)	Overall height	-	Maximum 2350 mm			
	2)	Operating handles	-	Maximum 1800 mm			
		(highest and lowest positions reached by operator's hands), protective mechanical indicators		Minimum 350 mm			
3.03.00	3)	Doors and panel	-	Maximum 1800 mm			
		handles and locks		Minimum 300 mm			
3.04.00	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, will exceed 10°C over ambient air temperature outside the Charger.						
3.04.00	Each Charger panel shall be provided with an illuminating lamp and one 5 Amp. Socket. Switches and fuses shall be provided separately for each of the above.						
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NTPS-PEM-EL	CLAUSE NO.	TECHNICAL REQUIREMENTS	एन टी पी सी NTPC
3.05.00		Locking facilities shall be provided as following: 1. For locking Trickle/Boost selector switch in the respective position. 2. The Charger enclosure door locking requirements 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.	
3.06.00		Wiring	
3.06.01		Each Charger shall be furnished completely wired upto power cable lugs and terminal blocks ready for external connection. The power wiring shall be carried out with 1.1 KV grade PVC insulated cables conforming to IS:1554 (Part-I). The control wiring shall be of 1.1KV grade PVC insulated stranded copper conductors of 2.5 sq.mm. conforming to IS:694. Control wiring terminating at electronic cards shall not be less than 1.0 sq. mm. Control terminal shall be suitable for connecting two wires with 2.5 sq.mm. stranded copper conductors. All terminals shall be numbered for ease of connections and identification. At least 20% spare terminals shall be provided for circuits.	
3.06.02		Power and control wiring within panels shall be kept separate. Any terminal or metal work which remains alive at greater than 415 V, when panel door is opened, shall be fully protected by shrouding.	
3.06.03		An air clearance of at least ten (10) mm 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 should be insulated or shrouded.	
3.07.00		PAINTING Treatment as per IS:6005. Two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers & RAL 5012 for end covers.	
4.00.00		TESTS	Refer Section-I, Clause 4.1 of this specification for dates to be considered.
4.01.00		All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of techno-commercial bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.	
4.02.00		However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of techno-commercial bid opening, or in the case of type test	
		Refer Section-I, Clause 4.1 of this specification for dates to be considered.	
	LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9	SUB-SECTION II-E-17 BATTERY CHARGER
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	report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.			
4.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.			
4.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design change". Minor changes if any shall be highlighted on the endorsement sheet.			
4.05.00	GENERAL The contractor shall conduct/ furnish the following Routine tests/ Type test reports for each rating of the equipment to be supplied under this contract. For details of Type/ Routine tests, refer QP no. 0000-999-QOE-S-005. 1. a) Complete physical examination b) Temperature rise test at full load. (For chargers of up to 400A rating, Temperature rise test report for rectifier assembly at 200% of full load shall also be submitted.) Please refer clause 6.1 of section-II for clarification c) Insulation resistance test. d) High voltage (power frequency) test on power and control circuits except low voltage electronic circuits. e) Ripple content test at i) No load ii) Half load iii) Full load f) Automatic voltage regulator operation test at specified A.C. supply variations at i) No load ii) Half load iii) Full load			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9		SUB-SECTION II-E-17 BATTERY CHARGER
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		g) Load limiter operation test h) Efficiency and power factor measurement. i) Surge withstand capability test at the following points of the Charger: i) Across each A.C. input phase ii) Across AC input line to ground. iii) Across D.C. output terminals. iv) Across each D.C. output terminal to ground The Charger shall not exhibit any component damage and there shall be no change in performance as per (g) and (h). j) Environmental Tests Steady state performance tests (f) and (g) shall be carried out before and after each of the following tests. i) Soak Test The electronic modules shall be subjected to continuous operation for a minimum period of 72 hours. During last 48 hours, the ambient temperature shall be maintained at 50 deg. C. The 48 hour test period shall be divided into four 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. ii) Degree of protection test. 2. Dynamic response test and Temperature rise test at full load shall be carried out on each charger before dispatch at manufacturer's works.	
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9	SUB-SECTION II-E-17 BATTERY CHARGER	PAGE 12 OF 13

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LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(3)-9		SUB-SECTION II-E-17 BATTERY CHARGER		PAGE 13 OF 13

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.

PACKING SPECIFICATION FOR BATTERY CHARGER**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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DATASHEET-A

Sr. No.	PARAMETER	UNIT	VALUE
1.0	Power Supply & fault level details		
1.1	Rated AC voltage & variation	V, %	415 V, 3Ph, 3 Wire Systems, (-) 10% to (+) 10%
1.2	Frequency & variation	Hz, %	50 Hz, +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 up to (max)	kA	The Charger shall be designed to restrict maximum fault level on DCDB limited to 25kA for 1 Sec.
1.6	Type/ Capacity of battery (min.)	AH	(i) 90 AH Ni-Cd battery (ii) 150 AH Lead acid battery * Refer Note 3 below
2.0	Charger current rating		
2.1	Float-cum-boost charger	A	(i) 50A (ii) 50A
3.0	Type of cooling		Natural air 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	1.6mm Cold rolled sheet steel for panel fabrication with folded type construction and 2.0mm Cold rolled sheet steel for panel frame.
6.2	Paint shade		Treatment as per IS 6005. Two coats of lead oxide primer followed by powder painting with final shade of RAL 9002 for complete panel except end covers & RAL 5012 for end covers.



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6.3	Cable gland plate thickness/ material	mm	3 mm / Sheet steel
6.4	Gasket thickness/ material	mm	3 mm / Rubber
6.5	CABLE SIZES a) Cable size from Battery TB to Fuse Box b) Cable size from Fuse Box to DCDB c) Cable size from Charger to DCDB d) Cable Size for FCB 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 –I/ Quality plan. Heat Run test to be conducted on one 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 fuse box		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	As per BOQ cum price schedule enclosed with NIT
9.2	If yes, list of mandatory spares		As per BOQ cum price schedule enclosed with NIT
10.0	E & C Spares		
10.1	E & C Spares to be quoted for this contract	Yes/ No	Yes
10.2	If yes, list of E & C Spares		As per NIT (BOQ cum Price Schedule)
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 the list.
12.0	Battery Fuse Box		Fuses for both Positive and Negative Pole shall be provided. Also Construction shall be same as Charger Panel. Battery Fuse Box shall be wall-mounted type. Minimum rating of Battery Fuse Box shall be as indicated in the BOQ cum price schedule.

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13.0	Discharge Resistor Panel	a) Portable type 90AH NI-CD battery discharge resistor panels shall be supplied with shunt suitable for 5 hrs discharge rate OR Portable type 150AH Lead acid battery discharge resistor panels shall be supplied with shunt suitable for 10 hrs discharge rate . b) Cooling of discharge resistor shall be natural/ forced air cooled. DOP for load bank, shall be at least IP 20. 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.
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Notes:

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

2) All tests as per QP No. : 0000-999-QOE-S-005 to be carried out.

3) 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 REQUIREMENTS

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1.0 INTENT OF SPECIFICATION

The intent of specification is not to specify all details of design & construction of material. The material shall, however, conform in all aspects to high standard of design, engineering and workmanship and be capable of performing in continuous operation up to & after bidder's guarantee period in manner acceptable to purchaser who will interpret the drawings & specification and shall have power to reject any work or material which in his judgement is not in full accordance with this specification.

This specification covers the design, manufacture, assembly, testing, packing and despatch of Battery charger (Float/Boost) complete in all respects with all components, fittings and accessories for efficient and trouble-free operation. The charger shall be connected with Lead acid/Ni-Cd type battery. 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 & STANDARDS

- 2.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 2.2 The design, material, construction, manufacture, inspection, testing and performance of 220V DC Battery Charger shall conform to the latest revision of relevant standards and codes of practices as per Annexure-I.
- 2.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 SERVICES AND EQUIPMENT TO BE EXCLUDED

- A) Civil works like foundation and cable cellar, flooring of the battery charger room etc.
- B) Ventilation of battery and charger room.
- C) DCDB
- D) Power and control cables except internal wiring of the charger
- E) Erection of the equipment
- F) Battery

4.0 OPERATIONAL REQUIREMENTS

- 4.1 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 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

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less than a minute for which the response of the charger is poor, shall be 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.

- 4.2 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.
- 4.3 The DC system shall be ungrounded and shall float with respect to be ground potential when healthy.
- 4.4 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.
- 4.5 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.
- 4.6 The voltage at load terminal will not exceed the limits of +10% and -15% of nominal system voltage for DC system.

5.0 BATTERY CHARGERS

- 5.1 The battery chargers shall be self-regulating, natural air cooled, static type, composed of silicon controlled rectifiers (SCRs) connected in three phase full wave full control bridge circuit.
- 5.2 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.
- 5.3 The charger shall have auto voltage regulators to enable stepless, smooth and continuous voltage control. The chargers shall have the effective current limiting feature and smoothing filters on both input and output to minimise harmonics, radio frequency transients, electromagnetic transients, etc.
- 5.4 The battery chargers as well as their automatic regulators shall be of static type. 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.
- 5.5 The battery chargers shall have a selector switch for selecting the battery-charging mode i.e. float or boost charging.
- 5.6 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

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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.

- 5.7 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.
- 5.8 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 $\pm 10\%$, frequency variation of $+3\%$ to -5% , a combined voltage & frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and stepless 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. Stepless adjustment of the load limiter setting shall also be provided from 80% to 100% of the rated output current for float charging mode.
- 5.9 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.
- 5.10 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.
- 5.11 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.
- 5.12 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.
- 5.13 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

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load or vice-versa. Output voltage shall return to, and remain, within the limits (+/- 1% of the set value) in less than 2 seconds after the above mentioned change.

6.0 DESCRIPTION OF EQUIPMENT

6.1 Rectifier assembly

Rectifier assembly shall be full wave bridge type 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. 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. 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 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.**

6.2 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. The rectifier transformers & chokes shall have class-F insulation with temperature rise limited to class-B insulation value.

6.3 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.

6.4 Voltage regulators

6.4.1 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.

6.4.2 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.

6.5 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.

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The component identification shall be printed on PCB by Silk screen method. All PCBs shall be tropicalized and masked.

6.6 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.

6.7 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.

6.8 Instruments

For all chargers, DC ammeter, DC voltmeter and AC voltmeter shall be provided in 96 mm² size with 1.5 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. Digital indicating instruments with built in communication port for remote data transfer shall be provided for all chargers, with display accuracy 0.5%, 4 digit-7 segment LED/LCD display and RS 485 Serial Bus port.

6.9 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.

6.10 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/ ECP. Transducers shall be provided in charger panel for DC battery voltage, charger output voltage and charger output current. **External power operated type transducer is also acceptable.** 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

6.11 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. The DC contactors shall be single/double pole air break type and suitable for continuous duty.

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6.12 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.

6.13 Air break switches

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

6.14 Fuses

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.

6.15 Variable Metallic Resistors

One set of variable metallic resistors and shunt suitable for carrying out discharge tests (5 hour discharge rate for Ni-Cd battery on the batteries shall be supplied.

6.16 Battery fuse box

Battery fuse of adequate rating meeting the load duty cycle shall be supplied. Battery fuse box shall have suitable termination arrangement for terminating the cables informed during detailed engineering stage.

6.17 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 mm & 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 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 electrolytic tinned copper cable lugs and double compression brass nickel-plated cable glands shall be provided in each panel for incoming and outgoing cables.

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6.18 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.**

6.19 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.

6.20 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.

6.21 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.

6.22 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 up to the terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

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6.23 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.

6.24 Cable Lugs

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

6.25 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.

6.26 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.

7.0 ANNUNCIATION SYSTEM

7.1 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:

- AC supply failure
- Rectifier fuse failure
- Surge circuit fuse failure
- Filter fuse failure
- Load limiter operated
- Charger trip/over loaded
- Battery on boost
- Charger earth fault
- Battery fuse blown
- DC system under voltage

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

- k) Battery fuse fails
- l) Battery on boost
- m) Charger over load
- n) Charger trouble (this being a group alarm initiated by any of the faults of charger other than charger over load).

7.2 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.

7.3 All indicating instruments, control & selector switches and indicating lamps shall be mounted on the front side of the Charger. Design of panels shall be based on the following dimensions:

- a) Overall height : Maximum 2350 mm
- b) Operating handles (Highest and lowest positions reached by operator's hands), Protective mechanical indicators : Maximum 1800 mm
Minimum 350 mm
- c) Doors & panel handles and locks : Maximum 1800 mm
Minimum 300 mm

8.0 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.

9.0 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.

10.0 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

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fails to meet the requirement, the supplier shall replace it with appropriate equipment free of cost without affecting the schedule.

11.0 INSPECTION & TESTING

11.1 The bidder shall confirm compliance to Quality plan enclosed with Section-II 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.

dates to be considered for various projects are specified in Section-I, Clause 4.1 of this specification.

11.2 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 ten years from the date of techno commercial bid opening date 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 routine tests & type tests are deemed to be included in the charger price).

11.3 The details of Type Tests to be conducted shall be as per Section-I of specification.

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

- i) Temperature rise test at full load for 8 hours.
- ii) Temperature rise test for rectifier assembly at current specified in Data Sheet-A Section-I for 8 hours.
- iii) Insulation resistance test
- iv) High voltage (power frequency) test on power & control circuits except low voltage electronic circuit
- v) Ripple content test at no load, half and full load
- vi) Automatic voltage regulation operation test at specified AC supply variations at no load, half and full load
- vii) Load limiter operation test
- viii) Efficiency and power factor measurement
- ix) 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:

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- a) Across each AC input phases
- b) Across AC input line to ground
- 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.

- x) 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

- xi) Complete physical examination

11.5 Rectifier transformers shall be subjected to following routine test:

- i) Temperature rise test for 8 hours.
- ii) Insulation Resistance test
- iii) High voltage test (power frequency) test

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

- i) Complete physical examination
- ii) Temperature rise test at full load for 8 hours.
- iii) Insulation resistance test
- iv) High voltage (power frequency) test
- v) Ripple content test at no load, half and full load
- vi) AVR operation test at specified AC supply variation at no load, half and full load
- vii) Load limiter operation test

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viii) Checking of proper operation of annunciation system

ix) 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%.

x) 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.

xi) Degree of protection test

The charger shall be checked for gasket arrangement as per the drawings.

11.7 Following routine tests shall be carried out on annunciation system:

i) Annunciation assembly and module shall be functionally tested as per EEUA-45D.

ii) Burn in test as specified above in cl. No. 10.5 (x) above.

11.8 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.

11.9 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 bid price.

12.0 INSTRUCTION MANUAL

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.

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- G) Routine, periodic and preventive inspection and maintenance procedures.
- H) Safety rules.
- I) Possible faults, their causes and remedies.
- J) Catalogues, literature and drawings.
- K) Outline dimension drawings showing constructional features, relevant cross sectional views and earthing details, operator oriented description of equipment and accessories.
- L) Operating procedures, maintenance procedures & precautions to be taken during operation and maintenance work.

13.0 SPARES

13.1 Bidder to furnish the E & C spares as per BOQ cum Price Schedule.

14.0 TOOLS AND TACKLE (IF APPLICABLE)

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.

15.0 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.

16.0 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.

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ANNEXURE-I**LIST OF APPLICABLE STANDARDS**

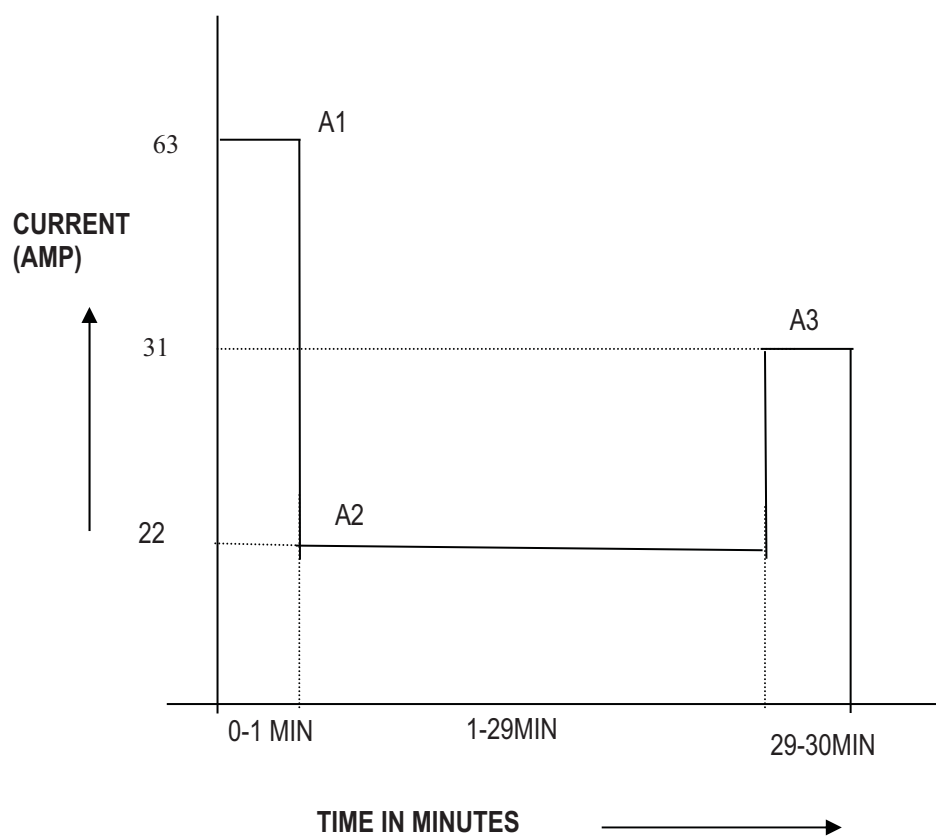
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|-----|--|---------------|
| 1. | GUIDE FOR SURGE WITHSTAND CAPABILITY TESTS | ANSI-C 37.90a |
| 2. | COLOURS FOR READY MIX PAINTS | IS-5 |
| 3. | PVC INSULATED CABLE FOR WORKING VOLTAGE 1100V | IS-694 |
| 4. | INDICATING ANALOGUE ELECTRICAL MEASURING INSTRUMENTS | IS-1248 |
| 5. | DOP FOR LV SWITCHGEAR AND CONTROL GEAR
PART-1 | IS-13947 |
| 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. | INDIAN ELECTRICITY RULES & INDIAN ELECTRICITY ACTS | |

NOTE: Equipment complying with 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.

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ANNEXURE-II

LOAD DUTY CYCLE





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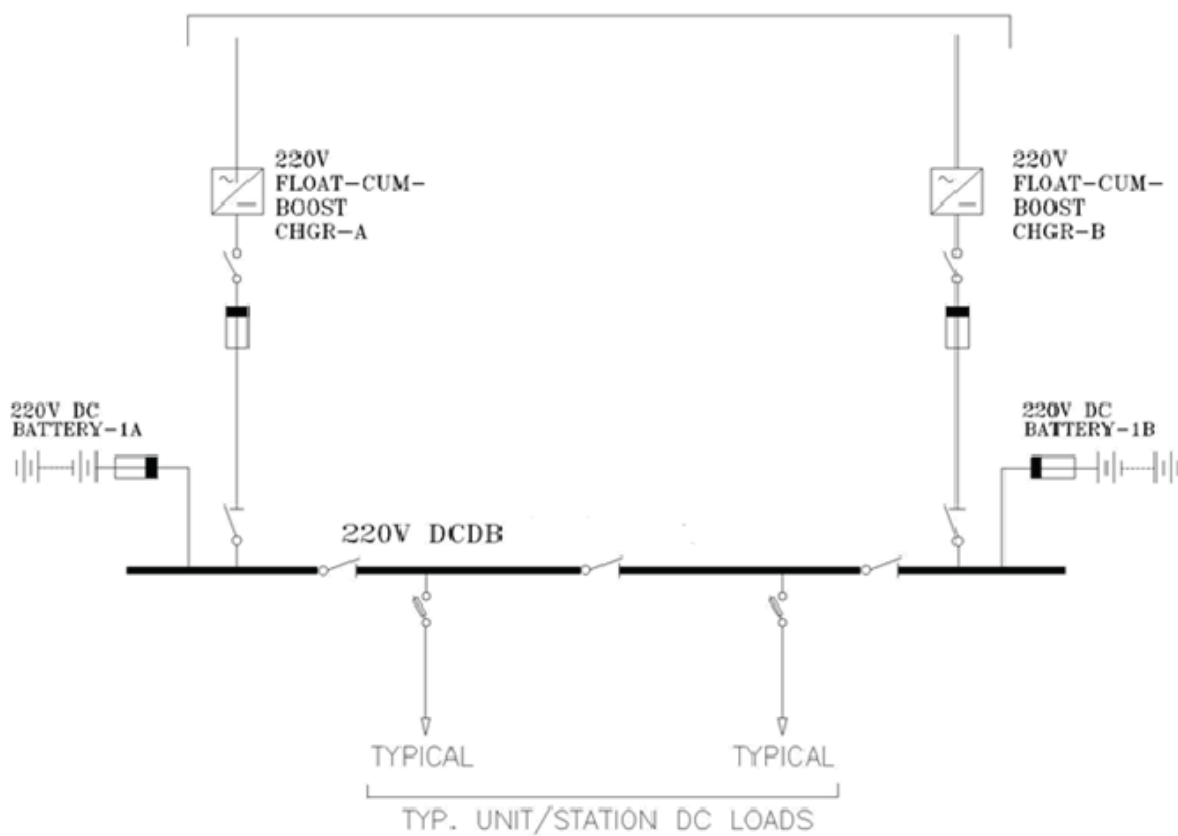
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ANNEXURE-III

ONE LINE DIAGRAM FOR 220 V DC SYSTEM



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SUB VENDOR LIST

ITEM/SERVICE DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
AC CONTACTORS	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	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
AC CONTACTORS	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
AC CONTACTORS	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
AC CONTACTORS	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000
AC LOAD BREAK SWITCH	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
AC LOAD BREAK SWITCH	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
AC LOAD BREAK SWITCH	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	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687
AC LOAD BREAK SWITCH	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
AC MCCB	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
AC MCCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
AC MCCB	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	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
AC MCCB	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
AC MCCB	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300
AIR CIRCUIT BREAKER	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
AIR CIRCUIT BREAKER	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	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
AIR CIRCUIT BREAKER	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
AIR CIRCUIT BREAKER	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
AUXILIARY RELAYS	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
AUXILIARY RELAYS	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
AUXILIARY RELAYS	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	OEN INDIA LTD	29/1479, VYTILLA, COCHIN - 682 019 KERALA, INDIA	Phone : +91 484 2301132, 2303709 Fax : +91 484 2302287, 2302221 sales@oenindia.com
AUXILIARY RELAYS	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	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI- 110015	011-41419554/59
BIMETAL RELAYS	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
BIMETAL RELAYS	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	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
CABLE GLANDS	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)-23287156 vijay_mohansood@yahoo.com
CABLE GLANDS	ARUP ENGG & FOUNDRY WORKS	391/119, PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	033 2473 0850
CABLE GLANDS	BALIGA LIGHTING EQPT.PVT.LTD.	63A, CP RAMASWAMY ROAD, ALWARPET, P.B.No 6910, CHENNAI-600018	44-24995505, 22680990-4
CABLE GLANDS	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	91-022-26852961/62/63 comet@vsnl.net
CABLE GLANDS	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/ 022-29270878.
CABLE GLANDS	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
CABLE GLANDS	INCAB	HARE STREET, KOLKATA, WEST BENGAL-700001	91-33-2480161/62/63/64 Fax : 91-33-2485766
CABLE LUGS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST).	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022- 29270876/
CABLE LUGS	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	033 2282 2540
D.C. MCCB	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300
D.C. MCCB	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI- 110015	011-41419554/59
D.C. MCCB	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL,	044-49681447
D.C. MCCB	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	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI- 110015	011-41419554/59
EARTH LEAKAGE CB	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

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SUB VENDOR LIST

ITEM/SERVICE DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
EARTH LEAKAGE CB	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
EARTH LEAKAGE CB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
EARTH LEAKAGE CB	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
EARTH LEAKAGE CB	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
EARTH LEAKAGE CB	INDO ASIAN	B-24, PHASE - II, NOIDA - 201305, U.P.	120-3042222
EARTH LEAKAGE CB	MDS SWITCHGEAR LTD	314-317 SHAH NAHAR ESTATE	011 - 25793021
EARTH LEAKAGE CB	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	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
DC CONTACTORS	BHEL (BHOPAL)	HEAVY ELECTRICAL PLANT	
DC CONTACTORS	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	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
DC CONTACTORS	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	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
DC CONTACTORS	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
CONTROL SWITCHES/ SELECTOR SWITCH	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687
CONTROL SWITCHES/ SELECTOR SWITCH	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
CONTROL SWITCHES/ SELECTOR SWITCH	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479000
CONTROL SWITCHES/ SELECTOR SWITCH	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	M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR,	
CONTROL SWITCHES/ SELECTOR SWITCH	RECOM PVT. LTD.	M/S RECOM PVT. LTD., 16A, 2ND FLOOR A, WING RAJ INDUSTRIAL COMPLEX, MILITARY	Mr. Chandrashekar Kamath (MD) : 09820249503
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	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	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: mira@kappaelectricals.com sales@kappaelectricals.com
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	LOGICSTAT	B-160, INDUSTRIAL AREA, C BLOCK RD, OKHLA I, OKHLA INDUSTRIAL AREA, NEW DELHI, DL 110020	011 2681 0032

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ITEM/SERVICE DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	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	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	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 Mr Sanjeev Aggarwal (9958897890)
LT- CURRENT TRANSFORMER	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
LT- CURRENT TRANSFORMER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
LT- CURRENT TRANSFORMER	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	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.com sales@kappaelectricals.com
LT- CURRENT TRANSFORMER	PRAGATI ELECTRICALS	280/3, II POKHRAN RD	5341779, 5427041
LT- CURRENT TRANSFORMER	PRECISE ELECTRICALS	47A-49A, CHAKALA ROAD ANDHERI(E), MUMBAI-99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433
LT- CURRENT TRANSFORMER	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	PRAYOG ELECTRICALS PVT. LTD.	GROUND FLOOR, THAKORE INDUSTRIAL COMPOUND, 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	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
LT- CURRENT TRANSFORMER	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 Mr Sanjeev Aggarwal (9958897890)
LT- POTENTIAL TRANSFORMER	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
LT- POTENTIAL TRANSFORMER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
LT- POTENTIAL TRANSFORMER	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

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SUB VENDOR LIST

ITEM/SERVICE DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
LT- POTENTIAL TRANSFORMER	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.com sales@kappaelectricals.com
LT- POTENTIAL TRANSFORMER	PRAGATI ELECTRICALS	280/3,II POKHRAN RD	5341779,5427041
LT- POTENTIAL TRANSFORMER	PRECISE ELECTRICALS	47A-49A,CHAKALA ROAD ANDHERI(E),MUMBAI- 99 MUMBAI, MAHARASHTRA, INDIA PIN-400 099	022-8323402 / 022-8216433
LT- POTENTIAL TRANSFORMER	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- POTENTIAL TRANSFORMER	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- POTENTIAL TRANSFORMER	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 Mr Sanjeev Aggarwal (9958897890)
DC SWITCH	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
DC SWITCH	KAYCEE	KAYCEE INDUSTRIES LTD., C/O-CMS COMPUTERS LTD., 35A, REAR BLDG., KILOKARI, NEW DELHI-110014	Rajiv Sharma-9312004687
DC SWITCH	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
FUSE BASE	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
FUSE BASE	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
FUSE BASE	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI- 110015	011-41419554/59
FUSE BASE	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI- 110020	011-3088 7520-29
FUSE BASE	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
FUSE BASE	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA- 121003	0129-2567580, 09871799449
FUSE BASE	SPACEAGE SWITCHGEARS LTD.	68 & 13-A INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD GURGAON, HARYANA-122001	0124-2302711, 4085091
FUSE BASE	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
FUSE BASE	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
FUSE BASE	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
HRC FUSES	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222

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HRC FUSES	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
HRC FUSES	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
HRC FUSES	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
HRC FUSES	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
HRC FUSES	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
HRC FUSES	SPACEAGE SWITCHGEARS LTD.	68 & 13-A INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD GURGAON, HARYANA-122001	0124-2302711, 4085091
HRC FUSES	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
HRC FUSES	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
HRC FUSES	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
INTERPOSING RELAY	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
INTERPOSING RELAY	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
INTERPOSING RELAY	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	OEN INDIA LTD	29/1479, VYTILLA, COCHIN - 682 019 KERALA, INDIA	Phone : +91 484 2301132, 2303709 Fax : +91 484 2302287, 2302221 sales@oenindia.com
INTERPOSING RELAY	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
INDICATING LAMPS	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000
INDICATING LAMPS	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	6832259,6918834-37
INDICATING LAMPS	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
INDICATING LAMPS	VAISHNO(HOTLINE SWGR.& CONTROL)	G-19, SECTOR - 11, NOIDA - 201301, UTTAR PRADESH, INDIA	8377805157 9818338922
INDICATING LAMPS	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	9818338922
INDICATING LAMPS	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
INDICATING LAMPS	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
MCB	MDS SWITCHGEAR LTD	314-317SHAH NAHAR ESTATE	011 - 25793021
MCB	INDO ASIAN	B-24, PHASE - II , NOIDA - 201305, U.P.	120-3042222
MCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
MCB	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 (PNEUMATIC)	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
PROTECTION - RELAYS (PNEUMATIC)	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
PROTECTION - RELAYS (PNEUMATIC)	GE-MULTILINE, GE INDIA INDUSTRIAL PVT. LTD.	NO. 90- B, ELECTRONICS CITY, HOSUR ROAD, BENGALURU - 560016, KARNATAKA	(080) 41314617, 9945478935
PROTECTION - RELAYS (PNEUMATIC)	SCHWEITZER ENGG. LAB (SEL)	406, BHIKAJI CAMA BHAVAN, BHIKAJI CAMA PLACE, BHIKAJI CAMA PLACE, MOHAMMADPUR, RK PURAM, NEW DELHI, DL 110066	011 4152 7899

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PROTECTION - RELAYS (PNEUMATIC)	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
PROTECTION - RELAYS (PNEUMATIC)	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
PROTECTION - RELAYS (PNEUMATIC)	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449
PROTECTION - RELAYS (PNEUMATIC)	AVK-SEG & CONTROLS(I) LTD	C-60,NOIDA PHASE-II	6918834-37
PROTECTION - RELAYS (NUMERICAL)	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
PROTECTION - RELAYS (NUMERICAL)	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
PROTECTION - RELAYS (NUMERICAL)	GE-MULTILINE, GE INDIA INDUSTRIAL PVT. LTD.	NO. 90- B, ELECTRONICS CITY, HOSUR ROAD, BENGALURU - 560016, KARNATAKA	(080) 41314617, 9945478935
PROTECTION - RELAYS (NUMERICAL)	SCHWEITZER ENGG. LAB (SEL)	406, BHIKAJI CAMA BHAVAN, BHIKAJI CAMA PLACE, BHIKAJI CAMA PLACE, MOHAMMADPUR, RK PURAM, NEW DELHI, DL	011 4152 7899
TERMINAL BLOCKS	WAGO-CONTROLS	C 27, GREATER NOIDA, SECTOR 58, C BLOCK, SECTOR 58, NOIDA, UTTAR PRADESH 201307	0120-2580409/10
TERMINAL BLOCKS	CONNECT WELL	309A/4, 3RD FLOOR, KALKAJI, OKHLA IND AREA PH-2, GOVINDPURI, NEW DELHI, DL 110019	9811881085 09871419996 011-65908877
TERMINAL BLOCKS	ELMEX CONTROLS PVT. LTD.	12,G.I.D.C.ESTATE,MUKARPURA ROAD,VADODARA-390010	9374631074
TERMINAL BLOCKS	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
TERMINAL BLOCKS	TECHNOPLAST	OPP.I.M.INTER COLLEGE, BEGUM SARAI KHURD ROAD, AMROHA - 244221, U.P.	PH:- 05922 264006 CELL NO:- 9012676000, 9319520799, 9319582467
TERMINAL BLOCKS	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	TEL.- +912066745000 Awasthi(09971119006) Tel: ++91 20 6674 5103, Mobile: +91 90499 95985, Fax: ++91 20 6674 5126 contact person : Vishwa bandhu E- mail:d.gupta@pmipl-online.com ;admin@pmipl-online.com
TERMINAL BLOCKS	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
TIMERS - PNEUMATIC	BCH	20/4, MATHURA ROAD, FARIDABAD, HARYANA-121006	0129-4293000
TIMERS - PNEUMATIC	ALSTOM LTD	A-7, SEC-65, NOIDA	0120-479 0000
TIMERS - PNEUMATIC	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
TIMERS - PNEUMATIC	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
TIMERS - PNEUMATIC	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
TIMERS - PNEUMATIC	ELECTRONIC AUTOMATION PVT. LTD.	20, KHB INDUSTRIAL AREA YELAHANKA BANGLORE-560064	080 -28567561 / 080 -28567562 / 080 -42802345
TIMERS - ELECTRONIC	ESSEN DEINKI	FLAT NO. 502, SKYLINE HOUSE 85, NEHRU PLACE NEW DELHI	011-26217060
TRANSDUCERS	AUTOMATIC ELECTRIC LTD.	ADDRESS : 96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
TRANSDUCERS	SOUTHERN TRANSDUCERS	INTERTECH B-83, FLATTED FACTORY COMPLEX, NEAR MODI MILLS, OKHLA, NEW DELHI-110020	Mr. Gurmohit Singh 011-41020365 / 9891402128
ENERGY METER (ANALOG)	BHEL (EDN)	MYSORE ROAD,BANGALORE-560026	080-26998500
ENERGY METER (ANALOG)	SIMCO ENGG. LTD	NO. 126, K ROAD, TIRUCHIRAPPALLI -620001, TAMIL NADU	Mr. Madaswamy Muthu +(91)-(431)-4046223 +(91)-(431)-4046210 +(91)-9786600915

84904/2020/PS-PEM-EL

TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER
PE-TS-457-508-E002

ANNEXURE IV
SUB VENDOR LIST

ITEM/SERVICE DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
ENERGY METER (ANALOG)	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007 MAHARASHTRA INDIA	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064
ENERGY METER (ANALOG)	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
ENERGY METER (ANALOG)	CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, UGURGAON 122001 HARYANA, INDIA.	4268899, 9910695701
ENERGY METER (DIGITAL)	CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, UGURGAON 122001 HARYANA, INDIA.	4268899, 9910695701
ENERGY METER (DIGITAL)	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 Mr Sanjeev Aggarwal (9958897890)
AMMETER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
AMMETER	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007 MAHARASHTRA INDIA	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064
AMMETER	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 Mr Sanjeev Aggarwal (9958897890)
VOLTMETER	AUTOMATIC ELECTRIC LTD.	96 AB LONAVLA INDUSTRIAL ESTATE NANGARGAON, LONAVLA-410401	Phone : +91 2114323665 Fax : +91 2114273482
	RISHABH INST.PVT LTD	RISHABH INSTRUMENTS PVT. LTD. F-31, MIDC, SATPUR NASHIK - 422007 MAHARASHTRA INDIA	marketing@rishabh.co.in 91-253 2202202/203 Fax: 91 253 2351064
VOLTMETER	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 Mr Sanjeev Aggarwal (9958897890)
MPCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
MPCB	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
MPCB	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
MPCB	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
MPCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
MPCB	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
MULTIFUNCTION METER	CONZERVE SYSTEMS PVT. LTD./ SCHNEIDER ELECTRIC INDIA PVT. LTD.	87, 1ST FLOOR INDUSTRIAL DEVELOPMENT COLONY (IDC) MEHRAULI ROAD, GURGAON 122001 HARYANA, INDIA.	4268899, 9910695701

84904/2020/PS-PEM-EL

TECHNICAL SPECIFICATION FOR 220V DC BATTERY CHARGER
PE-TS-457-508-E002

ANNEXURE IV
SUB VENDOR LIST

ITEM/SERVICE DESCRIPTION	VENDOR NAME	ADDRESS	PHONE
MULTIFUNCTION METER	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 Mr Sanjeev Aggarwal (9958897890)
RCCB	C&S ELECTRIC LTD.	222, OKHLA IND. ESTATE, PH-III, NEW DELHI-110020	011-3088 7520-29
RCCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.	9TH FLOOR, BLDG. NO. 10, TOWER-C, DLF CYBER CITY, PH-II, GURGAON-122002	0124-3940400
RCCB	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
RCCB	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447
RCCB	L&T	32, SHIVAJI MARG, P.O. BOX- 6223, NEW DELHI-110015	011-41419554/59
RCCB	CROMPTON GREAVES	RAIL TRANSPORTATION SYSTEMS,VANDANA BUILDING, 11, TOLSTOY MARG, TOLSTOY MARG, NEW DELHI, DL 110001	011 3041 6300
VAF METER (DIGITAL)	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 Mr Sanjeev Aggarwal (9958897890)

Note: Make of equipment/ components is indicative. Make of equipment/ components shall be subject to customer approval after award of contract without any commercial or delivery implication.

ITEM / EQUIPMENT :		STANDARD QUALITY PLAN										REVIEWED BY:	
220 V / 110 V BATTERY CHARGER (FLOAT CUM BOOST CHARGER)												APPROVED BY: S.D. SINGH	
Q.P. NO.: 0000-999-QOE-S-005/A		REV. NO: 00 DATE: 10-APR-08										APPROVED BY: A. MANDAL	
PAGE 1 OF 7		VALID UPTO: 9-APR-11										APPROVED BY: O.P. NIRANJAN	
CONFORMING TO NTPC SPECIFICATION		ACCEPTANCE NORMS										APPROVED BY: S.D. SINGH	
COMPONENT & OPERATIONS		REFERENCE DOCUMENT										APPROVED BY: S.D. SINGH	
CHARACTERISTICS		QUANTUM OF CHECK										APPROVED BY: S.D. SINGH	
CLASS		TYPE OF CHECK										APPROVED BY: S.D. SINGH	
3.		4.										APPROVED BY: S.D. SINGH	
5.		6.										APPROVED BY: S.D. SINGH	
7.		8.										APPROVED BY: S.D. SINGH	
9.		10.										APPROVED BY: S.D. SINGH	
1. A list of major components / bought out items is indicated at Appendix A. Makes for these will be proposed by the manufacturer along with the Endorsement Sheet for NTPC acceptance.													
2. Documents identified in the SQP for NTPC verification will be maintained. However, other documents i.e. IR, IPIR & Mfr's TCs mentioned in the QP will also be maintained by the Manufacturer, which NTPC may verify on surveillance basis at the time of final inspection. QC Records in soft form are also acceptable.													
1.0 Raw Material:													
1.1	M.S. Sheet (CRCA)	1. Grade	Major	Visual	100%	-	Mfr drg	Mfr drg	IR	P	-	-	IR= Inspection record
		2. Thickness & Finish	Major	Physical	Sample/lot	-	NTPC Specification	NTPC Specification	-do-	P	-	-	
1.2	Powder Paint	Shade	Major	Visual	Sample/Lot	-	IS-5(1994) SHADE CARD	NTPC appd drg / data sheet	-do-	P	-	-	
2.0 Major Bought Out Items (Refer note 1 also)													
2.1	Power Switches, MCCB Contactor & Relay	1) Type, Rating	Major	Physical	100%	100%	NTPC appd drg / data sheet	NTPC appd drg / data sheet	IR	P	V	V	
		2) Mechanical Operation / functional check	Major	Visual	100%	-	Mfr std.	Mfr std.	-do-	P	-	-	
	MCB, Push Buttons	1) Type, Rating	Major	Visual	100%	-	NTPC approved Drg / Data Sheet	NTPC approved Drg / Data Sheet	-do-	P	-	-	
	HRC fuse, terminal blocks, control & selector switches, Semiconductor Fuses, Heaters, Thermostat, Lamps, Plug in socket, Neutral Link, Lamp holders and Exhaust Fan, Heat sink	2) Continuity Test	Major	Electrical	100%	-	Mfr std.	Mfr std.	-do-	P	-	-	
2.2	Rectifier bridge Elements	Type, Rating	Major	Visual	100%	100%	NTPC appd drg / Data Sheet	NTPC appd drg / Data Sheet	IR	P	V	V	
2.3	Digital Multi Function Meters	1) Type & rating	Major	Visual	100%	100%	NTPC appd drg / data sheet	NTPC appd drg / data sheet	-do-	P	V	V	
		2) Calibration Certificate	Major	Visual	100%	100%	-do-	-do-	Mfr TC	V	V	V	
		3) Routine TC	Major	Electrical	100%	100%	-do-	-do-	-do-	V	V	V	
2.4	PVC Insulated Electric Cable	1) Type, size	Major	Visual	100%	At random	NTPC Specification / Data Sheet	NTPC Specification / Data Sheet	IR	P	V	V	All power cables to conform to IS 1554; Control wires to conform to IS 694
		2) I.R. Test	Major	Electrical	Sample/lot	-	-do-	-do-	-do-	P	-	-	

LEGEND: RECORDS IDENTIFIED WITH 'TICK' (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER. Note: NTPC Inspector Engineer to check, approval date/revision

N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE. QP: NTPC SHALL IDENTIFY IN COLUMN 'N' AS 'W'

FORMAT NO.: OS-01-QA-IP-10/F1-R1

ENGG. DIV./QA&I

ITEM / EQUIPMENT :		STANDARD QUALITY PLAN						REVIEWED BY:				
220 V / 110 V BATTERY CHARGER (FLOAT CUM BOOST CHARGER)								A.MANDAL V. TALWAR I.A. O.P. NIRANJAN S.D. SINGH				
APPROVED ASSURANCE		DATE : 10-APR-08						APPROVED				
NTPC Limited		PAGE 2 OF 7						NTPC Limited				
VALID UPTO : 9-APR-11												
CONFORMING TO NTPC SPECIFICATION												
S/N	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	M	C	N
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.		
		3) H.V. Test	Major	Electrical	Sample/lot	-do-	-do-	-do-	P	-	-	
		1) Routine TC & calibration report	Major	Electrical	100%	NTPC Specification / Data Sheet / IS 12784	NTPC Specification / Data Sheet / IS 12784	Mfr TC	V	V	V	
		2) Type. Rating	Major	Visual	100%	-do-	-do-	-do-	P	V	V	
		1) Routine Tests	Major	Electrical	100%	NTPC appd drg / Data Sheet / IS 2705	NTPC appd drg / Data Sheet / IS 2705	Mfr TC	V	V	V	
		2) Type. Rating	Major	Visual	100%	-do-	-do-	IR	P	V	V	
		1) Dimensional checkup	Major	Physical	100%	-do-	-do-	-do-	P	-	-	
		2) Conductivity Test	Major	Electrical	Sample / lot	-do-	-do-	-do-	P	-	-	
		All routine tests as per IEEE/A-45D	Major	Electrical	100%	NTPC Specification / appd drg / data sheet	NTPC Specification / appd drg / data sheet	Mfr TC	P	V	V	
		Electronic card used for indication (Refer Electronic card assembly & location at cl. no. 3.4, for checks)				NTPC Specification / appd drg / data sheet	NTPC Specification / appd drg / data sheet					
2.10	Visual Indications for charger status using LED / indicating lamps (if annunciation facia not used)											
		Rectifier transformer	Major	Visual	100%	NTPC approved data sheet	NTPC approved data sheet	IR	V	V	V	
		1) Rating	Major	Physical	100%	Mfr drg.	Mfr drg.	-do-	V	V	V	
		2) Dimensional check	Major	Physical	100%	-do-	-do-	-do-	V	V	V	
		a) Overall size	Major	Physical	100%	-do-	-do-	-do-	V	V	V	
		b) Mounting details	Major	Physical	100%	-do-	-do-	-do-	V	V	V	
		3) Terminal Board	Major	Physical	100%	-do-	-do-	-do-	V	V	V	
		4) Polarity Test	Major	Electrical	100%	-do-	-do-	-do-	V	V	V	
		5) I.R. Test	Major	Electrical	100%	-do-	-do-	-do-	V	V	V	
		6) Routine Tests										
		a) Voltage Ratio Test	Major	Electrical	100%	NTPC approved data sheet / NTPC spec. / IEC 146	NTPC approved data sheet / NTPC spec. / IEC 146	IR / Mfr TC	V	V	V	
		b) DC Resistance Test	Major	Electrical	100%	-do-	-do-	-do-	V	V	V	
		c) No Load Test & Measurement of iron losses	Major	Electrical	100%	-do-	-do-	-do-	V	V	V	

REMARKS:
APPROVED
NTPC Limited

DATE: 10 APR 2008

Q.P. NO.: 0000-989-QOE-S-005 A
REV. NO.: 00 DATE: 10-APR-08
PAGE 2 OF 7
VALID UPTO: 9-APR-11

Note: NTPC Inspection Engineer to check, approval date/revision no. of reference documents at the time of inspection

ENGINEER DIV/QA/SI

ITEM/EQUIPMENT :		STANDARD QUALITY PLAN		REVIEWED BY:		APPROVED ASSURANCE					
220 V /110 V BATTERY CHARGER (FLOAT CUM BOOST CHARGER)		CONFORMING TO NTPC SPECIFICATION		Q.P. NO.: 0000-999-QOE-S-005 A REV. NO: 00 DATE :10-APR-08 PAGE 3 OF 7 VALID UPTO : 9-APR-11		A. MANDAL V. TALWAR O. P. NIRANJAN S.D. SINGH					
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.		
					M	C/N			M	C	
		d) Measurement of Tap Voltages	Major	Electrical	100%	100%	-do-	-do-	✓	P/V	V
		e) Measurement of Cu. Losses	Major	Electrical	100%	100%	-do-	-do-	✓	P/V	V
		f) High voltage test	Major	Electrical	100%	100%	-do-	-do-	✓	P/V	V
		g) Induced High Voltage test	Major	Electrical	100%	100%	-do-	-do-	✓	P/V	V
		h) Heat run Test	Major	Electrical	100%	100%	-do-	-do-	✓	P/V	V
							-do-	-do-	✓	P/V	V
							-do-	-do-	✓	P/V	V
2.12	Choke	1) Rating	Major	Physical	100%	100%	NTPC approved data sheet	IR	✓	P	V
		2) Dimensional check	Major	Physical	100%	100%	Mfr. drg.	-do-	✓	P	V
		a) Overall Size			100%	100%	-do-	-do-	✓	P	V
		b) Mounting details			100%	100%	-do-	-do-	✓	P	V
		3. Terminal Board / Bakelite plate or busbar	Major	Physical	100%	100%	-do-	-do-	✓	P	V
		4. Terminal rating	Major	Physical	100%	100%	-do-	-do-	✓	P	V
		5. Air Gap Measurement	Major	Physical	100%	100%	-do-	-do-	✓	P	V
		6. Continuity test	Major	Elec.	100%	100%	-do-	-do-	✓	P	V
		7. Insulation Resistance	Major	Elec.	100%	100%	NTPC approved data sheet / NTPC spec./ IEC 146	IR / Mfr TC	✓	P/V	V
		8. High Voltage test	Major	Elec.	100%	100%	-do-	-do-	✓	P/V	V
		9. DC resistance test	Major	Elec.	100%	100%	-do-	-do-	✓	P/V	V
		10) Heat run Test	Major	Electrical	100%	100%	-do-	-do-	✓	P/V	V
							-do-	-do-	✓	P/V	V
2.12	Printed Circuit Boards	1) Visual Checks	Major	Physical	100%	100%	Mfr drg & NTPC spec.	IR		P	-
		2) Compliance report	Major	-	100%	100%	NTPC spec. req. for PCB	-do-		P	-
3.0	In process Inspection										
3.1	Enclosure fabrication	1) Dimensional checks	Major	Physical	100%	100%	Mfr. Fabrication Drawing	IPR		P	-
		2) Diagonal (Skewness)	Major	Physical	-do-	-do-	-do-	-do-		P	-
		3) Straightness	Major	Physical	-do-	-do-	-do-	-do-		P	-
		4) Welded Joints	Major	Visual	-do-	-do-	-do-	-do-		P	-

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M: MANUFACTURER'S SUB-SUPPLIER C: MAIN SUPPLIER.

✓: NTPC P: PERFORM W: WITNESS V: VERIFICATION, AS APPROPRIATE. CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO. OS-01-OA/P-10/F-1-R1

Note: NTPC Inspection Engineer to check, approval date/revision no. or reference documents at the time of inspection

ENGG. DIV./QA&I

ITEM/EQUIPMENT: 220 V /110 V BATTERY CHARGER (FLOAT CUM BOOST CHARGER)		STANDARD QUALITY PLAN				CONFORMING TO NTPC SPECIFICATION				REVIEWED BY:		APPROVED BY:	
OP NO.: 0000-999-QOE-S-005/A REV. NO: 00 DATE: 10-APR-08 PAGE 4 OF 7 VALID UPTO: 9-APR-11		ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY		M C N		M C N		M C N	
CLASS		TYPE OF CHECK		QUANTUM OF CHECK		REFERENCE DOCUMENT		8.		9.		10.	
3.		4.		5.		6.		7.		8.		9.	
2.		3.		4.		5.		6.		7.		8.	
1.		3.		4.		5.		6.		7.		8.	
1.		3.		4.		5.		6.		7.		8.	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.			
		5) Deburring & Finishing of welded joints	Major	Visual	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
3.2	Pre treatment of enclosure	1) Degreasing	Major	Physical	-do-	-do-	IS 6005 / Mfr Std Practice	-do-	-do-	-do-	-do-	P	-
		2) Water rinsing	Major	Physical	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
		3) Derusting	Major	Physical	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
		4) Water rinsing	Major	Physical	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
		5) Phosphating	Major	Physical	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
		6) Water Rinsing	Major	Physical	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
		7) Hot-Chromating	Major	Physical	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
		8) Sealing (If used)	Major	Physical	-do-	-do-	-do-	-do-	-do-	-do-	-do-	P	-
3.3	Powder Coating	1) Shade, thickness & finish	Major	Cross Hatch	Random	-do-	-do-	-do-	-do-	-do-	-do-	P	-
		2) Adhesion check by cross hatch method	Major	Visual	100%	-do-	-do-	-do-	-do-	-do-	-do-	P	-
3.4	Electronic card assembly & location	1) Check electronic cards are modular fitted in standard 19" metal racks with guides	Major	Visual	100%	100%	NTPC spec.	-do-	-do-	-do-	-do-	P	V
		2) Check for mechanical interlock to avoid wrong insertion of cards	Major	Visual	100%	100%	NTPC spec.	-do-	-do-	-do-	-do-	P	V
		3) Check for correct electronic components	Major	Visual	100%	-	Mfr drg.	-do-	-do-	-do-	-do-	P	-
		4) Check for jumpers / track modifications	Major	Visual	100%	random	NTPC spec.	-do-	-do-	-do-	-do-	P	V
		5) Check finish of electronic cards	Major	Visual	100%	-	Mfr drg.	-do-	-do-	-do-	-do-	P	-
		6) Environmental check on cards to remove cards with infant mortal components	Major	Visual	100%	-	Mfr Std.	-do-	-do-	-do-	-do-	P	-
3.5	Assembly of components & Modules	1. Transformer & choke	Major	Visual	100%	-	Mfr drg	-do-	-do-	-do-	-do-	P	-

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (*) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER. Note: NTPC Inspection Engineer to check approval date/revision of NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE. CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO.: OS-01-QA-IP-10/F1-R1

ENGG. DIV/QA&I

ITEM/EQUIPMENT: 220 V /110 V BATTERY CHARGER (FLOAT CUM BOOST CHARGER)		STANDARD QUALITY PLAN				CONFORMING TO NTPC SPECIFICATION				REVIEWED BY: A. AMANDAL V. TALVAR O. P. NIKANJAL S.D. SINGH				APPROVED BY: 10 APR 2008	
SL. NO.		CHARACTERISTICS		CLASS	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			APPROVED BY:		
1.		3.		4.	5.		6.	7.	8.	9.	10.			11.	
COMPONENT & OPERATIONS		CHARACTERISTICS		CLASS	TYPE OF CHECK	M	C/N	DOCUMENT	NORMS	RECORD	M	C	N	APPROVED BY:	
2.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
1.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
2.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
3.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
4.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
5.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
6.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
7.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
8.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
9.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
10.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
11.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
12.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
13.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
14.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
15.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
16.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
17.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
18.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
19.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
20.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
21.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
22.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
23.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
24.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
25.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
26.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
27.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
28.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
29.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
30.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
31.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
32.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
33.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
34.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
35.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
36.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
37.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
38.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
39.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
40.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
41.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
42.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
43.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
44.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
45.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
46.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
47.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
48.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
49.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
50.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
51.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
52.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
53.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
54.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
55.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
56.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
57.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
58.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
59.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
60.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
61.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
62.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
63.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
64.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
65.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
66.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
67.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
68.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
69.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
70.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
71.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
72.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
73.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
74.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
75.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
76.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
77.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
78.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
79.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
80.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
81.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
82.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
83.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
84.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
85.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
86.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
87.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
88.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
89.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
90.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
91.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
92.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
93.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
94.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
95.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
96.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
97.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
98.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
99.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
100.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
101.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
102.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
103.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
104.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
105.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
106.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
107.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
108.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
109.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
110.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
111.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
112.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
113.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
114.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
115.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
116.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		
117.		3.		4.	5.	6.	7.	8.	9.	10.	11.		12.		

ITEM /EQUIPMENT :		STANDARD QUALITY PLAN				CONFORMING TO NTPC SPECIFICATION				REVIEWED BY:				APPROVED BY:			
220 V /110 V BATTERY CHARGER (FLOAT CUM BOOST CHARGER)						Q.P. NO.: 0000-999-QOE-S-005 [A] REV. NO: 00 DATE: 10-APR-08 PAGE 5 OF 7 VALID UPTO: 9-APR-11				A. MANDAL V. TALWAR O.P. NIKAM S.D. SINGH				APPROVED BY: NTPC Limited			
COMPONENT & OPERATIONS		CHARACTERISTICS		CLASS		TYPE OF CHECK		QUANTUM OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY	
1.		3.		4.		5.		6.		7.		8.		9.		10.	
2.																	
		9) Wiring quality	Major	Visual	100%	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		10) Paint shade, Adhesion and Thickness check	Major	Visual	100%	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
4.2	Electrical Testing	1) Burn in check at 50°C for 48 hrs in energized condition	Major	Electrical	100%	100%	NTPC specification & appd Data sheet	IR -	✓	P	V	W	W	✓	P	W	W
		2) AVR operation Test with input voltage variation of $\pm 10\%$	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		a) No Load					-do-	-do-	✓	P	W	W	W	✓	P	W	W
		b) Half Load					-do-	-do-	✓	P	W	W	W	✓	P	W	W
		c) Full Load					-do-	-do-	✓	P	W	W	W	✓	P	W	W
		3) Ripple Test	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		a) No Load					-do-	-do-	✓	P	W	W	W	✓	P	W	W
		b) Half Load					-do-	-do-	✓	P	W	W	W	✓	P	W	W
		c) Full Load					-do-	-do-	✓	P	W	W	W	✓	P	W	W
		4) Logic simulation / interlocks/ General operation test	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		a) Trickle / boost mode selector switch operation	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		b) Auto / manual selector switch operation	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		c) Soft start feature check	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		d) Uniform step-less trickle mode voltage adjustment in auto / manual operation	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		e) Boost charge mode current adjustment from 50 % to 100 % continuously	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		5) Control Circuit and Charger status indication test	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		6) Load Limiter Operation	Major	Electrical	100%	100%	-do-	-do-	✓	P	W	W	W	✓	P	W	W
		7) Heat Run Test	Major	Electrical	One unit	One unit	-do-	-do-	✓	P	W	W	W	✓	P	W	W

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M: MANUFACTURER'S SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE. CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO.: QS-01-QA-P-10/F1-R1

Note: NTPC Inspection Engineer to check approval date/revision no. of reference documents at the time of inspection

ENGG. DIV/O&A

LEGEND: RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO.: QS-01-QALP-10F-1-R1

Note: NTPC Inspection Engineer to check, approval date/revision no. of reference documents at the time of inspection

ENGG. DIV./QA&I