



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	NK	SKS	AG
TITLE 220 V, 240A & 48 V, 100A FLOAT & FLOAT-CUM-BOOST BATTERY CHARGER				SIGN	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
				DATE	07.07.20	07.07.20	07.07.20
				GROUP	TBEM		
				CUSTOMER			
PROJECTS				400 kV Switchyard at 5X800MW Yadadri TPS			

CONTENTS

Section	Description	No. of Sheets
Section-1.	SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES	05
Section-2.	DETAILED TECHNICAL REQUIREMENTS – EQUIPMENT SPECIFICATION	09
Section-3.	PROJECT DETAILS AND GENERAL SPECIFICATION	13
Section-4.	SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS	8
Section-5.	CHECK LIST	3
	ANNEXURE – A (Technical Deviation)	1
	ANNEXURE – B (Technical PQR)	1

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SECTION - 1

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 220V and 48V Float and Float-cum-Boost Battery Charger complete in all respects for efficient and trouble free operation along with supervision of testing and commissioning at site.

This section covers the scope, quantities & project specific technical requirements as specified by the customer for 220V & 48 V Battery Chargers. The Specific Technical Requirements for the above item are given in Section-2. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

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

No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer.

The equipment is required for the following project's:

Name of the Customer : Telangana State Power Generation Corp. Ltd.
Name of the Project1 : 400 kV Switchyard at 5X800MW Yadadri TPS
Consultant : TCE Bangalore

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

1.2 SPECIFIC TECHNICAL REQUIREMENTS

Equipment and system shall be designed to meet the following major technical parameters as brought out hereunder. For detailed technical requirements, please refer Section-2, Annexure-1.

1	Nominal Voltage Rating (V)	220 V	48 V
2	Rated Current Capacity	240 A	100 A
3	Voltage regulation in		
a	- float charging	±1%	±1%
b	- boost charging	±1%	±1%
4	Short Circuit Level		
a	A.C. (for 1 Sec.)	50 kA	50 kA
b	D.C. (for 1 Sec.)	25 kA	25 kA
	Battery Data		
1	Rating	1605 (AH)	645 (AH)
2	Type of Battery	Lead-Acid (Plante) type	
3	Proposed method of working (Volts per Cell)		

a	Float Charging (normal)	2.25 V/Cell	
b	Equalising charge (occasional)	2.33 V/Cell	
c	Boost Charging/cell (after complete discharge)	2.75 V/Cell (Max.)	
	<u>Note:</u> 220 V DC system is unearthed & 48 V DC system is +ve earthed		
	Battery Charger		
1	Charger	Float & Float-cum-Boost charger	
2	Type	Solid-state, full wave, fully controlled with microprocessor based AVR, three phase bridge, suitable for continuous duty application.	
3	Enclosure	Sheet steel enclosure, IP-42	
	System Condition		
1	3 phase A.C. supply	415 V - 50 Hz	415 V - 50 Hz
2	1 phase A.C. supply	240 V - 50 Hz	240 V - 50 Hz
3	Voltage Variation	-15% to +10 %	
4	Frequency Variation	+3 % to -5 %	
5	Combined volt + frequency variation	10% (absolute sum)	
6	Short-circuit level	50KA r.m.s. symmetrical	
	System earthing	Solidly earthed	
	Performance Requirements	a) The output voltage of the charger shall be regulated within $\pm$ 1% of the set value for any load variation from 0 to 100% and A.C. input voltage and frequency variations as indicated above in system condition b) The ripple content in charger DC output shall be limited to 1% (rms) with or without battery.	

DISCHARGE RESISTOR BANK

Type:	Portable
Construction:	Sheet steel enclosed,
Resistor material:	Copper-nickel alloy/stainless steel
Enclosure Protection Class:	IP-32
Cooling:	Forced air-cooled
Rating:	To meet the functional requirement C10 Rate
Control:	Using rotary switches for step control of current against falling voltage with ON OFF facility.

1. Boost/Float-cum-boost charger shall be sized to restore the fully discharged battery to full charge condition in ten (10) hour.
2. Size of cable between battery charger & distribution board's shall be intimated during detailed engineering stage. Bidder to provide TB's of appropriate size as per the input.

It will be battery charger supplier's responsibility to ensure proper co-ordination and satisfactory operation of the offered chargers with stationary batteries procured separately by BHEL.

1.3 BILL OF QUANTITIES

Sl. No.	Details	Unit	Qty (Nos)
1.3.1	Main Items		
1	220V, 240A Float and Float cum Boost Charger complete in all respects for efficient and trouble free operation as per technical specification	Sets	2
2	48V, 100A Float and Float cum Boost Charger complete in all respects for efficient and trouble free operation as per technical specification	Sets	2
3	Battery Discharge Resistor Unit (suitable for 220V & 48V Battery)	Set	1
4	Portable Single Cell Charger (for 220V Battery)	Set	1
5	Portable Single Cell Charger (for 48V Battery)	Set	1
1.3.2	Mandatory Spares as per clause 1.3.5		
1	Mandatory spares for 220V Battery charger	Lot	1
2	Mandatory spares for 48V Battery charger	Lot	1
1.3.3	Services		
1	Supervision of Installation, Testing & Commissioning of 220V, 240A Float and Float cum Boost Charger	Lot	2
2	Supervision of Installation, Testing & Commissioning of 48V, 100A Float and Float cum Boost Charger	Lot	2
1.3.4	Special Tools & Tackles as per clause 1.3.6		
1	Special tools & tackle	Lot	1

Notes: -

- Each set of battery charger shall be equipped with accessories like base channel frame, floor channel sill and kick plates for all floor-mounted charger panels, complete with holding down bolts and nuts and terminals with lugs for connecting cables from battery, cables from DC board and control cables. Prices of above accessories or any other accessory required are deemed to be included in prices of Main items.
- Alarms and indications as per list of “ALARMS & AND INDICATIONS” specified in section-2 shall be provided with each charger. Prices of these alarms and indications or any other alarms and indications required are deemed to be included in prices of Main items.

1.3.5 List of Mandatory Spares

Bidder has to supply following items for Battery chargers as mandatory spares:

S. No.	Details	Unit	Qty (220V)	Qty (48V)
1.	Fuses & fuse links	Nos.	200% of total quantity for each type & rating of fuses used in the system.	200% of total quantity for each type & rating of fuses used in the system.
2.	SCR	Nos.	8 Nos. for each type and rating.	8 Nos. for each type and rating.

3.	Diode	Nos.	8 Nos. for each type and rating.	8 Nos. for each type and rating.
4.	Indicating lamps	Nos.	10	10
5.	Electronic Module/PCB/Card	Nos.	2 (Two) Nos. each type used in the system.	2 (Two) Nos. each type used in the system.
6.	Pulse transformer	Set	4	4

If any mandatory spares specified in BOQ are not applicable as per battery charger design, bidder to supply equivalent spares for the same.

1.3.6 Special Tools & Tackles

A set of special tools & tackle which are necessary or convenient for erection, commissioning, maintenance and overhauling of the equipment shall be supplied.

The tools shall be shipped in separate containers, clearly marked with the name of the equipment for which they are intended.

1.3.7 Recommended Spares

The Bidder shall submit a list of recommended spare parts for five (5) years satisfactory and trouble free operation, indicating the itemized price of each item of the spares. The prices of these shall be indicated in separate schedules and these shall not be considered for the purpose of evaluation.

1.4 TYPE TESTING

Bidder shall submit valid type test reports (as per relevant IEC/IS standard) for the tests carried out after 17.10.2012. The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are earlier than 17.10.2012 or the reports of type tests are found to be technically unacceptable by TSGENCO, the type test shall be conducted by the vendor without cost and delivery implication to BHEL.

1.5 QUALITY PLAN

The bidder to follow BHEL/ TSGENCO approved quality plan at contract stage.

1.6 SUPERVISION OF INSTALLATION & COMMISSIONING

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

1.7 TITLE BLOCK

The drawings / documents submitted shall be project and product specific and shall incorporate following details:

- a) Project Name : 400 kV Switchyard at 5X800MW Yadadri TPS
b) Customer Name : Telangana State Power Generation Corp. Ltd.
c) Consultant Name : TCE, Bangalore
d) Contractor : BHEL
e) Customer LOA no. : ED/TPC/SE-III/YADADRI TPS(5X800MW)/D.No. 102/17, Dated: 17/10/2017

1.8 Drawings / Documents

The drawings / documents submitted shall be project and product specific and shall incorporate all project details and title block of the customer as detailed in Section 1, 2 & 3.

The drawings/ documents, as follows shall be used for providing engineering manufacturing clearance of the equipment (220 V & 48V Battery Chargers) and furthermore, it shall be used for delay analysis, if any from bidder.

The schedule for submission and resubmission shall be in line with details provided in section-3.

1	OGA, SLD, BOM, GTP & CKT Diagram/Scheme drawings
2	Type Test Reports
3	Quality Assurance Plan & Inspection Test Schedule

Date of Submission of first lot of drawings/ documents shall be counted only from the date of submission of reasonably correct drawings/ documents.

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

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SECTION – 2

2.1 GENERAL TECHNICAL REQUIREMENTS

APPLICABLE STANDARDS

IS:3895	- Mono-crystalline Semiconductor Rectifier Cells and Stacks
IS:4540	- Mono-crystalline Semiconductor Rectifier Assemblies and Equipment.
IS:6619	- Safety Code for Semiconductor Rectifier Equipment
IS:2026	- Power Transformers
IS:2959	- AC Contactors for Voltages not Exceeding 1000 Volts
IS:1248	- Indicating Instruments
IS:2208	- HRC Fuses
IS:13947 (Part-3)	- Air break switches, air break disconnectors & fuse combination units for voltage not exceeding 1000V AC or 1200V DC
IS:2147	- Degree of protection provided by enclosures for low voltage switchgear and controlgear
IS:6005	- Code of practice for phosphating of Iron and Steel
IS:3231	- Electrical relays for power system protection
IS:3842	- Electrical relay for AC Systems
IS:5	- Colours for ready mix paint
IEEE-484	- Recommended Design for installation design and installation of large lead storage batteries for generating stations and substations.

2.2 Codes and Standards

All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

Equipment and material conforming to any other standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

2.3 Design Basis

The battery and charger combination shall be such as to ensure continuity of DC supply at load terminals at all times without even momentary interruption. For continuous operation at specified ratings, temperature rise of the various components of battery charger shall be limited to the permissible values stipulated in the relevant standards and/or this specification.

The equipment will be installed indoor in a clean but hot, humid and tropical atmosphere. For the purpose of design an ambient temperature of 50oC and relative humidity of 85% shall be considered.

2.4 System Concept

The battery charger shall be capable of providing the initial charging current as required for the battery.

- a) One (1) no. float and float cum boost battery chargers will be provided for each set of battery which is normally ON in float charging mode, supplying the DC load current and at the same time float charging the battery. Both the float chargers are in parallel mode of operation. Due to failure of one charger, the other charger will take full load requirement and the characteristics shall be such that if load is high and exceeds the charger capacity, the excess load shall be supplied by the battery.
- b) When the float-cum-boost charger will be in boost charging mode (when battery voltage drops below a set value) and in boost charging mode it will boost charge a fully discharged battery to fully charged condition in 10 hours. The other float charger will supply DC load current.
- c) Float-cum-boost charger shall also have provision for float, equalizing and boost charging the battery through manual selection.
- d) On failure of A.C. supply both chargers will go out of service and battery will take over to supply emergency loads without any interruption.
- e) Suitable electrical interlock shall be provided in the charger to ensure that boost charging can commence only after the relevant load isolating switch in the DCDB open. This ensures availability of both redundant feeders to the loads when any charger is isolated from the system for boost charging. However in case of failure of any charger, the other charger shall feed both sections of the DCDB and provided trickle charging to both sets of battery.
- f) Output of the chargers shall be controlled automatically as well as manually. AUTO/MANUAL selector switch along with voltage/current setter shall be provided for this purpose.
- g) For ungrounded DC system, suitable ground fault detection system shall be provided in the battery charger panel to detect ground fault on either polarity for annunciation in charger panel.

2.5 Battery Charger General

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

h) The design of the equipment will be such that during the period both trickle charger unit and boost charger units are working independently, the tap connection from various taps of the battery cell to the load circuit should not involve any circulating current.

2.6 Construction

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

2.7 Charger Equipment

- a) All power diode and control rectifiers shall be silicon type. Rectifier transformer shall be resin impregnated in vacuum, dry type, double wound with copper conductor and class-F insulated with temperature rise limited to class-B having off-circuit tap $\pm 2.5\%$ on primary side. LC filter suppressor shall be provided in the output to minimize ripple content and to keep the value within the specified limit.
- b) The diode & bridge elements shall be liberally sized for forward current, minimum Momentary overloads & voltage spikes. The current & peak inverse voltage (PIV) should be chosen accordingly. Wherever necessary power semiconductor device shall be provided with over current and over temperature protection by using special fuses. Blocking diodes shall be fully rated and shall have redundancy so that failure of a single diode shall not incapacitate the system in any way.
- c) Isolating switches shall be heavy duty, load break type, operated by an external handle with provision for padlocking in ON & OFF position.
- d) AC Changeover switch shall be 3 position, 4 pole, load break type with 2 NO + 2 NC auxiliary contacts. The switch shall be installed in such a manner that the operating handle shall be accessible only after opening the front door.
- e) Double pole, double throw DC switch shall be load break type with 2 NO + 2 NC auxiliary contacts.

- f) Control switches shall be dust protected, heavy duty, switchboard type complete with escutcheon plates. Contacts shall be silver plated, rated 10A at operating voltage. Selector switch shall be maintained contact, lockable stay-put type with knob handle. Meter selector switch shall be four-position type. Ground fault detection switch shall be three-position type spring return to neutral.
- g) Push button shall be heavy duty, shrouded, push to actuate type with colored button and inscription plate. Each push button shall have 2 NO + 2 NC contacts, rated 10A at 240V AC and 5.0A at 220V DC.
- h) Contactor shall be air-break type with hand reset type thermal overload relays having in built temperature compensator and single phase preventor. Contactor duty class shall be AC-3.
- i) Fuses shall be HRC type, mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of base. In such cases, one set of insulated fuse pulling handles shall be supplied with each board. Kick-off fuses (trip fuses) with alarm contacts shall be provided for all DC fuses. Semi conducting device fuses shall be fast-acting. All upstream fuses shall be properly coordinated with corresponding down stream fuses.
- j) Indicating lamps shall be clustered of LEDs suitable for the duty involved. The body shall be made of polycarbonate Unbreakable lens. LEDs shall be protected by inbuilt fuse with surge suppressor or leakage voltage glow protection. Both lamps and lens shall be replaceable from front.
- k) Each battery charger shall be provided with one (1) no. voltage transducer and one (1) no. current transducer for monitoring the DC output. These transducers shall have twin-channel output of 4-20mA and will be used for analog inputs to central DDCMIS/ EDMS.
- l) Ground fault relay shall be provided to detect DC system ground leakage current.
- m) Switch fuse shall be provided to receive incoming AC supply.
- n) Charger shall be equipped with LCD display, so the system or particular module operation parameters can be locally or remotely viewed / monitored. Following parameters to be displayed:
 - # Input AC voltage
 - # Input AC current
 - # Charging voltage
 - # Charging current
 - # Load voltage
 - # Load current
 - # Battery voltage
 - # Battery current

2.8 Alarms

- a) Solid-state, audio visual annunciation system shall be provided for battery chargers. Annunciation system shall operate on 220V DC.
- b) One (1) minimum twelve-points alarm facia shall be provided on float cum- boost charger panel, complete with proper actuating devices, circuitry, legends, push buttons (Accept, Reset and Test) and hooter.
- c) Each central panel shall be provided with one (1) minimum eight point alarm facia complete with proper actuating devices, circuitry, legends, push- buttons (Accept, Reset and Test) and hooter.
- d) The arrangement shall be such that on occurrence of a fault the corresponding window will light up and stays lighted until the fault is cleared and reset button is pressed.

- e) Each time a window lights up, a master relay will get energized to provide group alarm signals for Owner/Purchaser's remote panel.
- f) The requirements of indication/metering/alarms are given in Section-1.
- g) The alarm shall be compatible with central DCS/SCADA

2.9 Meters

Meters shall be 96 x 96 mm switchboard type, 90 deg scale, antiglare glass, accuracy class 2.0, with zero adjuster on the front. Charger panel shall be provided with the following meters:

- a) Input voltmeter (0 – 500 V AC) with voltmeter selector switch.
- b) Output DC voltmeter at each charger output.
- c) Output DC voltmeter at battery output.
- d) Output DC ammeter at each charger output (0 – 150% of rated full load charger output)
- e) Battery charging / discharging ammeter.

2.10 Transducers

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

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

2.11 Controls

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

- a) Charger ON/OFF push button.
- b) Selection of float or boost charge in case of float-cum-boost charger.
- c) Voltage setters for setting the output of float/ equalizing / boost charge. Setting shall be independent of each other so that setting of one voltage shall not require resetting other.
- d) Ground fault detection switch with indicating lamps.
- e) Current limit setter/ charging rate.
- f) Under/Over voltage relay including battery earth fault monitoring relay.
- g) Acknowledge-Reset-Test push buttons for annunciation system. The color of reset buttons shall be BLACK.

2.12 Lamp/Space heaters/receptacles

- a) The charger panels shall be provided with :-
 - # Internal illumination lamp with door switch, the lamp shall be located in the ceiling and guarded with protective cage.
 - # Space heater with thermostat control
 - # 5 pin 6A receptacle with plug
 - # Communication plug.
- b) Lamp, heater and receptacle circuits shall have individual ON-OFF switch fuse units and shall be suitable for 240V AC supply.

2.13 Wiring/Cabling

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

2.14 Terminal Block

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

2.15 Grounding

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

2.16 Tropical protection

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

2.17 Painting

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

2.18 Nameplate

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

2.19 Battery Discharge Resistor Unit / Portable Single Cell Charger

It shall be designed to perform periodic discharge tests. The Resistor Unit shall be made specially to check initial battery performance, guarantee smooth operation of back up system during emergencies and improve overall health and life of Battery system.

Resistor Unit shall be an assembly consisting of copper-nickel alloy wire grid elements supported by stainless steel tie rods. The resistor bank shall have adequate trimming facility (coarse and fine) to maintain a constant current against falling voltage during discharge operation. An ammeter shall be provided on the unit to monitor discharge current of battery.

Portable single cell charger shall be supplied with all accessories like input & output cables, ammeter, etc. It will be used for charging a cell while operating as part of a battery bank, even if another charger is connected, without removing it from service item of the spares.

2.20 TESTS

All equipment and components thereof shall be subject to shop tests as per relevant IS standards.

Following minimum tests shall be performed on each battery charger.

- a) Dielectric tests.
- b) Voltage regulation check from 0 to 100% load with $\pm 10\%$ input voltage variation.
- c) Ripple content measurement.
- d) Heat run test on current limiting value.
- e) Functional test.

All other routine tests shall be carried out on each equipment as per relevant standard.

2.21 SUBMISSION OF DOCUMENTS

Following drawings and document shall be submitted.

- (a) General Technical Particular (GTP)
- (b) GA & Foundation Plan Drgs.
- (c) Schematics
- (d) Write-up on operation
- (e) Charger Characteristics in Boost and Float mode
- (f) Complete technical literature supported by catalogues
- (g) Quality plan
- (h) Field Quality plan
- (i) Type Test Reports
- (j) Storage and Installation Instruction
- (k) Operation and Maintenance Manual

All drawings shall be prepared by using Auto CAD, approved version and documents shall be generated using MS Office. The paper copy of the drawings & document shall be submitted for approval & reference. All final drawings and documents shall be submitted in CD in Auto CAD (approved version) and MS office format as applicable for Purchaser's future reference.

2.22 LIST OF ALARMS & AND INDICATIONS

- 1.0 Following list of alarm / annunciation shall be provided at each charger.
 - a) AC supply failure.
 - b) Charger overload.
 - c) SCR fuse blown.
 - d) Filter fuse blown.
 - e) DC output fuse blown.
 - f) DC system under voltage.
 - g) DC system over voltage.
 - h) Battery earth fault.
 - i) AC Input fuse blown
- 2.0 Initiating contacts wired to two terminals at battery charger panel shall be provided for group annunciation "Battery Charger Trouble" of the events mentioned above, at central control room. Separate contacts shall be provided for "Battery earth fault" annunciation at central back-up panel.
- 3.0 I Initiating contacts for all alarm points shall also have electrically separate spare set of contacts wired to the terminal block for future use.
- 4.0 All alarm contacts shall be rated 5.0A at 220V DC and 10 Amp. at 240V AC.
- 5.0 In addition to the alarm points mentioned above, any other alarm point, if required for battery charger, shall be provided.

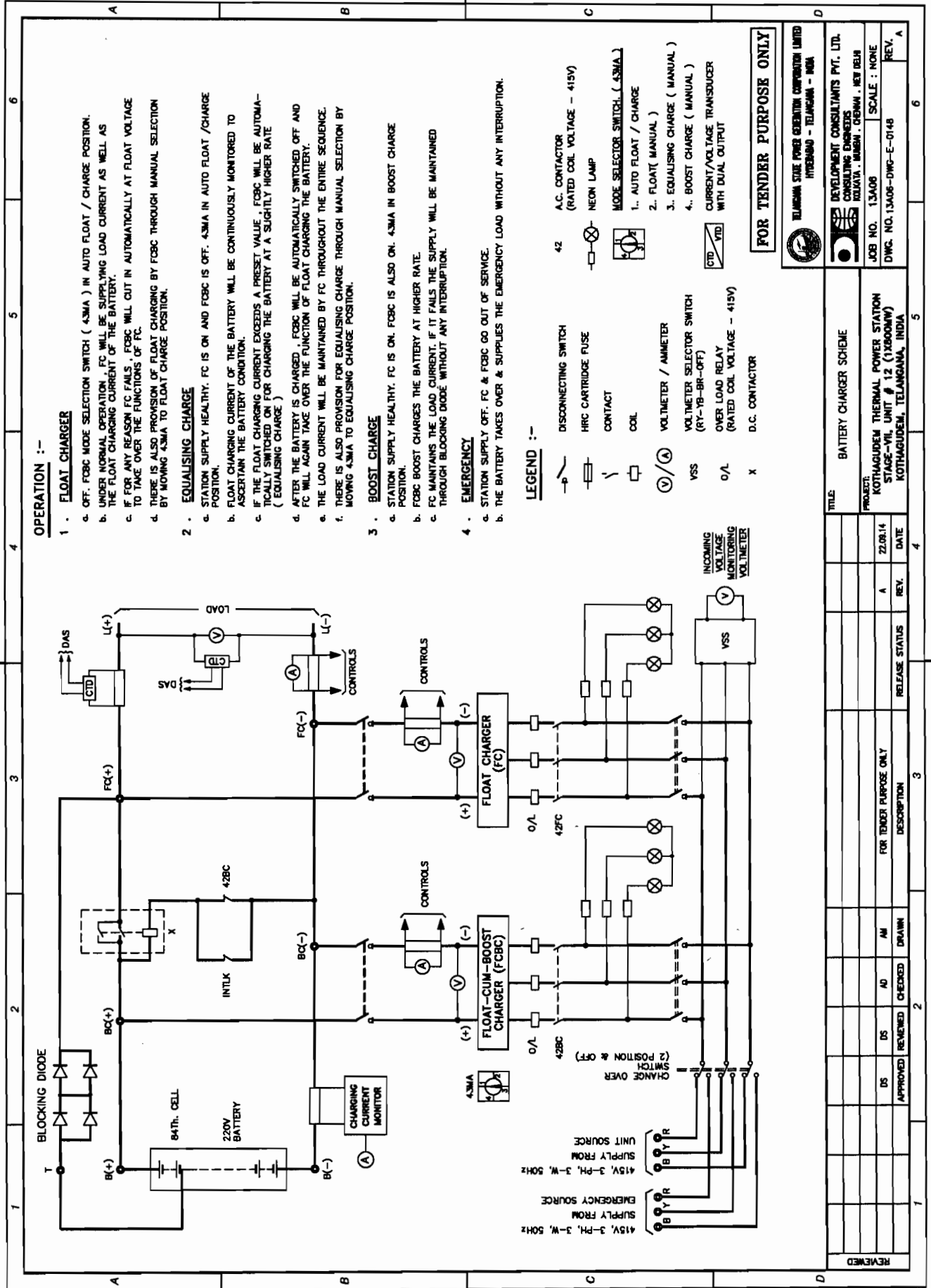
6.0 Charger panel shall also have the following minimum indications:

- a) Charger power supply ON (at all three phases)
- b) Charger DC output healthy.
- c) Control supply ON.
- d) DC supply healthy.
- e) Float / boost charger in operation (in float-cum-boost charger)

2.23 SCHEDULE OF PRE-COMMISSIONING TESTS OF BATTERY CHARGER

The following tests (but not limited to the same) are a general guideline. Other tests as necessary shall also be conducted.

- a) Insulation resistance test.
- b) Test on transformer (I.R., voltage ratio).
- c) Automatic voltage regulator & annunciator operation & testing.
- d) Load test.
- e) Functional check of battery charger.
- f) Calibration test of relays and meters of battery charger.
- g) Space heater operation check.
- h) Annunciations.





Project: 5x800 MW YADADRI THERMAL POWER STATION.
Customer: TELANGANA STATE POWER GENERATION CORPORATION LTD

Section-3: Project Details & General Specifications

Rev. No. 01

SECTION - 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

GENERAL TECHNICAL REQUIREMENTS

1.0 PROJECT DETAILS

Customer	:	M/s Telangana State Power Generation Corporation Ltd.
Project Title	:	5x800MW Yadadri Thermal Power Station
Project Location	:	Veerlapalem Village, Damercherla Mandal, Nalgonda District, Telangana
Nearest Railway station	:	Vishnupuram railway station.
Nearest Road Head	:	NH-9 is at 45km North SH-2 is at 7km South
Nearest Airport	:	Hyderabad (about 120 Km) Chief Engineer (O&M), 5X800MW Yadadri Thermal Power
Postal Address	:	Station, TSGENCO, Village - Veerlapalem, Mandal- Dameracheral, Dist. – Nalgonda, Telangana

1.1 SITE CONDITIONS (FOR DESIGN PURPOSES)

1.1.1 SITE CONDITIONS

a).	Average rainfall per year	:	1124 mm
b).	Maximum hourly rainfall intensity	:	102 mm
c).	Altitude	:	1000 m

1.1.2 DESIGN AMBIENT

a).	Minimum Temperature	:	13.5°C
b).	Maximum Temperature	:	45°C
c).	Design Ambient Temperature	:	50 °C

1.1.3 RELATIVE HUMIDITY

a).	Maximum	::	85%
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Section-3: Project Details & General Specifications

Rev. No. 01

1.1.4 WIND PRESSURE (AS PER IS:875-1987)

a). Design wind speed : 44 m/sec.

1.1.5 SEISMIC FACTORS

a). Horizontal Seismic Coefficient : As per latest IS : 1893

b). Vertical Seismic Coefficient : As per latest IS : 1893

} **Zone - III**

1.1.6 ELECTRICAL DATA

		400 kV System	415V AC System	240V AC System	220 V DC System	48 V DC System
1.	Nominal Voltage	400 kV	415 V	240 V	220 V	48 V
2.	Highest System Voltage	420 kV	457 V	264 V	242 V	55 V
3.	No. of phases	3	3	1	NA	NA
4.	Frequency	50 Hz	50 Hz	50 Hz	NA	NA
5.	Voltage variation	± 5%	+10 %	+10 %	+10 % to -15%	+10 %
6.	Neutral Earthing	Effectively Earthed	Solidly Earthed	Solidly Earthed	-	-
7.	Fault Level	50 kA for 1 sec.	50 kA for 1 sec.	50 kA for 1 sec.	15 kA for 1 sec.	-

1.1.7 SYSTEM PARAMETERS

Dry and wet one minute power frequency withstand voltage : 630 kVrms
Dry impulse withstand voltage positive and negative : 1425 kVpeak
Minimum Total Creepage : 25 mm/kV

1.1.8 MINIMUM CLEARANCE (AS PER IS: 10118)

Phase to phase (PP) : 4200 mm
Phase to earth (PE) : 3500 mm
Section clearance : 6500 mm
Minimum ground clearance from plinth level (Plinth level : 300 mm) : 8000 mm



Vertical ground clearance to nearest part not at earth
potential of an insulator supporting live conductor/ equipment 2440 mm

1.2 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification. It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

1.3 STANDARDS

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other. When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval. The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.



1.4 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

The purchaser intends to repeat the type tests and additional type tests on cables for which test charges shall be payable as per provision of contract.

The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractors premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Manufacturer's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Manufacturer shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Manufacturer's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Manufacturer may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Manufacturer shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The



Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/ inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of this test or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Manufacturer's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser.

1.5 MATERIAL/WORKMANSHIP

1.5.1 GENERAL REQUIREMENT

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purposes for which they are intended.



The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

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

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

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

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

1.5.2 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to



the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

1.6 COLOUR SCHEME AND CODES FOR PIPE SERVICE

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

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade 631 of IS-5. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

1.7 PAINTING

- a) All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS: 6005 "Code of practice for Phosphating Iron and Steel".
- b) Oil, grease, dirt and swerve shall be thoroughly removed from emulsion by cleaning.
- c) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- d) After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute bichromate solution and over drying.
- e) The phosphate coating shall be sealed by the application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "Flash dried" while the second coat shall be stoved.
- f) After application of the primer, two coats of finishing epoxy paint shall be applied, each coat followed by stoving. The panel shall have colour conforming to shade 631 of IS-5 for outside and inside of the panel with black colour for base frame.
- g) Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.



- h) Finished painted appearance of panel shall present an asthetically pleasing appearance free from dents and uneven surface.
- i) A small quantity of finishing paint shall be supplied for minor touching up required at site after the installation of the panels.

1.8 PROTECTION

- a) All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.
- b) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.
- c) The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.
- d) Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

1.9 FUNGISTATIC VARNISH

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

1.10 SURFACE FINISH

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

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



1.11 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be 610 gm/sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

1.12 AUXILIARY POWER SUPPLY

1.12.1 A.C power supply for auxiliaries will be available at 240 V, 50 C/s 1-phase, 2 wire and 415V, 50 C/s, 3-phase, 4 wire, neutral solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%

1.12.2 D.C. power supply at 220 V, 2-wire ungrounded will be available 187 V to 242 V.

1.13 INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type tests/routine tests/acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested within 5 years from the date of opening the bid. Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the subcontractor will have to carry out the type tests without any extra cost and without any delivery implications.

1.14 PACKAGING

Aluminium Tube shall be partially packed with Hessians cloths. Similar items shall be grouped and tied with steel wires/strip for convenient handling during transits.

MARKINGS

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

- a) Name and address of the consignee.
- b) Purchase order number.
- c) Name of supplier/s.
- d) Description of equipment / material.



e) Tare weight.

f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/material at a later date, in case the need arises, while packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage wagons and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

1.15 HANDLING, STORING AND INSTALLATION

In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser.

Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the contractor at his own expenses.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the



purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the Contractor's account.

The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance to the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of such nature, corrosion, damages etc.

The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipments which require indoor storage.

The words erection and installation used in the specification are synonymous. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

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

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

1.16 TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

1.14 EQUIPMENT BASES

A cast iron or welded steel base-plate shall be provided for all rotating equipment, which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base-plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units shall have a raised lip all around, and shall have threaded drain connections.

1.15 QUALITY

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



1.16 DOCUMENTATION

1.16.1 DRAWINGS

All drawings shall be prepared in AutoCAD and ultimate documentation would include drawings/documents on CDs. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part nos. in the contract drawings. Such parts, which are to be dispatched to site from works in dispatchable units and are reassembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. The shipping list should be sent along with the general arrangement drawings for engineer's approval. All the items of the shipping list should be identified in the drawing.

The drawing submitted by the supplier shall be reviewed by the purchaser as far as practicable within two weeks of receipt of drawings and shall be modified by the sub-contractor if any modifications and/or corrections are required by the purchaser. The sub-contractor shall incorporate such modifications and / or corrections and submit the final drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings shall not alter the contract completion date.

Further work by the subcontractor shall be in strict accordance with these drawings and no deviation shall be allowed without the written approval of the purchaser.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at supplier's risk.

Approval of drawing or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modifications that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built drawings' and required no. of prints thereof.

1.16.2 INSTRUCTION MANUALS

The supplier shall submit to the purchaser, draft instruction manuals for approval within 30 days of placement of order. The final instruction manuals complete in all respects shall be submitted 60 days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment furnished, the erection procedures, testing, operation & maintenance procedures of the equipment.

If after the commissioning and initial operation of the plant, the instruction manuals require any modification/ addition / changes, the same shall be incorporated and the up- dated final instruction manuals shall be submitted as required.



1.16.3 TITLE BLOCK & DRAWING/ DOCUMENT NUMBERING SCHEME

Title block for drawing / document should be followed as per ANNEXURE-3

1.16.4 DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A.	<u>For approval</u>	<u>No of Copies</u>
	Copies of all drawings with project details, dimension, shipping weights, No. of cases & dimensions, fixing details, tolerance etc.	10
	Copies of type test reports.	5
	Copies of works quality plan & field quality plan.	5
	Copies of installation, operation & maintenance manual.	5
	Copies of drawings on floppies/CDs	1 set
B.	<u>After approval and for information / distribution</u>	
	Copies of all drawings	15
	Copies of installation, operation & maintenance manual including Routine test reports	15
	Sets of RTF of drawings	2
	CDs of Drgs and O & M Manuals	4
C.	<u>As Built Drawings</u>	
	Hard copies of Drawings	15
	CDs	4

NOTE:

1. Any revision of drawings / documents shall be submitted in the same no. of copies submitted first time for approval
2. Final drawings / documents shall be submitted in bound volume with customer and project details etc. written on the top.

B. BATTERY CHARGER

Float/Float-cum-Boost Charger

1.0 GENERAL

- | | | |
|-----|--------------------|---|
| 1.1 | (Ψ) Make | : |
| 1.2 | (Ψ) Cat. No | : |
| 1.3 | Type | : |
| 1.4 | Reference Standard | : |

2.0 RATING

2.1 A.C. Input

- | | | |
|----|--|---|
| a) | Voltage $\pm$ % variation Volt | : |
| b) | Phase No. | : |
| c) | Frequency $\pm$ % variation Hz | : |
| d) | (Ψ) Input amps at rated load including
supply of battery charging current | : |

2.2 (Ψ) D.C. Output

a) Voltage Volt/Cell :

b) Current Amp. :

2.3 Type of Cooling :

2.4 Maximum Temperature within cubicle above 50°C ambient

a) Rectifier transformer Deg. C :

b) SCR Deg. C :

3.0 **PERFORMANCE**

3.1 Regulation for 0-100% rated load with $\pm 10\%$ input voltage and $\pm 5\%$ input frequency variation % :

3.2 Ripple content in D.C. output

a) With battery % :

b) Without battery % :

3.3 (Ψ) efficiency at rated load % :

3.4 (Ψ) Power Factor at rated load % :

4.0 **MISCELLANEOUS**

4.1 Charger provided with following features

a) Automatic voltage regulation :

b) Current limiting circuitry :

c) Smoothing filter circuit :

d) Soft-start feature :

e) Is manual operation permissible ? :

4.2 SCR elements provided with

a) Surge protection :

b) Fast acting HRC fuse :

5.0 A.C. SWITCH

- 5.1 (Ψ) Make :
- 5.2 Type/Cat. No. :
- 5.3 Reference Standard :
- 5.4 (Ψ) Rated Current Amp :

6.0 A.C. FUSE

- 6.1 (Ψ) Make :
- 6.2 Type/Cat. No. :
- 6.3 Reference Standard :
- 6.4 (Ψ) Current rating
- a) Continuous Amp :
- b) Interrupting KA :

7.0 A.C. CONTACTOR

- 7.1 (Ψ) Make :
- 7.2 Type/Cat. No. :
- 7.3 Reference Standard :
- 7.4 (Ψ) Rated Current Amp :
- 7.5 Utilization category :
- 7.6 Thermal overload with in-built single-phase preventor provided ? :

8.0 RECTIFIER TRANSFORMER

- 8.1 (Ψ) Make :
- 8.2 Type/Cat. No. :
- 8.3 Reference Standard :

8.4 (Ψ) Ratings

- a) (Ψ) KVA :
- b) (Ψ) Voltage ratio :
- c) (Ψ) Vector group :
- d) (Ψ) %impedance at 75 Deg.C :

8.5 Class of insulation :

8.6 Method of cooling :

9.0 CONTROLLED RECTIFIER (SCR)

9.1 (Ψ) Make :

9.2 Type/Cat. No. :

9.3 Reference Standard :

9.4 (Ψ) Rms Current rating Amp :

9.5 (Ψ) Surge Current

- a) One-cycle Amp :
- b) Repetitive cycle Amp :

9.6 (Ψ) Peak inverse voltage

- a) Continuous Volt :
- b) Surge Volt :

10.0 FILTER CHOKE

10.1 (Ψ) Make :

10.2 (Ψ) Value mH :

10.3 (Ψ) Quantity :

10.4 Class of Insulation :

11.0 FILTER CAPACITOR

11.1 (Ψ) Make and Type :

11.2	Voltage Class	Volt	:	
11.3	(Ψ) Current Rating	Amps	:	
11.4	(Ψ) Quantity		:	
12.0	D.C. FUSE			
12.1	(Ψ) Make		:	
12.2	Type/Cat. No.		:	
12.3	Reference Standard		:	
12.4	(Ψ) Current rating			
	a) Continuous	Amp	:	
	b) Interrupting	KA	:	
13.0	D.C. CONTACTOR			
13.1	(Ψ) Make		:	
13.2	Type/Cat. No.		:	
13.3	Reference Standard		:	
13.4	(Ψ) Current rating	Amp	:	
13.5	Utilization category		:	
13.6	Economy resistor provided		:	Yes/No
14.0	BLOCKING DIODES			
14.1	(Ψ) Make		:	
14.2	Type/Cat. No.		:	
14.3	Reference Standard		:	
14.4	(Ψ) Current rating			
	a) One-minute	Amp	:	
	b) One-hour	Amp	:	
14.5	(Ψ) Peak inverse voltage	Volt	:	

15.0 INDICATION LIGHTS

- 15.1 (Ψ) Make :
- 15.2 Type/Cat. No. :
- 15.3 Reference Standard :
- 15.4 (Ψ) Wattage Watt :
- 15.5 (Ψ) Series resistor Ohm :

16.0 METERS

- 16.1 (Ψ) Make :
- 16.2 Type/Cat. No. :
- 16.3 Reference Standard :
- 16.4 Size :
- 16.5 Accuracy :

17.0 (Ψ) ALARM-FACIA

- 17.1 Make :
- 17.2 Type/Cat. No. :
- 17.3 Reference Standard :
- 17.4 No. of window per facia :

18.0 CHANGE-OVER SWITCH

- 18.1 (Ψ) Make :
- 18.2 Type/Cat. No. :
- 18.3 Reference Standard :
- 18.4 (Ψ) Rating Amp :
- 18.5 No. of poles :
- 18.6 Key interlock furnished ? :

19.0 D.C. SWITCH

- 19.1 (Ψ) Make :
- 19.2 Type/Cat. No. :
- 19.3 Reference Standard :
- 19.4 (Ψ) Rating Amp :
- 19.5 No. of poles :
- 19.6 Key interlock furnished ? :

20.0 CHARGER PANEL

- 20.1 (Ψ) Make :
- 20.2 Type :
- 20.3 Reference Standard :
- 20.4 Enclosure
- a) Degree of protection :
- b) Sheet steel thickness mm :
- 20.5 Panel provided with
- a) Internal lamp with door-switch :
- b) Space heater with thermostat :
- c) 5A 3-pin receptacle :
- 20.6 Internal Wiring
- a) Insulation :
- b) Voltage grade :
- c) Minimum conductor size :
- 20.7 Power Terminals
- a) (Ψ) Make :
- b) (Ψ) Size/Cat. No. :

20.8 Control Terminals

- | | | |
|-------|---|------|
| a) | (Ψ) Make | : |
| b) | (Ψ) Size/Cat. No. | : |
| c) | 20% spare terminal furnished ? | : |
| 20.9 | Ground Terminal furnished ? | : |
| 20.10 | (Ψ) Overall dimension (LxBxH) | mm : |
| 20.11 | (Ψ) Approx. Weight | Kg : |
| 20.12 | (Ψ) General Arrangement drawings furnished ? | : |
| 20.13 | Accessories as specified furnished with battery charger ? | : |

C. DISCHARGE RESISTOR BANK

- | | | |
|------|----------------------------|----------------------|
| 1.00 | Type | : |
| 2.00 | Construction | : |
| 3.00 | Resistor material | : |
| 4.00 | Enclosure Protection Class | : |
| 5.00 | Cooling | : |
| 6.00 | (Ψ) Rating | : |
| 7.00 | Control | : |
| 8.00 | (Ψ) Painting | : |
| | Interior | |
| | Exterior | Shade No.....of IS-5 |
| 9.00 | Reference standard | : |

SECTION 5
CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN THIS
CHECKLIST AS PART OF THE OFFER DULY SIGNED

PLEASE NOTE:

- a) The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.
- b) The evaluation of bidder against qualifying criteria specified under Technical PQR of technical specification shall be based on the documentary proof submitted by bidder along with the offer. Hence bidder shall ensure the completeness of their offer in this regard.

BHEL ENQUIRY. NO:

S.No.	Qualifying criteria (Annexure-B)	Documentary proof required	Yes/No
1	The manufacturer, whose Chargers are offered, should have manufactured and supplied at least two (2) numbers of static automatic voltage regulator type Battery Chargers of highest offered rating or above, at least one (1) each at two (2) different industrial installations, which should be in successful operation for at least two (2) years on 17.10.2017.	Documentary proof attached	

S. No.	Parameters	Data	Yes/No	Remarks
1	Type of Battery Charger	a) Static Type with automatic regulators. b) Compatible with Lead Acid (Plante) Batteries	Yes/No	
2	Float charging	Offered battery chargers are capable of continuous operation at respective rated load at 2.25 Volts per cell while supplying the DC Load	Yes/No	
3	Equalising Charging	Offered battery chargers are capable of equalising charging at 2.33 Volts per cell while supplying the DC Load	Yes/No	
4	Boost Charging	Offered Battery chargers are capable of boost charging associated DC battery at 2.75 Volts per cell at the desired rate	Yes/No	
5	Voltage and Current control	a) All offered battery chargers shall be provided with facility for both automatic and manual control of the output voltage and current. b) Charger output voltage variation shall be within +/- 1%	Yes/No	
6	Ripple content in output voltage	Suitable filter circuits shall be provided in all chargers to limit the ripple content in charger DC output to 1% (rms) with or without battery	Yes/No	
7	Rectifier Transformer	Dry air cooled (A.N), Class F insulation type	Yes/No	
8	Remote Indication	I.)Provision of Potential free NO contacts	Yes/No	

		for following abnormalities – a) AC supply failure. b) Charger overload. c) SCR fuse blown. d) Filter fuse blown. e) DC output fuse blown. f) DC system under voltage. g) DC system over voltage. h) Battery earth fault. i) AC Input fuse blown j) Any other annunciation (as recommended by manufacturer) Separate contacts shall be provided for “Battery earth fault” indication. II) Potential free contact for Float / boost modes provided		
9	Charger construction	In line with clause 2.6 (Section-2)	Yes/No	
10	Tests	Shall be performed in line with clause In line with clause 2.20 (Section-2)	Yes/No	
11	Type test reports	Bidder shall submit valid type test reports (as per relevant IEC/IS standard) for the tests carried out after 17.10.2012. The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports older than 17.10.2012 or the reports of type tests are found to be technically unacceptable by BHEL/Customer, the type test shall be conducted by the vendor without cost and delivery implication to BHEL.	Yes/No	
12	Mandatory spares quoted in line with clause 1.3.5 of section-1		Yes/No	
13	Special tools & tackles as per clause 1.3.6 of section-1 included in the scope of supplies		Yes/No	
14	Transducers as per clause 2.10 (Section-2) included in the scope of supplies		Yes/No	
15	Bidder to confirm that it will offer approved make of components & fitments at Contract stage. In case the offered make is not approved by the Customer, then alternate make shall be supplied without any commercial implication to BHEL.		Yes/No	

ANNEXURE - A
SCHEDULE OF TECHNICAL DEVIATIONS

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

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

Date:

Tenderer's Stamp & Signature

ANNEXURE – B

Technical Pre-Qualifying Requirements

The Bidder should have manufactured and supplied at least two (2) numbers of static automatic voltage regulator type Battery Chargers of highest offered rating or above, at least one (1) each at two (2) different industrial installations, which should be in successful operation for at least two (2) years as on zero date of Yadadri (17.10.2017).