SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

110 V, 15A, 30A, 60A BATTERY CHARGER

APPLICABLE TO KSEBL	**Rev#0**	DOC. NO.: **SCM-SPEC/XT/110V,15A, 30A, 60A Battery Charger**
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Technical Specification and Evaluation Committee for Transmission Material

(i) Document Approval & Control Status

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Date	09/04/2021	23/04/2021	03/05/2021
Signature	Sd/-	Sd/-	Sd/-

(ii) Amendments and History

Sec. #	*Rev. #*	*Date*	*History of Change*

1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **110 V, 15A, 30A, 60A Battery Charger** in a professional manner

2. SCOPE:

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL. Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **110 V, 15A, 30A, 60A Battery Charger** used in field by KSEBL

3. RESPONSIBILITY:

The Executive Engineer (T), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION:

Modifications if any, in the technical specification will be incorporated as **Revisions.** Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **"(ii)-Amendments and history"** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM).** Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**

CONTENTS

TECHNICAL SPECIFICATION AND CONSTRUCTIONAL FEATURES FOR BATTERY CHARGER

1.0) **General:-** The specification covers the design, manufacture, factory testing, marking, packing, shipping, transportation, installation, site testing and commissioning of 110V Chargers.

The detailed and specific data are specified in the Drawings, Guaranteed Technical Particulars (GTP) and other documents that form part this Specification.

The required Charger shall conform in every respect to recognize standards for engineering design and workmanship and shall be capable of performing continuous commercial operation within the parameters guaranteed by the manufacturers and in accordance with the specifications.

The Chargers, to be offered, shall be complete in all respects necessary for their effective and trouble free operation as far as possible.

1.1) **Drawings:-** Typical drawings for Substation Supply Systems shall be provided.

1.2) **Standard to be followed:-** The components of the charger shall comply with existing IS/IEC standards specification, including as amended from time to time.

2.0) **Technical Description:-**

2.1) **General Requirements:-** The 110V DC charger systems shall be used in various Generating Stations/ Substations to provide the required DC supply for the protection relays, tripping circuit of all feeders & subsequent restoration, closing circuit of all feeders, local indication, control equipment and fire fighting (if available).Generally 55 Cells Lead acid Battery will be used.

The required charger /distribution board systems shall be designed with following functional blocks integrated in a single unit.

a) One Float cum Boost charger

b) One distribution board for distributing power to the various loads

Each system shall be rated to feed 100% of the entire calculated DC load. The Supplier/Contractor shall provide a comprehensive calculation for the charger capacities considering the worst loading conditions, for KSEB approval.

The nominal rating of the DC Supply shall be 110V at DC Distribution Board Busbar. The chargers shall be fed through 415V AC, 3 –phase, 50Hz 4 wire system. The charger offered shall be designed to work as indoor equipment (unless otherwise specified)

Electronic circuits shall be preferably of conventional analog and digital mixed circuits but not limited to the same. Various limits and configuration settings shall be accessible to user through trim potentiometers.

Where numerical circuits using microcontrollers were used as controllers, manufacturer shall provide sufficient proof and guarantee regarding reliability of programmed memories/circuits in case of faults/ Earth potential Rises and severe EMI conditions. Circuits shall be designed as immune to all such external interferences. Spares of these microcontrollers cards should be provided and be made available by the firm.

Where numerical circuits are used in configuration, all software /tools shall be provided for configuration of chargers such as voltage and current limits, program for automatic modes etc along with each equipments or shall be integrated with the equipment.

2.2) **Charger & Distribution Board:-**

2.2.1) **General:-** The battery charger and DC distribution board shall be integrated in a single unit based on the rating. It should have 2 incomers having the same rating, one for connecting the battery system and another for paralleling with a second distribution board for taking/giving backup DC. The first incomer should have a normal DC ammeter and second incomer should have a central zero DC ammeter. The bidder/supplier shall submit GA drawing along with the tender.

The battery charger shall be designed for float mode and boost mode. It shall be suitable for initial charging of Lead Acid, Plante type and Tubular Type Battery. The battery charger shall be capable of continuous operation to feed the 100% load including charging the corresponding battery bank, either on float or on boost charging modes. The cubicle shall be an indoor, floor-mounted, self-supporting sheet metal enclosed cubicle.

All necessary base frames, anchor bolts and hardware shall be part of cubicle fixing. 3.0mm thick sheet shall be used for load bearing parts and 2.0mm thick sheet shall be used for other parts of the charger. Type of cooling shall be natural air cooled/forced air cooled as per the design requirement. Heat dissipation and temperature rise calculation inside the cubicle of the charger shall be submitted for the approval of the KSEB Limited. For forced air cooling system, suitable louvers with filters shall be provided.

Removable gland plates shall be provided in the cubicle. The lugs for power cables shall be made of electrolytic copper with tin coat. Power cable sizes shall be defined based on calculation for the voltage drop over each stage and accordingly the suitable cable lugs and drilling of gland plates shall be defined.

The cubicle shall be vermin proof. Ventilation louvers shall be backed with air filter. Cooling fans shall be provided as specified above. Fan failure alarms shall be provided, wherever applicable. All doors and covers shall be fitted with synthetic rubber gaskets of good quality.

The cubicle shall have hinged double leaf doors at the backside and hinged single leaf front door (2 Nos.) i.e, cubicle shall have both front and rear end openings for adequate access to the inside components. All indicating instruments, control switches and indicating lamps shall be mounted on the inner front door of the cubicle. Front outside door shall be provided with polycarbonate sheet window to view the equipments installed in the inner front door, from outside. The cubicle doors shall be properly earthed. The degree of protection of charger cubicle shall be at least IP-42.

The control wiring shall be PVC insulated, fire retardant (1.1kV) of at least 2.5mm^2 stranded copper wires. Control terminals shall be suitable for connecting two wires, with 2.5mm^2 stranded copper conductors. All terminals shall be numbered for ease of connections and identification. Each wire shall bear a ferrule or tag on each end for identification. At least 10% spare terminals shall be provided for control circuits.

The insulation of all circuits except the low voltage electronic circuits shall withstand test voltage of 2 kV AC for one minute.

The detailed technical specifications are to be filled up in the GTP, Annexure II that form part of this specification.

AC and DC switches shall be provided at the input and output respectively with adequate rating. The operating handle of the switch shall be fully insulated.

The charger failure device shall detect the AC supply voltage failure. The detecting device shall not operate on switching surges or transient loss of voltage due to faults on the power system. In addition, the charger shall be equipped with a 4 pole MCB and contactor at the input and fuses and an off load isolator at the DC output. A suitable single phasing detection shall be provided for the AC input. The relay shall initiate necessary alarms for single phasing.

Application of chargers will be as follows:- The float cum boost charger is to be designed to charge the battery after drainage as well as supply to the load simultaneously.

Sl No	Rating of Charger	Max Battery Current from charger	Battery to be used	Remarks
1)	15 A	10 A	100 AH Lead Acid plante/tubular /VRLA in 0.1C10 curve	Shall be suitable for all batteries, but in case of VRLA we will use only float mode
2)	30 A	20 A	200 AH, lead acid plante/tubular/VRLA In 0.1C10 curve	Shall be suitable for all batteries, but in case of VRLA we will use only float mode
3)	60 A	40 A	300 AH or 400 AH lead acid plante/tubular in 0.1 C10 curve	Battery current limit shall be adjustable to connect 100 Ah and 200 also

Chargers shall be equipped with following modes manually selectable via multiple position switches.

Sl. No.	Mode	Controller characteristics	Range
1)	FLOAT	Constant voltage controller with adjustable battery current limit	90 V to 127 V at battery terminals Voltage variation and battery current limit shall be possible through input Potentiometers
2)	Manual boost	Constant current controller with adjustable voltage limit	20 % to 100 % battery current(in 0.1 C10 curve) shall be adjustable through potentiometer.
3)	Automatic boost	Constant voltage controller or constant current controller	Boost initiation shall be depends on discharge condition and stop shall be depending on voltage attainment during charging. Change over shall be fully automatic.
4)	Initial Charging	Constant current controller with adjustable voltage limit	20 % to 100 % battery current(in 0.1 C10 curve) , shall be adjustable through potentiometer. Voltage range from 90 to 150 V.

During changing of charger from float to boost and vice versa, should be with uninterrupted DC output. The battery tapping connected to output for boost charging should

have the full DC current output rating. In all cases output voltage at DC distribution shall be within safe range specified elsewhere in this document.

The battery charger shall be provided with facility for both automatic and manual control of output voltage and current. It shall have current limiting facility, if the voltage control is in an automatic mode and shall cause a gradual lowering of the output voltage when the DC load current exceeds the load limiting setting. The current limiting characteristics shall be such that any overload or short circuit in the DC system shall neither damage the charger, nor cause blowing of any of the charger fuses. The charger shall have an adjustable current limiting facility, also for safe guarding the Battery. The charger shall not trip for overload or external short circuit. Soft start feature should be invariably provided to minimize the in-rush current.

Uniform and smooth adjustments of voltage setting (in both manual and automatic modes) shall be provided. During boost charging, the battery charger shall operate on constant current mode. It shall be possible to adjust the boost charging current continuously over a range of 20 to 100% of the rated output current for boost mode. During float mode, the charger shall be on constant voltage mode with battery current limiter. During boost charging, DC output from charger shall be within specified limit. For achieving this, suitable battery tap selection with adequate contactors and blocking diode shall be provided.

For limiting the output voltage of the charger, a potentiometer shall be provided, whereby it shall be possible to set the upper limit of the boost voltage as per specified value.

The charger shall be able to recharge the battery after a complete discharge cycle, i.e, to 95% of its capacity within a time interval of not more than 10 hrs and in the mean time supply the entire equipment design load. Suitable filter circuits with fuse failure alarms shall be provided in the charger to reduce as much as possible the ripple content and also to suppress noise in the output voltage irrespective of the DC load, especially when the battery is not connected to the charger. The charger output voltage (battery disconnected from the charger) shall be free of noise by providing noise filters. The input of the charger shall be equipped with a device, which shall cause the charger to switch off in the event of DC output over voltage, short circuit at the charger and shall not cause any damage to the charger from the battery side.

The construction of the charger shall ensure easy access to all components for smooth and safe maintenance.

AC and DC Voltmeters and ammeters (with shunt) shall be provided for the charger, at the input and output correspondingly. The instruments shall be flush type, dust proof and moisture resistant. The instruments shall have easily accessible means for zero adjustment. A low range Ammeter (0-5) A with push button shall be provided to measure trickle charging

current in float operation. All fuses for the protection of outgoing DC circuits shall be HRC type. Rectifier unit shall be protected with semiconductor fuses in AC & DC side with fuse failure alarms. Fuses shall be mounted on fuse holders mounted on fuse bases. The design of the charger shall not allow any reverse current flow from the DC battery into the charger.

The rectifier shall be for three phase full wave thyristor controlled bridge circuit with LC ripple filters.

2.2.2) **Distribution Board:-** The incomers should have HRC fuses with on load 2 pole isolation switches with sufficient DC rating. At the output, the 110V DC distribution boards shall comprise DC MCBs at the output to feed all various equipment. All DC MCBs shall be connected to the DC Bus bar in the panel. The output of MCBs shall be terminated in suitable bolted type terminal connectors. The cables between MCBs and terminal block shall be selected at suitable rating.

OPTIONAL:

Single core PVC insulated un- armored flexible stranded copper cable with suitable lugs (as required) shall be offered along with Battery charger.

400AH- size of 70 mm^2

200 & 100AH size of 35 mm^2

Per unit cost of the cable shall be quoted by the bidder along with commercial offer.

At the output, the 110V DC distribution boards shall comprise DC MCBs at the output to feed all various equipment. MCB used in DC circuit is suitable and rated for DC application.

2.2.3) **Devices on the Instrument Panel:-** The following devices shall be furnished and mounted on the instrument panel of the chargers.

a) MANUAL-AUTOMATIC change-over switch.
b) Boost/Float Selection Switch.
c) DC Leakage detector: Centre “0” DC Analogue meter with E/F detector Alarm.
d) One AC voltmeter for reading the AC input supply voltage with selector switch.
e) One AC ammeter for reading the AC input current with selector switch.
f) Three DC voltmeters with suppressed zero (one for the charger output, one for the battery voltage and one for the load voltage)
g) Four DC ammeter, (one for the charger output current, one for the battery current bi-directional and one for the load current and one for trickle charger) with externally – mounted shunt as applicable.

h) Potentiometer shall be provided for current control and voltage control in float and boost modes separately.

i) An isolating switch to disconnect 415 V AC supply to the charger before MCB is to be provided with HRC fuse rating of minimum 10 A, 16 A & 32 A for 15 A, 30 A & 60A Battery Chargers respectively.

j) Battery disconnecting device with auxiliary switch as per specification.

k) In the DC distribution board, the first incomer should have a normal DC ammeter and second incomer should have a central zero DC ammeter

2.2.3.1) **Alarms and Indications:-** The following LED indications shall be provided in the charger and distribution panel to announce and monitor the following events respectively: Test, accept, reset facility shall be provided. Alarm shall be triggered at every event of faults. (Irrespective of persisting alarm).

1) Push button for all LEDs testing.
2) Charger supply on.
3) Supply main failure.
4) Rectifier failure.
5) Charger, fuse/MCB trip.
6) DC output high.
7) DC output low.
8) Charger on boost mode.
9) Battery earth leakage.
10) AC Under voltage and over voltage.
11) Battery isolator open.
12) Output DC filter fuse failure.
13) Single phasing alarm.
14) Fan failure alarm/OVER TEMEPRATURE ALARM.

All alarms shall be wired up to Terminal Block. Item Nos. 4,6,7 and 12 shall be grouped and provided with a potential free contact for remote monitoring. One potential free contact shall be provided for 8, for remote monitoring.

2.2.3.2) **Protection and Control System:-** The charger shall be equipped but not limited to the following protective and control devices:

a) Charger shall be self protected against high transient over-voltages in DC and AC control and power circuits. The protection shall be built into the equipment and no special external connections, configuration of leads or connections of any external equipment shall be required.

b) Protection against discharge of the battery into the battery chargers upon failure of AC supply, with automatic resumption of pre-set charging rate when power is restored.

c) Single Phasing Prevention (all three phases if a three-phase unit is specified).

d) Low DC voltage relay.

e) DC over-voltage relay.

f) Any failure of the charger, detected by any of these alarms, or protective devices shall be indicated locally, either by lights, or on the front of the rectifier and on local annunciation panel. These alarms shall be possible for grouping in one common alarm for remote transmission.

g) Forced air cooling system failure alarm shall be provided if such a cooling system is used.

h) Terminal blocks: Nut & Bolt type shall be used.

i) Zero of earth leakage detector system shall be earthed and voltage of +ve & -ve terminal of DC shall be equal in magnitude with respect to ground.

2.2.4) **Noise Level:-** The level of the noise generated by the charger equipment, which is supplied under this specification, shall meet requirements as specified in the Guaranteed Technical Particulars (62dB).

In case the maximum level of the sound exceeds the specified allowable value, the Supplier/contractor shall use acoustical treatment features, subject to review of KSEB and acceptance, to achieve the sound control design objectives.

2.2.5) **Nameplates, Labels and Marking:-** The nameplate shall be white with black engraved letters. On top portion of each battery bank and charger, on front as well as rear sides, larger and bold nameplates shall be provided to identify the charger. Nameplates with full and clear inscription shall also be provided on and inside of the panels for identification of various equipments and ease of operation and maintenance.

2.2.6) **Painting/Corrosion Protection:-** All sheet steel work shall be phosphated in accordance with IS-6005 “Code of practice for phosphating iron and steel.

Oil, Grease and dirt shall be thoroughly removed by emulsion clearing. Rust and scale shall be removed by picking with diluter acid followed by washing with running water, rinsing with slightly alkaline hot water and drying. After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed stowing type zinc chromate primer. The first coat may be “Lush dried” while the second coat shall be stowed.

After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stowing. The second finishing coat shall be applied, after inspection of 1st coat of painting. The exterior paint colour shall be RAL7032. The interior colour shall be white. Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the panels.

2.2.7) **Interior Lighting and Receptacles:-** Each panel shall be provided with a fluorescent lighting fixture rated for 240 Volts, single phase, 50 Hz supply for the interior illumination of the panel during maintenance. The fittings shall be complete with switch fuse unit, panel door switch etc. for the automatic switching of the fitting. Each panel shall be provided with 240V, single phase, 50 Hz, 5A, 3 Pin receptacles with switch. This shall be mounted inside the panel at a convenient location.

2.2.8) **Earthing:-** The charger panels shall be equipped with an earth fixed along with inside base of panel. The materials and sizes of the bus bar shall be at least 50 x 6 mm tinned copper flat unless specified otherwise. Provision shall be made on the earth bus bars of the end panels for connecting to purchaser's earthing grid. Necessary terminal clamps and connectors for this purpose shall be included in the scope of supply. All metallic cases of relays, instruments and other panel mounted equipment shall be connected to the earth bus by independent copper wires of size not less than 2.5 Sq. mm. The colour of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connections and soldering shall be permitted. Earthing pad of minimum size 30x30mm shall be provided on the side of the panel.

3.0) TESTING AND INSPECTION:-

3.1) General:- Testing of the battery charger shall be performed in line with this specification and in accordance with the relevant IS/ IEC Standards (as minimum requirement) and other Standards as may be approved by KSEB Limited. The battery charger system shall be subject to inspection and test by KSEB Limited.

Acceptance by KSEB Limited representative of any unit shall not relieve the manufacturer from any of his performance guarantees or from any other obligations. Test certificates for each unit shall be submitted prior to delivery of the unit.

KSEB Limited reserves the right to perform checks during manufacturing process at any time or all the times. It shall be at the discretion of KSEB Limited to witness tests on 100% or any percentage quantity of each lot for routine tests, apart from the type tests, wherever called for.

Zero of Earth Leakage Meter shall be earthed. Both sides shall be $\pm$ 55V.

3.2) **Factory Tests:-**

3.2.1) **Type Tests:-** The battery charger system/equipment shall be fully type tested, including capacity test, No load test, insulation test and temperature rise test, as defined in the relevant IS/ IEC recommendation (as a minimum requirement).

Evidence shall be given that the battery charger under these specifications, have successfully passed all type tests of design, service frequency, impulse, insulation level, dynamic operating range, and electrical and mechanical endurance performance, as appropriate and as specified.

However, if deemed necessary, KSEB Limited shall decide if additional special tests are required to be performed by the Supplier/Contractor. The Supplier/Contractor shall supply certified copies of type test certificates covering the proposed battery chargers of similar operating range, data features, design and construction.

Type tests certificates/reports shall be considered acceptable if they are in compliance with the relevant Standards and the following:

- The equipment quoted shall have type test certificate from an accredited laboratory as per IEC/ IS/ Technical specification.
- Type test certificate within 7 years shall be submitted.
- Type tests witnessed by an approved agency acceptable to KSEB Limited shall also be considered.

If the presented type test reports are not in accordance with the above requirements, KSEB Limited may decide to ask for the type tests to be carried out in the manufacturer's premises or other places subject to the approval of KSEB Limited at no additional cost, and in the presence of an approved agency acceptable to KSEB Limited and should issue the relevant type test certificates upon successful test.

3.2.2) **Sample Tests:-** Sample Tests shall be performed, comprising as a minimum the following tests.

1. Visual checks and measurements of dimensions.
2. Battery Charger labeling as per this specification.
3. Functional tests.

3.2.3) **Routine Tests:-** The Supplier/Contractor are required to carry out routine tests on each assembled and finished charger system to demonstrate the integrity of the DC Supply system.

Routine test certificates shall be submitted for KSEB Limited's review and approval before shipment of the charger.

The battery charger shall pass all the routine tests as laid down in the relevant IEC/other specified Standard. The proposed routine tests are:

1. Visual inspection to determine conformity of the battery charger.
2. Insulation resistance test (HV test)
3. **Voltage regulation (both load and line regulation)** check from 0 to 100% loads with + / - 1 0 % voltage variation in all modes of charging
4. Ripple content measurement.

In addition to the standard routine tests on the charger, the following tests shall be performed:

- Load test and **temperature rise test for the transformer and thyristor**
- Automatic voltage regulator operation
- Performance test on the completed panel
- Surge withstand capacity test
- Load limiting feature
- Efficiency of the charger at full load
- Sensitivity of Ground fault protection cards

3.2.4) **Special Tests:-** The following test shall carried out in addition to what has been stipulated in the IEC Standard:-

- Ripple Test (with and without battery)
- Noise measurement
- High voltage test on power and control circuits

3.3) **Acceptance Tests:-** The tests shall comprise but not limited to the following test:

3.3.1) **Physical Inspection:-**

a) Checking of the battery charger cabinet interior to verify clearances between live electrical parts, insulation of phase and neutral buses from cabinet, and tightness of all mechanical connections.

b) Checking of main breaker trip element dimension and ratings at the battery charger cabinet shall be performed and comparison with the approved wiring diagrams.

c) Checking the operation of the main breaker by application open-close-open sequence manually.

d) Checking of wiring termination and conductor sizes.

e) Checking of tightness of connection and fastenings, and use of proper tools.

f) Checking the correct phasing of equipment connection.

g) Checking the proper grounding.

h) Checking of all current carrying connections, including bus connections and wiring, as installed by Supplier/Contractor, in agreement with wiring drawings.

i) Checking of physical integrity of major parts and all instruments and components.

j) Checking of proper battery charger cabinet and cable identification **and proper terminations.**

k) Checking the correct circuit **fuse rating.**

l) Checking the ratings, dimensions, protection class of all major components, as panels, cubicles, silicon rectifiers, buses, circuit breaker, fuses, relays, transformers, etc. and confirmation that the equipment complies with the specification. Any non-compliance shall be reported to the Contracting Officer.

3.3.2) **Tests:-**

a) Polarity check.

b) Proper settings and calibrations **of all equipment used.**

c) Meter calibration and operation.

d) Functional check of all alarm circuits including low voltage, ground detection and AC failure.

e) Insulation resistance test.

f) Output ripple test.

g) The ability of the charger to maintain this desired operating voltage level.

h) Testing of breaker trip settings.

i) Measurement the continuity of each current carrying connection by MEGGER.

j) Testing the changing output voltage function by disconnected battery.

k) Testing the quick charge and trickle charge mode.

l) Testing the charging current limiting (maximum current) by short-circuited DC output.

m) Testing of automatic periodic dis-charging/re-charging.

n) Testing the Battery Charger inputs/digital outputs and control (LED's) and protection functions at/from the Battery Charger Board.

o) Testing the Battery Charger inputs/digital outputs, alarm indications (LED's) and fault monitoring at the Battery Charger Board.

p) Measurement of Voltage Regulation.

q) Efficiency of the charger at full load.

r) Sensitivity of Ground fault protection circuits.

4.0) Documents:- User/Technical/ commissioning Manual shall be submitted for approval. Manual shall contain following information but not limited to the same.

1) General arrangement drawing with main dimensions.

2) Detailed drawing and explanation showing all functional block diagram, user inputs, user accessible settings, controller card, thyristor assembly, DC distribution, Alarm circuited layout etc.

3) Detailed description of working of charger in Float Mode, Boost Mode (Manual and Automatic), Initial charging of Batteries, various configuration settings, pre cautions to be taken in handling and commissioning etc shall be explained in Manual.

4) Detailed proposed wiring diagram. As Built wiring diagram shall be provided along with equipment after implementing all approved deviations.

5) Bill of Materials

4.1) Important points to be included in the drawing

1) Battery charger circuit to be shown clearly including the functions of each mode (Auto, Float and Boost) and shall be explained in the drawing as foot note for O&M application at site.

2) Initial charging facility provided to be specified.

3) Power circuit wiring shall be provided with adequate cable capacity up to 15A Charger transformer circuit 4mm2 and above 15A charger 10mm2 minimum .

4) Rear side door should be manufactured as double leaf whose panel width above 600mm size for easy maintenance and due to space constrains in the substation.

5) The **rectifier transformer** used in the power circuit and control circuit should be manufactured with copper winding with adequate VA **and as per IS 2026** and its latest amendments. The connection shall be Star/Star or Star/Delta. The minimum VA required for the charger is 2500/ 5000/10000 for 15A/30A/ 60A chargers respectively.

6) Single phase prevention scheme including direction of circuit activation to be specified.

7) Voltage and current selection scheme to be clearly shown.

8) Supply side and battery side fuses and electronic switch contacts should be provide with adequate capacity/ rating. Over rated contacts paralleling not recommended, preferably use single contacts with adequate rating or use 2 equal rating of contacts in parallel.

5.0) Training:- Training shall be provided to selected KSEB Limited Engineers at Factory on a mutually agreed date.

6.0) Installation Commissioning:- Installation shall be done by KSEB Limited and advance notice will be given for commissioning. Commissioning of charger and onsite training will be in the scope of work of contractor.

ANNEXURE II - SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

Sl. No.		Required	Tendered		
1	**BATTERY CHARGER**		**15A**	**30A**	**60A**
1.01	**General**				
1.01.1	Manufacturer				
1.01.1.1	Name				
1.01.1.2	Country of manufacturing				
1.01.2	Applicable Standards	IS 4540/IEC 146			
1.01.3	Configuration	3 Phase 4 wire thyristor controlled full wave bridge rectifier with float cum boost charger			

1.01.4	Type test	To be carried out at any approved lab/witnessed by Central Govt. Utility Engineer/ KSEB Engineer			
1.01.4.1	Carried out	Yes/No			
1.01.4.2	Date	DD/MM/YY			
1.01.4.3	Testing Laboratory	-			
1.01.4.3.1	Name	-			
1.0.1.4.3.2	Country	-			

2.02	**Design Data**				
2.02.1	AC input details				
2.02.1.1	Rated input voltage (if 3 phase) (V)	415V-15%+10%			
2.02.1.2	Rated frequency Hz	50			
2.02.1.3	Input Power VA	2500/5000/10000 for 15 A/30 A/60 A respectively			
2.02.2	Nominal output voltage V	110			
2.02.3	Charger characteristics follows	Float Cum Boost Charger			

2.02.4	Constant voltage/constant current	Yes			
2.02.5	Output voltage stability from no load to full load with the AC variation as specified above %	0.5			
2.02.6	Radio interference suppression degree of interference	Yes			
2.02.7	Charger continuous rated output current (at 40^0c) including the derating factor	100%			
2.02.7.1	On float mode A	15/30/60 A			
2.02.7.2	On boost mode A	15/30/60 A			

2.02.8	Ripple content in DC output				
2.02.8.1	With battery mV	1			
2.02.8.2	Without battery mV	<1.5%			
2.02.9	Charger rated output voltage	110 V DC normal Up to 150 V for initial charging			
2.02.9.1	Float charging Voltage	90-127 VDC			
2.02.9.2	Boost charging Voltage	0-150 VDC			
2.02.10	Load limiter current setting range for float charge %	100 %			

2.02.11	Time required to charge an empty battery after a discharge cycle Hrs	10 Hrs			
2.02.12	Automatic voltage regulator (float/boost charge)	Yes			
2.02.12.1	Type				
2.02.13	Manual voltage regulator (float/boost charge)	Yes			
2.02.13.1	Type	Potentio-meter			
2.02.13.2	Voltage setting range V	Float 90-127 V Boost 90-150 V			
2.02.13.3	Boost charging current setting range A	>1.5 to 15 A >3 to 30 A > 6 to 60 A			
2.02.13.4	Boost charging voltage limit setting range V	90-150 VDC			

2.02.14	Rectifier input transformer				
2.02.14.1	Manufacturer				
2.02.14.1.1	Name				
2.02.14.1.2	Country of manufacturing				
2.02.14.2	Type (3Ø Star-Star or Star - Delta)	Double wound dry type with copper winding			
2.02.14.3	Rated power	2500/5000 /10000 for 15 A/30 A/60 A			
2.02.14.3.1	Float charging KVA	Preferably 100 %			
2.02.14.3.2	Boost charging KVA	100 %			

2.02.14.4	Class of insulation	Class F			
2.02.14.5	Power frequency withstand voltage(1 min) KVrms	>=2			
2.02.14.6	Overload capacity %	110			
2.02.15	DC Instrument				
2.02.15.1	Voltmeter				
2.02.15.1.1	Manufacturer				
2.02.15.1.1.1	Name				

2.02.15.1.1.2	Country of manufacturing				
2.02.15.1.2	Type				
2.02.15.1.3	Range V	0-150 V			
2.02.15.1.4	Accuracy class %	1			
2.02.15.2	Ammeter for load current				
2.02.15.2.1	Manufacturer				
2.02.15.2.1.1	Name				

2.02.15.2.1.2	Country of manufacturing				
2.02.15.2.2	Type	Analogue			
2.02.15.2.3	Range	Min 150 % of FL			
2.02.15.2.4	Accuracy class %	1			
2.02.15.3	Ammeter for battery				
2.02.15.3.1	Manufacturer				
2.02.15.3.1.1	Name				

2.02.15.3.1.2	Country of manufacturing				
2.02.15.3.2	Type	Analogue			
2.02.15.3.3	Range Current	Centre Zero meter with 150% FL capacity			
2.02.15.3.4	Accuracy class %	1			
2.02.16.	AC Instrument				
2.02.16.1	Voltmeter				
2.02.16.1.1	Manufacturer				
2.02.16.1.1.1	Name				

2.02.16.1.1.2	Country of manufacturing				
2.02.16.1.2	Type				
2.02.16.1.3	Range Voltage	0-500 V			
2.02.16.1.4	Accuracy class %	1			
2.02.16.2	Ammeter				
2.02.16.2.1	Manufacturer				
2.02.16.2.1.1	Name				
2.02.16.2.1.2	Country of manufacturing				
2.02.16.2.2	Type	Analogue			

2.02.16.2.3	Range	Based on Transformer input VA			
2.02.16.2.4	Accuracy class %	1			
2.02.17	Float charging A	Depends on charger capacity			
2.02.17.1	Boost charging A	150% of FL			
2.02.17.2	Short time current rating A	>110 - 150 % of rated current			
2.02.17.3	Float charging A	Based on charger capacity			
2.02.17.4	Boost charging A	150% of FL			

2.02.17.5	Type of semi-conducting material	Silicon			
2.02.17.6	Rectifier input protection	Ultra fast rectifier fuses with fuse failure alarm			
2.02.18	DC Outlet MCBs for 15A Charger (i) DP- 3Nos. A (ii) DP-12Nos.A	 25 16			
2.02.19	DC Outlet MCBs for 30A Charger (i) DP- 2Nos. A (ii) DP- 6Nos.A (iii) DP- 12Nos. A	 50 25 16			
2.02.20	DC Outlet MCBs for 60A Charger (i) DP- 2Nos. A (ii) DP- 5Nos. A (iii) DP- 12Nos. A (iv) DP- 25Nos. A	 100 50 25 16			
2.02.21	Guaranteed efficiency at rated load %	80			

2.02.22	Noise level (maximum) dB(A)	62			
2.02.23	Automatic voltage regulators	Yes			
2.02.24	Automatic current regulators	Yes			
2.02.25	Soft start feature	Yes			
2.02.26	Smoothing resistor/capacitor filter circuit	Yes			
2.02.27	Selector switch for automatic and manual	Yes			
2.02.28	Climatic requirement				

2.02.28.1	Operation temperature (max.) ^{0}C	40			
2.02.28.2	Operation temperature (min.)^{0}C	4			
2.02.28.3	Relative humidity				
2.02.28.3.1	Maximum %	95			
2.02.28.3.2	Minimum%	5			
2.03	**Other Performance Data**				
2.03.1	First commercial operation of the battery charger DD/MM/YY				

2.03.2	Reference list attached Yes/No				
2.04	**Supporting Documents**				
2.04.1	All drawings and technical literature of battery chargers enclosed	Yes			
3.00	**TESTS**				
B.	**Battery Charger**				
3.01	Insulation test	Yes			
3.02	Load test	Yes			
3.03	Ripple test	Yes			

3.04	Noise measurement test	Yes			
3.05	Voltage regulation checks	Yes			
3.06	Current limit facility test	Yes			
3.07	Recharge test of discharged battery	Yes			
3.08	Checking of all auxiliary contacts	Yes			
3.09	Alarm indications checks	Yes			
3.10.	Verification of voltage and current adjustments	Yes			
3.11	Heat Run Tests	Yes			
4.00	**SUPPORTING DOCUMENTS**				
4.01	All assembly and detailed drawings	Yes			

4.02	Technical literature of chargers enclosed	Yes			
4.03	Type test reports enclosed	Yes			