



GUJARAT ENERGY TRANSMISSION
CORPORATION LTD.

SARADAR PATEL VIDYUT BHAVAN,
RACE COURSE, BARODA – 390 007.

TECHNICAL SPECIFICATIONS

FOR

110 V BATTERY CHARGER

GETCO / E / TS- BCHR 3201 / R3 Mar 16

SPECIAL INSTRUCTIONS TO BIDDER

Please read following instructions carefully before submitting your bid.

1. All the drawings, i.e. elevation, side view, plan, cross sectional view etc., in AutoCAD format and manuals in PDF format, for offered item shall be submitted. Also the hard copies as per specification shall be submitted.
2. The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.
3. The bidder shall have to submit all the required type test reports for the offered item. **However in case of partial submission or reports older than specified limit, bidder must submit his confirmation for those type test report/s to be submitted in the event of an order, without affecting delivery schedule, before commencement of supply, free of cost. In absence of this confirmation, the evaluation shall be carried out accordingly as non-submission of type test reports.**
4. The bidder must fill up all the point of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in.
5. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.
6. The bidder is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by GETCO, in the event of an order, free of cost. The cost of logistics will be bear by GETCO.
7. Please note that the evaluation will be carried out on the strength of content of bid only. No further correspondence will be made.
8. The bidder shall bring out all the technical deviation/s only at the specified annexure.
9. The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).

QUALIFYING REQUIREMENT DATA

(For Supply)

Bidder to satisfy all the following requirements.

- 1) The bidder shall be Original Equipment Manufacturer (OEM). The offered equipment have to be designed, manufactured and tested as per relevant IS/IEC with latest amendments.
- 2) The minimum requirement of manufacturing capacity of offered type, size and rating of equipment shall be **7 times tender / bid quantity**. The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).
- 3) Equipment proposed shall be of similar or higher rating and in service for a minimum period of THREE (3) years and satisfactory performance certificate in respect of this is to be available and submitted.
- 4) The bidder should clearly indicate the quantity and Single Value Contract executed during last FIVE (5) years, for the offered equipment. Bidder should have executed one single contract during last five years for the quantity equivalent to tender / bid. The details are to be submitted in following format,

Sr. No	ITEMS SUPPLIED TO	ORDER REFERENCE No. & DATE	ITEMS	QUANTITY	ORDER FULLY EXECUTED. YES/NO	STATUS, IF ORDER UNDER EXECUTION	REMARK
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- 5) Equipment offered shall have Type Test Certificates from accredited laboratory (accredited based on ISO/IEC Guide 25 / 17025 or EN 45001 by the National accreditation body of the country where laboratory is located), as per IEC / IS / technical specification, valid for a period of **SEVEN** years *from the expiry date of validity of technical bid*.

TECHNICAL SPECIFICATION OF BATTERY CHARGER FOR 110V, LEAD ACID or Ni-Cd TYPE BATTERY SETS

1.0. SCOPE:

- 1.1 This specification covers design, manufacture, testing at works and supply of the complete (i) **Single phase, Float - 10A & Boost - 20A** (ii) **Three phase, Float - 30A & Boost - 50A/55A/80A** battery chargers **with DCDB** suitable for 110 Volts Lead Acid or Ni-Cad Battery set.

The scope shall also include SCADA compatibility if indicated in schedule-A of respective tender.

2.0. APPLICABLE STANDARDS:

- 2.1 The design, manufacturer, and performance of the charger shall comply with all currently applicable statutes, regulations and safety codes. NOTHING IN THESE specifications shall be construed to relieve the bidder of his responsibility.
- 2.2. Unless otherwise specified, the battery charger shall conform to the latest applicable Indian/IEC, standards, and in particulars, to the followings standards.
- a) IS: 3895 : Specification for Rectifier equipment in general.
 - b) IS: 2208 : Specification for HRC fuses.
 - c) IS: 1248 : Indication instruments
 - d) IS: 13947-I : Low Voltage Switchgear And Controlgear**
 - e) IS: 2147 : Degree of protection for cubicles.
 - f) IS: 375 : Specification for wiring.
 - g) IS: 4540 : Mono-crystalline semiconductor rectifier assemblies and equipment.
 - h) IS: 6619 : Safety code for semiconductor rectifier equipment.
 - i) IS: 2026 : Transformers.

- j) IS: 2959 : AC contractors for voltage not exceeding 1000 V.
- k) IS: 6005 : Code of practice for phosphating of Iron and steel.
- l) IS: 5921 : Printed Circuit board.
- m) IEC: 249 : Printed Circuit Board.

2.3. The bidder shall clearly state the standards to which the charger & its part items offered by him – Confirmed.

3.0 CONSTRUCTION:

- i) It will be indoor, free standing, floor mounting and naturally air cooled type designed for continuous operation in a ambient temperature of 50 °C. Good ventilation shall be made through side louvers.
- ii) Each charging equipment offered shall be housed in a sheet steel cubical reinforced by M.S. angle frame **of size 25 x 25 x 3 mm min.** and shall be mechanically strong. The cubical shall be dust and vermin proof. The degree of protection IP - 42 shall be provided and stated in the offer. The rear & front door cover of cubical shall be hinged and shall have locking agreement. Thickness of sheet steel shall be 3.0 mm for load bearing members and 2.0 mm for other sides.
- iii) All the accessories and parts/items shall be adequate rating to suit the above requirement.
- iv) Dimensions of the charger shall be within the following range:
 - a) Width 1200 mm x Depth 450mm x Height 1400mm for 110V, **10/20A** single phase battery charger.
 - b) Width 1450mm x Depth 700mm x Height 1850mm for three phase 110V, **30/50-55A** three phase battery charger.

**For other ratings of Battery Charger minimum dimensions shall be:
Width - 1200 mm x Depth - 450 mm x Height 1400 - mm for single
phase charger and Width - 1450 mm x Depth - 700 mm x Height 1850**

- mm for three phase charger by maintaining sufficient working space as well as adequate clearances which shall be decided during detailed engineering.

- v) All **equipments / items / accessories** mounted on door or mounted inside the cabinet shall be provided with individual **riveted, life lasting** labels with **description** engraved.
- vi) Gland plate: Gland plate **of 3 mm thick M. S. Sheet** for incoming / outgoing cables shall be provided.
- vii) Arrangement for two separate earthing shall be provided.
- viii) Electrical indicating instruments shall be mounted flush-on panel with only flange projecting. The dial shall be white with black numbers and lettering.
- ix) The electronic control circuitry should have built in feature of soft start, so that whenever the charger is switched on, the output voltage should increase gradually.
- x) **Battery Charger shall be provided with earth bus bar of tinned copper flat, having minimum cross section 19 x 3 Sq. mm flat securely fixed along with insulator base and provision on both the sides of earth bus for connecting to purchaser's earthing grid.**

Finish:

Each cubicle will undergo a through process of derusting cleaning, application of red oxide primer paint followed by two coats of light gray synthetic enamel paint of shade 631 of IS: 5 inside and outside. Components mounting plates inside the charger shall be painted with egg shell white colour **inside and outside. Components mounting plates inside the charger shall be painted with egg shell white colour. Paint thickness shall be 80 ± 20 microns.**

Wiring

All chargers will be complete with internal wiring, input and output terminals. The components shall be liberally rated. Standard colour code practice shall be followed, with the use of ferrules for numbering and identification of wires. 1.1 KV grade FR & C1 type Copper conductor of suitable size shall be used. All hard wares such as screws, nuts, studs, washer etc. shall be of brass and non ferrous parts in electrical circuitry control / power.

4.0. RATINGS:

4.1 The charger for 110V battery set consisting of 55 Nos., 2.0 Volts Lead Acid (**Tubular / Plante'**) battery set shall have following output ratings.

In case of Ni-Cad battery set (If specified in schedule-A)having equivalent nos. of 1.2 V Ni-Cad cells, the charger output ratings shall be in accordance to the requirement of Ni-Cad battery set.

a) 110V, Single Phase Battery charger:

(i) Float charge & load current ratings:

10 Amps at 110 V to 126 V DC.

(ii) Boost charging current rating:

20 Amps at 100V to 152 V D.C.

b) 110V, Three Phase Battery Charger:

(i) Float charge & load current rating:

30 Amps at 110 V to 126 V DC.

(ii) Boost charging current rating:

50 Amps / **55Amp / 80Amp** at 100 V to 152 VDC.

5.0 DUTY:

5.1 The composite charger shall consist of two separate chargers viz. the float charger and the Boost charger. The charger shall be require to cater the following requirements.

5.2 **The float section of the charger shall be compatible to operate in auto (fully automatic) as well as manual mode with a provision of selection through Auto/Manual switch and all related components & schemes.**

5.2.1 Normally the float charger operating in parallel with the 110 V, Battery **set** and the load, shall supply the DC load of the sub station and also provide the trickle charge for keeping the battery **set** floating totaling up to full capacity. For this condition, the float charger shall be designed to **trickle** charge all the cells of lead acid battery between 110 V to 126 V and supply DC load of the sub station, keeping the load bus bar voltage **approximately at rated voltage of DC load components by using dropper diodes.**

5.2.2 The float charger shall supply the D.C. output voltage as specified under clause **4.1** with +/-1% stability of adjusted value for A.C. **voltage** fluctuation as specified under clause **6.3** of the specification and for D.C. load variation from zero to 100% load.

5.3. During emergency, when the AC supply fails, the battery shall meet the DC load of the sub stations and in doing so, will get discharged gradually. The battery will need boost charging. For this, a separate charger, called the boost charger shall be required.

5.3.1 Boost charger shall have adequate rating to quick charge the battery fully within 10 hrs. **(Lead Acid) / 5 hrs (Ni-Cd)** after an emergency during which the complete DC loads is met by the battery.

5.3.2. **During** boost charging the battery, the charger may also be **required** to supply the DC load of the sub station in case of float charges failure. Based on the condition of battery, it shall be possible to set the boost charging voltage between 100V to 152 V for 55 cells of lead acid battery set / **87 cells of Ni-Cd battery set** with a total output current between zero to full load capacity of the charger with current stability of 2% of set value with voltage on the load bus bars not exceeding 126.0 volts. The required dropper diodes shall be provided to restrict load bus bar voltage.

5.3.3. Boost charger shall incorporate static components, comprising of silicon controlled rectifiers with necessary protection. Boost charger, apart from its normal constant current operation shall be also capable of constant voltage operation which shall enable it to operate as a float charger delivering stabilized DC output voltage within +/-1% from no load to full load in case of float charger failure. Suitable electrical circuitry shall be provided for this purpose. In the constant current mode it shall have a current stability of +2% of the set value. The constant current setting shall

have step less range from 10% to 100% of full rated current. Further, the boost charger shall have a provision of manual mode of operation, over and above auto-mode of operation. Required circuitry arrangement with auto/manual selector switch etc. shall also be provided for the purpose.

5.3.4 The boost charger and the float charger shall be so interlocked electrically that during boost charging of the battery, the float charger will supply the DC constant load with out supplying to the battery, and at the same time will be in parallel with the battery through a reverse current blocking diode at a suitable tapping. One D.C. contactor may be incorporated which shall get energized through N/C contact of the contractor on A.C. side of the boost charger. In case of failure of A.C. supply, this contractor shall connect the entire battery supply to the load through one of its N/O contacts automatically without any interruption of D.C. supply even of a momentary nature. Under no circumstances the voltage across lower taped terminals shall exceed (+) 10% or fall below (-) 15% of the rated voltage.

5.4. LOAD LIMITING:

The charger shall be provided with load limiting feature for protection against overload. The load limiting curves shall be submitted with the offer. The SCRs / thyristors shall be protected against voltage surge by providing voltage suppressor devices and/or other latest method of protection.

6.0. INCOMING SUPPLY:

6.1. **110 V, Single Phase Battery Charger:**

Single Phase, 240Volts (+10%, -15%), 50 Hz, ± 3%

6.2. **110 V, Three Phase Battery Charger:**

Three Phase, 415Volts (+10%, -15%), 50 Hz, ± 3%

7.0. CHARGER OUTPUT:

7.1 Suitable ripple filtering circuits shall be provided to give a smooth DC output. The ripple content, without connected battery shall be limited to less than 3% on resistive load. The DC output shall be free from switching surges, transients etc.

8.0. SPECIFIC PROVISION:

8.1 As specified under clause-4, the composite charging equipment shall have a separate float charger and a boost charger. Each charger shall consist of the following components and components shall be of the best quality and bill of materials alongwith rating of the same shall be submitted invariably with the offer.

8.1.1 Float charger (Single Phase):

- 1) Single phase A.C. input ON/OFF main switch (Rotary type)
- 2) AC input HRC fuse of required capacity.
- 3) LED type Indicating lamp for AC supply 'ON' indication (After main AC fuse).
- 4) **Two winding copper wound** naturally air cooled single phase transformer **of adequate rating** with -15% and 10% **tapping (5% step)** on primary side **with necessary secondary taps** for achieving required controlled DC output voltage.
- 5) Full wave half controlled rectifier bridge comprising of silicon diodes and silicon controlled rectifiers (SCR) with R/C surge suppressor net work and suitable heat sink along with free wheeling diodes and semi conductor fuse protection.
- 6) Ammeter (with external shunt) for measuring DC output current of float charger (0-15 Amps).
- 7) Auto/ manual mode selector switch.
- 8) Potentiometer for controlling DC output voltage in auto and manual modes.
- 9) Suitable filter circuit comprising filter choke, filter condenser with HRC fuse protection & bleeder resistor.

Bleeder resistor shall be automatically isolated from the circuit, when float charger current reaches to a value which is sufficient to keep the SCRs ON and it comes back into circuit when float charger current decreases to a value just above the hold ON current of the SCR.
- 10) Blocking diode with suitable heat sink.
- 11) DC output ON/OFF switch.

- 12) DC output fuses (HRC).
- 13) DC 'ON' LED type indicating lamp.
- 14) Dropper diode selector switch with minimum three positions.**
- 15) Diodes for dropper diode scheme (minimum 10 nos.).**
- 16) Dropper Diode Bypass scheme in case of AC supply fail.**
- 17) Any item not specifically mentioned but **required** for efficient working of the **charger**.

8.1.2 Boost charger (Single Phase):

- 1) Single phase A.C input ON/OFF main switch (Rotary type)
- 2) AC input HRC fuse of required capacity.
- 3) LED type indicating lamp for AC 'ON' indication (After main AC fuse).
- 4) **Two winding copper wound** naturally air cooled single phase transformer **of adequate rating** with -15% and 10% **tapping (5% step)** on primary side **with necessary secondary taps** for achieving required controlled DC output voltage.
- 5) Full wave half controlled rectifier bridge comprising of silicon diodes and silicon controlled rectifiers (SCR) with R/C surge suppressor network and suitable heat sink alongwith free wheeling diodes and semiconductor fuse protection.
- 6) Ammeter (with external shunt) for measuring DC output current of boost charge (0-30 Amps).
- 7) Auto/ Manual mode selector switch.
- 8) Constant current/constant voltage mode selector switch.
- 9) Potentiometer for adjustment of constant current in boost mode.
- 10) Potentiometer for controlling DC output voltage in float mode (Manual and auto modes).
- 11) Suitable filter circuit comprising filter choke, filter condenser with HRC fuse protection & bleeder resistor.

Bleeder resistor shall be automatically isolated from the circuit, when float charger current reaches to a value which is sufficient to keep the SCRs ON and it comes back into circuit when float charger current decreases to a value just above the hold ON current of the SCR.

- 12) Thermal relay for overload protection.
- 13) Blocking diode with suitable heat sink.
- 14) Double pole DC output On/OFF switch
- 15) DC output fuses (HRC).
- 16) DC 'ON' indication lamp with series resistor
- 17) Dropper diodes scheme ON/ Off switch..
- 18) Dropper diodes selector switch with minimum four positions
- 19) Diodes for diode- dropper scheme (minimum 28 Nos.)
- 20) Any item not specifically mentioned but **required** for efficient working of the charger.

8.1.3 Float Charger (Three Phase):

- 1) Triple pole A.C. input ON/OFF main switch (Rotary type)
- 2) AC input HRC fuses of required capacity.
- 3) Fuse fail and **phase sequence reversal** detector (Solid state type) for **AC input**.
- 4) LED type indicating lamps for 3 Phase AC supply 'ON' indication (After main AC fuses)
- 5) **Two winding copper wound** naturally air cooled three phase transformer **of adequate rating** -15% to +10% **tapping (5% step)** on primary side with necessary secondary taps for achieving required controlled DC output voltage.
- 6) Three Phase, half controlled full wave rectifier bridges comprising of 3 nos. Silicon diodes & 3 Nos. silicon controlled rectifiers (SCR) with R/C surge suppressor net work and suitable heat sink along with free wheeling diodes and semiconductor fuses protection.

- 7) Fuse fail detector (Solid state type) for semi conductor fuses as above.
- 8) Ammeter (with external shunt) for measuring DC output current of float charger.
- 9) Auto/Manual mode selector switch.
- 10) Potentiometer for controlling DC output voltage in auto & manual control modes.
- 11) Suitable filter circuit comprising filter choke, filter condenser with HRC fuse protection & bleeder resistor.

Bleeder resistor shall be automatically isolated from the circuit when float charger current reaches to a value which is sufficient to keep the SCRs ON and it comes back into circuit when float charger current decreases to a value just above the hold ON current of the SCR.

- 12) Blocking diode with suitable heat sink.
- 13) D.C. output ON/OFF switch
- 14) D.C. output fuses (HRC)
- 15) D.C. 'ON' LED type indicating lamp
- 16) Dropper diode selector switch with minimum three positions.**
- 17) Diodes for dropper diode scheme (minimum 10 nos.).**
- 18) Dropper Diode Bypass scheme in case of AC supply fail.**
- 19) Any item not specifically mentioned but **required** for efficient working of the charger.

8.1.4 Boost Charger (Three Phase):

- 1) Triple pole A.C. input ON/OFF main switch (Rotary type)
- 2) AC input fuses of required capacity.(HRC)
- 3) Fuse fail and **phase sequence reversal** detector (Solid state type) for **AC input**.

- 4) LED type indicating lamps for 3 Phase AC supply 'ON' indication (After main AC fuses)
- 5) **Two winding copper wound** naturally air cooled three phase transformer **of adequate rating** -15% to +10% **tapping (5% step)** on primary side with necessary secondary taps for achieving required controlled DC output voltage.
- 6) Three Phase, half controlled full wave rectifier bridges comprising of 3 nos. Silicon diodes & 3 Nos. silicon controlled rectifiers (SCRs) with R/C surge suppressor net work and suitable heat sink along with free wheeling diodes and semiconductor fuses protection.
- 7) Fuse fail detector (Solid state type) for semi conductor fuses as above).
- 8) Ammeter (with external shunt) for measuring D.C. output current of boost charger.
- 9) Auto/manual mode selector switch.
- 10) Constant current/ constant voltage mode selector switch.
- 11) Potentiometer for adjustment of constant current in boost mode.
- 12) Potentiometer for controlling D.C. output voltage in float mode (Manual and auto control modes).
- 13) Suitable filter circuit comprising filter choke, filter condenser with HRCfuse protection & bleeder resistor.

Bleeder resistor shall be automatically isolated from the circuit when float charger current reaches to a value which is sufficient to keep the SCRs ON and it comes back into circuit when float charger current decreases to a value just above the hold ON current of the SCR.
- 14) Thermal relay for overload protection
- 15) Blocking diode with suitable heat sink.
- 16) Double pole D.C. output ON/OFF switch
- 17) D.C. output fuses (HRC)
- 18) D.C. 'ON' LED type indicating lamp

- 19) Dropper diodes scheme ON/ Off switch.
- 20) Dropper diodes selector switch with minimum four positions
- 21) Diodes for dropper diodes scheme (minimum 28 Nos.)
- 22) Any item not specifically mentioned but **required** for efficient working of the charger.

8.1.5 Common Components (Three Phase & Single Phase charger):

- 1) D.C. voltmeter double pole 4 positions rotary type to measure DC voltage across float section, boost section, load and battery with HRC fuse protection.
- 2) AC voltmeter to measure the AC input voltage with suitable fuse, link and selector switch arrangement.
 - a) Range 0-300 V for single phase charger.
 - b) Range 0-500 V for three phase charger.
- 3) D.C. charge / discharge ammeter with suitable external shunt to read discharge / charge currents of the battery. **Ammeter range shall be as per the current rating of charger.**
- 4) Ammeter (Range 100-0-100 mA) showing the earth leakage current of the charger & outgoing ckt (load side).
- 5) Space heater **(80W)** with thermostat **(05-85 °C)**, ON/OFF switch and required fuse.
- 6) The charger shall be provided with horizontal CFL tube of 14W with fixture including reflector, front cover etc. It shall be controlled by door operated switch.**
- 7) Detachable cable gland plates **of M.S. Sheet, min. 2 Nos.** for cable entry from bottom **and size suitable for required cables.**
- 8) DC contactor inter-locked with boost charger AC contactor.

- 9) Silicon blocker diode with suitable heat sink to be connected to a suitable tapping of battery to maintain DC continuity during power failure while batteries are on boost charge.
- 10) **Multipin socket (15A, 230V rating)** with switch and fuse.
- 11) Foundation bolts as per requirements.**
- 12) All switches shall be rotary type.**
- 13) Lifting lugs.**

Note:

1. All selector switches shall be rotary stay put type with adequate rating.

2. All Ammeters shall be of analogue type with 90 deg. dial scale and size 96x96 sq.mm.

3. The LED type indicating lamp shall be of 7 segment type with overall diameter of lamp shall be 30 mm while that of cut out shall be 22.5 mm.

4. All equipments/components shall be of adequate rating as per Battery charger requirement.

8.1.6 SCADA Compatibility (If specified in schedule – A)

The Battery Charger shall be fully SCADA compatible. It shall have sufficient Nos of potential free contacts & transducers (4-20mA output) for digital and analogue signals respectively. It shall also be possible to control various functionality of Battery Charger from SCADA system through hard wire connection.

Typical I/O requirement is tabulated here under. The exact number and description shall be as per detailed engineering.

PARAMETERS	DIGITAL INPUTS	CONTROL OUTPUTS	ANALOGUE INPUTS (4-20mA)
AC mains fail			
Load Bus Over Voltage			

Load Bus Under Voltage			
Float Charger fail			
Earth Leakage			
Float Charger On			
Float Charger Off			
Float Charger on Auto mode			
Float Charger on Manual mode			
Boost Charger On			
Boost Charger Off			
Boost Charger On CV mode			
Boost Charger On CC mode			
Charger on local mode			
Charger on Remote mode			
Battery Voltage			
Boost Voltage			
Float Voltage			
Load Voltage			
Battery Current			
Boost Current			
Float Current			
Load Current			
Battery Room Temperature			

9.0 **OUTGOING CIRCUITS:**

9.1 The following outgoing circuit comprising of a double pole ON-OFF rotary switch HRC fuses and LED type indicating lamps (The over all diameter of lamp shall be 30 mm while that of cut out shall be 22.5 mm) shall be provided.

a) Single Phase charger:

- i) 10 Amps feeder 5 Nos.
- ii) 15 Amps feeder 2 Nos.

b) Three phase charger :

- i) 50 Amps feeder 2 Nos.
- ii) 30 Amps feeder 3 nos.

- iii) 20 Amps feeder 5 Nos.

10.0 PROTECTION AND ANNUNCIATION:

Following protection with alarm indicating lamps and alarm accept push button and lamp test push button shall be included in the scope of supply.

a) Single phase Charger:

- i) Load under voltage relay
- ii) DC Earth leakage relay.
- iii) Float charger failure
- iv) Boost Charger fail
- v) Main AC supply fail
- vi) DC over voltage relay for battery protection.
- vii) Semiconductor Fuse fail - Float
- viii) Semiconductor Fuse fail - Boost

b) Three phase Charger.

- i) Load under voltage relay
- ii) DC Earth leakage relay.
- iii) Float charger failure
- iv) AC mains failure
- v) DC over voltage relay for battery protection.
- vi) Boost charger failure.
- vii) HV phase fail/phase sequence reversal protection.
- viii) Semiconductor Fuse fail - Float

ix) Semiconductor Fuse fail - Boost

x) AC input Fuse fail – Float

xi) AC input Fuse fail - Boost

11.0 Looking to the detailed description of duty requirements of both the chargers and the battery, the manufacturer, shall design a circuit which shall be capable of providing complete protection to various components of the unit and automatic circuit with automatic voltage regulator in the float circuit operation of the unit without-interruptions.

12.0 Necessary product information, booklets, drawings circuit diagram, operating & maintenance manuals, FQP, type test reports as per applicable standards, supply & performance certificate etc. shall be submitted along with the offer.

13.0 Successful bidder shall submit the following drawings in duplicate for approval.

a) GA drawings – Front view, Rear view, Top view, Side View, Internal front view, Internal rear view, Sectionalized side view.

b) Foundation drawing showing cable cutouts and foundation bolt pockets.

c) Rating plate details.

d) Float cum boost charger circuit schematic.

e) Float charger circuit schematic.

f) Annunciation and indication circuit schematic.

g) DC distribution circuit schematic.

h) Illumination and heating circuit schematic.

i) Terminal block details.

j) Bill of material.

13.0 TESTS:

13.1 TYPE TESTS

All type test reports as per applicable Standard for Battery chargers shall be submitted. Rectifier transformers shall conform to all type tests specified in IS : 4540 and short circuit test as per IS : 2026. The type test reports from NABL approved laboratory shall not be older than seven years from the expiry of the validity of the offer. Tests shall be carried out as per procedures specified in Annexure-I.

1. Voltage regulation test
2. Load limiter characteristics test
3. Measurement of Efficiency.
4. High voltage tests
5. Temperature rise test
6. Short circuit test at no load and full load at rated voltage for sustained short circuit.
7. Degree of protection test – IP 42
8. Measurement of ripple by Oscilloscope
9. Temperature compensation feature demonstration
10. Type test reports of Rectifier Transformers - all tests as specified in IS : 4540 and short circuit test as per IS : 2026

Important Note:

In case of non-submission of some of the valid type test reports, the bidder shall confirm the submission of same before commencement of supply, without affecting delivery schedule, from NABL accredited laboratory, free of cost. In absence of this confirmation, the offer will be evaluated as non-submission of type test report.

13.2 ACCEPTANCE / ROUTINE TESTS

The following test shall be carried out by the manufacturer on each battery charger.

- 1) Visual inspection and dimensions.
- 2) Checking of wiring & continuity of circuits
- 3) Insulation resistance.
- 4) HV test
- 5) Ripple content measurement
- 6) **Voltage regulation test**
- 7) Measurement of efficiency
- 8) Operational tests for protection, alarm, indication.
- 9) Auto/Manual operation test.

14.0 Three sets of each of detailed dimensional drawings, commissioning and operating instructions manual, literature, write up and test certificates of bought out items shall be supplied with the each batter charger.

15.0 PACKING / MARKING:

The charger shall be dispatched securely packed in wooden crates suitable for handling during transit by Rail / Road, so as to avoid any loss or damage during transit.

16.0 UNPRICED SCHEDULE:

Unpriced schedule (without price) of offered items shall be submitted along with the Technical Bid.

Note:

In case the rating of the battery charger asked in schedule-A is different than mentioned in this specification then all the components and equipments shall be adequate to meet the specified rating.

APPENDIX – I**GUARANTEED TECHNICAL PARTICULARS FOR 110V DC, SINGLE
PHASE BATTERY CHARGER TO BE FILLED IN BY BIDDER
WHEREVER NOT SPECIFIED BY BUYER.**

Important Note: Bidder is not liable to indicate any change in parameters specified by buyer.

Sr. No.	Parameter	Specified (by buyer)	Offered (by Bidder)
1)	Manufacturer		
2)	Type & Designation (as per type test report)		
3)	Product Specification Sheet		
	Constructional details		
4)	Colour Shade	Light Grey as per 631 of IS:5	
a)	Outside		
b)	Inside		
c)	<u>Mounting Plate</u>	<u>Egg shell white</u>	
d)	<u>Paint thickness</u> <u>Nos. of coats</u>	<u>60-100 micron</u> <u>Two</u>	
5)	Thickness of CR sheet steel	3 mm for load bearing parts & 2 mm for others	
a)	All sides		
b)	Doors		
c)	<u>Gland Plates</u>	<u>2 Nos, 3 mm</u>	
d)	Reinforced by M.S. angle frame	<u>Angle Size : Min.</u> <u>25 x 25 x 3 mm</u>	
6)	Degree of Protection	IP 42	
7)	Indoor type		
8)	Floor mounting		

9)	Free standing		
10)	Naturally air cooled type		
11)	Designed for continuous operation in a ambient temperature of 50°C		
12)	Gaskets		
a)	Material	Neoprene / Synthetic Rubber	
b)	Size		
13)	Recommended clearance at rear		
14)	Input AC supply	1 - Ph, 240 V, 50 Hz (+10 % , -15 % for Voltage & + / - 3% for Frequency)	
15)	Output DC		
a)	Float Charger	110 to 126 V	
b)	Boost Charger	100 to 152 V	
16)	DC Bus Bar		
a)	Material	Electrolytic copper	
b)	Size		
17)	Earthing Bus		
a)	Material	Electrolytic copper	
b)	Size	<u>19 x 3 sq.mm</u>	
18)	Wiring	1.1KV FR & C1 copper conductors	
19)	Weight		
20)	Hard ware (N/Bs, Screws etc.)	Brass, Non Ferrous parts	
<u>21)</u>	<u>Ripple Content at rated Load</u> <u>- With Battery</u> <u>- Without Battery</u>	<u>< 3%</u>	
<u>22)</u>	<u>Guaranteed Efficiency Float section</u>		

a)	<u>At 20% Load</u>	<u>> 75%</u>	
b)	<u>At 50% Load</u>	<u>> 80%</u>	
c)	<u>At rated Load</u>		
23)	<u>Guaranteed Efficiency Float cum Boost section</u>		
a)	<u>At 20% Load</u>	<u>> 75%</u>	
b)	<u>At 50% Load</u>	<u>> 80%</u>	
c)	<u>At rated Load</u>		
	General Arrangement		
24)	Charger Size	<u>For 10/20 Amp</u>	
a)	Height (mm)	1400 mm	
b)	Width (mm)	1200 mm	
c)	Depth (mm)	450 mm	
25)	Front View		
26)	Hinged Doors		
27)	Door width		
28)	Door Locking Arrangement	At Three Points	
	Meters		
29)	Type & size of Ammeters for	<u>Analogue 90 Deg Scale, 96x96 Sq.mm</u>	
30)	Ammeters for		
a)	Float Charger Current		
b)	Boost Charger Current		
c)	Battery Charger Current		
d)	Earth Leakage Current		
31)	Type & size of Voltmeters	<u>Analogue 90 Deg Scale, 96x96 Sq.mm</u>	
32)	Voltmeter for		
a)	Charger Voltage		
b)	Input AC Supply		

	Switches		
31)	<u>Type of Switches</u>	<u>Rotary</u>	
32)	Supply Switches for		
a)	Float Charger AC Input		
b)	Float Charger DC Output		
c)	Boost Charger AC Input		
d)	Battery Charger DC Output		
e)	Feeders - 10 Amp (5 Nos.)		
f)	Feeders - 15 Amp (2 Nos.)		
33)	Voltage Selector Switches for		
a)	DC Voltage		
b)	Input AC Supply		
34)	Mode Selector Switches for		
a)	Float Charger Auto / Manual		
b)	Boost Charger Auto / Manual		
c)	Boost Charger CC / CV		
35)	<u>Dropper Diode scheme for Float Charger</u>		
36)	<u>Dropper Diode scheme for Float Cum Boost Charger</u>		
a)	ON / OFF		
b)	Selection		
37)	Earth leakage Ammeter switch		
38)	<u>Setting Potentiometers</u>		
a)	Float Charger Voltage - Auto		
b)	Float Charger Voltage - Manual		
c)	Boost Charger CV - Auto		
d)	Boost Charger CV - Manual		

e)	Boost Charger CC		
39)	Indicating Lamps	<u>7 segment</u> LED Type, <u>30mm dia,</u> <u>22.5 mm cutout</u>	
a)	Main AC Supply ON		
b)	Boost Charger AC ON		
c)	Float Charger AC ON		
d)	Boost Charger DC ON		
e)	Float Charger DC ON		
f)	Feeder ON (7 Nos.)		
40)	Alarm Indicating Lamps	LED Type Lamps / Annunciation Scheme	
a)	AC Mains Fail		
b)	Float Charger Fail		
c)	Battery Over Voltage		
d)	Load Under Voltage		
e)	Earth Leakage		
f)	Boost Charger Fail		
g)	Semiconductor Fuse Fail - Float		
h)	Semiconductor Fuse Fail - Boost		
41)	Push Buttons		
a)	Alarm Accept		
b)	Alarm Reset		
42)	Top View		
a)	Gland plates		
b)	Foundation Drawing		
c)	Cable cutouts		
d)	Foundation Bolt pockets		
43)	Rear View		
a)	Hinged Doors		

b)	Door width		
c)	Door Locking Arrangement	At Three Points	
44)	<i>Side View</i>		
a)	Louvers		
b)	Wire mesh behind louvers		
c)	Sectional View (showing Inside Arrangement)		
d)	Earth Bus		
e)	Arrangement of earthing connection		
45)	<i>Name Plate</i>		
a)	<i>Material</i>		
b)	Make		
c)	Type		
d)	Input Supply	240 V, (+10 % , -15 %), 1-Ph, 50Hz (+ / - 3%)	
e)	DC Output		
	- Boost <u>voltage at rated current</u>	<u>100 to 152 V</u>	
	- Float <u>voltage at rated current</u>	<u>110 to 126V</u>	
f)	Sr. No.		
g)	Year Of manufacturing		
h)	Weight		
i)	A/T No.		
j)	Property of GETCO		
46)	<i>Schematic Drawings</i>		
a)	AC & DC Circuit		
b)	Boost Charger		
c)	Float Charger		
d)	DC Distribution Circuit		
e)	<u>SCADA Interface circuit for Transducers and</u>		

	<u>Contactors (if applicable)</u>		
f)	Annunciation Circuit		
g)	Control Circuit		
	- Float Charger		
	- Boost Charger		
h)	Terminal Block Details	800V grade, stud type	
	- AC supply		
	- Battery		
	- Feeders		
47)	BOM		
48)	TYPE TESTS		
a)	Voltage regulation test		
b)	Load limiter characteristics test		
c)	Efficiency tests		
d)	High voltage tests		
e)	Temperature rise test		
f)	Short circuit test at no load and full load at rated voltage for sustained short circuit.		
g)	Degree of protection test		
h)	Measurement of ripple by Oscilloscope		
i)	Temperature compensation feature demonstration		
k)	Type test reports of Rectifier Transformers - all tests as specified in IS : 4540 and short circuit test as per IS : 2026		

**GUARANTEED TECHNICAL PARTICULARS FOR 110V DC, THREE
PHASE BATTERY CHARGER TO BE FILLED IN BY BIDDER
WHEREVER NOT SPECIFIED BY BUYER.**

Important Note: Bidder is not liable to indicate any change in parameters specified by buyer.

Sr. No.	Parameter	Specified (by buyer)	Offered (by Bidder)
1)	Manufacturer		
2)	Type & Designation (as per type test report)		
3)	Product Specification Sheet		
	Constructional details		
4)	Colour Shade	Light Grey as per 631 of IS:5	
a)	Outside		
b)	Inside		
c)	<u>Paint thickness</u> <u>Nos. of coats</u>	<u>60-100 micron</u> <u>Two</u>	
5)	Thickness of CR sheet steel	3 mm for load bearing parts & 2 mm for others	
a)	All sides		
b)	Doors		
c)	<u>Gland Plates</u>	<u>2 Nos, 3 mm</u>	
d)	Reinforcement by MS angles	<u>Angle Size : Min.</u> <u>25 x 25 x 3 mm</u>	
6)	Degree of Protection	IP 42	
7)	Indoor type		
8)	Floor mounting		
9)	Free standing		
10)	Naturally air cooled type		

11)	Designed for continuous operation in a ambient temperature of 50°C		
12)	Gaskets		
a)	Material	Neoprene / Synthetic Rubber	
b)	Size		
13)	Recommended clearance at rear		
14)	Input AC supply	3 - Ph 4 wire, 415 V, 50 Hz (+10 % , -15 % for Voltage & + / - 3% for Frequency)	
15)	Output DC		
a)	Float Charger	<u>110</u> to 126 V	
b)	Boost Charger	100 to <u>152</u> V	
16)	DC Bus Bar		
a)	Material	Electrolytic copper	
b)	Size		
17)	Earthing Bus		
a)	Material	Electrolytic copper	
b)	Size	<u>19 x 3 sq.mm</u>	
18)	Wiring	1.1KV FR & C1 copper conductors	
19)	Weight		
20)	Hard ware (N/Bs, Screws etc.)	Brass, Non Ferrous parts	
<u>21)</u>	<u>Ripple Content at rated Load</u> <u>- With Battery</u> <u>- Without Battery</u>	<u>< 3%</u>	
<u>22)</u>	<u>Guaranteed Efficiency Float section</u>	-	
<u>a)</u>	<u>At 20% Load</u>	<u>> 75%</u>	

b)	<u>At 50% Load</u>	<u>> 80%</u>	
c)	<u>At rated Load</u>		
23)	<u>Guaranteed Efficiency Float cum Boost section</u>	-	
a)	<u>At 20% Load</u>	<u>> 75%</u>	
b)	<u>At 50% Load</u>	<u>> 80%</u>	
c)	<u>At rated Load</u>		
	General Arrangement		
24)	Charger Size	<u>For 30/50-55 Amp</u>	
a)	Height (mm)	1850mm	
b)	Width (mm)	1450mm	
c)	Depth (mm)	700mm	
25)	Front View		
26)	Hinged Doors		
27)	Door width		
28)	Door Locking Arrangement	At Three Points	
	Meters		
29)	Type & size of Ammeters	<u>Analogue 90 Deg Scale, 96x96 Sq.mm</u>	
30)	Ammeters for		
a)	Float Charger Current		
b)	Boost Charger Current		
c)	Battery Charger Current		
d)	Earth Leakage Current		
31)	Type & size of Voltmeters	<u>Analogue 90 Deg Scale, 96x96 Sq.mm</u>	
32)	Voltmeter for		
a)	Charger Voltage		
b)	Input AC Supply		
	Switches		

<u>31)</u>	<u>Type of Switches</u>	<u>Rotary</u>	
32)	Supply Switches for		
a)	Float Charger AC Input		
b)	Float Charger DC Output		
c)	Boost Charger AC Input		
d)	Boost Charger AC Contactor		
e)	Battery Charger DC Output		
f)	Feeders – 50 Amp (2 Nos.)		
g)	Feeders - 30 Amp (3 Nos.)		
h)	Feeders - 20 Amp (5 Nos.)		
33)	Voltage Selector Switches for		
a)	DC Voltage		
b)	Input AC Supply		
34)	Mode Selector Switches for		
a)	Float Charger Auto / Manual		
b)	Boost Charger Auto/ Manual		
c)	Boost Charger CC / CV		
35)	<u>Dropper Diode scheme for Float Charger</u>		
36)	<u>Dropper Diode scheme for Float Cum Boost Charger</u>		
a)	ON / OFF		
b)	Selection		
37)	Earth leakage Ammeter switch		
<u>38)</u>	<u>Setting Potentiometers</u>		
a)	Float Charger Voltage - Auto		
b)	Float Charger Voltage - Manual		

c)	Boost Charger CV - Auto		
d)	Boost Charger CV - Manual		
e)	Boost Charger CC		
39)	Indicating Lamps	<u>7 segment</u> LED Type, <u>30mm dia,</u> <u>22.5 mm cutout</u>	
a)	Main AC Supply ON		
b)	Boost Charger AC ON	For all the Three Phases	
c)	Float Charger AC ON	For all the Three Phases	
d)	Boost Charger DC ON		
e)	Float Charger DC ON		
f)	Feeder ON (10 Nos.)		
40)	Alarm Indicating Lamps	LED Type Lamps / Annunciation Scheme	
a)	AC Mains Fail		
b)	Float Charger Fail		
c)	Battery Over Voltage		
d)	Load Under Voltage		
e)	Earth Leakage		
f)	Boost Charger Fail		
g)	Semiconductor Fuse Fail - Float		
h)	Semiconductor Fuse Fail - Boost		
i)	Phase Seq. Reversal		
j)	<u>AC Input Fuse fail – Float</u>		
k)	<u>AC Input Fuse fail – Boost</u>		
41)	Push Buttons		
a)	Alarm Accept		
b)	Alarm Reset		
42)	Top View		
a)	Gland plates		

b)	Foundation Drawing		
c)	Cable cutouts		
d)	Foundation Bolt pockets		
43)	Rear View		
a)	Hinged Doors		
b)	Door width		
c)	Door Locking Arrangement	At Three Points	
44)	Side View		
a)	Louvers		
b)	Wire mesh behind louvers		
c)	Sectional View (showing Inside Arrangement)		
d)	Earth Bus		
e)	Arrangement of earthing connection		
45)	Name Plate		
a)	<i>Material</i>		
b)	Make		
c)	Type		
d)	Input Supply	415 V, (+10 %, -15 %), 3-Ph, 50Hz (+ / - 3%)	
e)	DC Output		
	- Boost <u>voltage at rated current</u>	<u>110</u> to 126 V	
	- Float <u>voltage at rated current</u>	100 to <u>152</u> V	
f)	Sr. No.		
g)	Year Of manufacturing		
h)	Weight		
i)	A/T No.		
j)	Property of GETCO		
46)	Schematic Drawings		

a)	AC & DC Circuit		
b)	Boost Charger		
c)	Float Charger		
d)	DC Distribution Circuit		
e)	<u>SCADA Interface circuit for Transducers and Contactors (if applicable)</u>		
f)	Annunciation Circuit		
g)	Control Circuit		
	- Float Charger		
	- Boost Charger		
h)	Terminal Block Details		
	- AC supply		
	- Battery		
	- Feeders		
47)	BOM		
48)	TYPE TESTS		
a)	Voltage regulation test		
b)	Load limiter characteristics test		
c)	Efficiency tests		
d)	High voltage tests		
e)	Temperature rise test		
f)	Short circuit test at no load and full load at rated voltage for sustained short circuit.		
g)	Degree of protection test		
h)	Measurement of ripple by Oscilloscope		
i)	Temperature compensation feature demonstration		
k)	<u>Type test reports of Rectifier Transformers - all tests as specified in IS : 4540 and short circuit test as per IS : 2026</u>		

ANNEXURE - I
Type test procedure for Battery Charger

Sr. No	Test description
1	<p><u>Voltage regulation test:</u> A) Float charger B) Float mode of boost charger: Test condition: -</p> <ul style="list-style-type: none"> • The adjustment of output voltage at no load is verified by front panel Potentiometer. • Output voltage of charger is set at maximum voltage setting and input voltage is varied from -15% & +10% of nominal volts; Variation in output voltage is verified. • The unit is loaded up to 100% rated load and output voltage is observed. Under this condition, the input voltage is varied as specified above and variation in output voltage is verified. Regulation should be limited to or less than $\pm 1\%$ of rated output voltage of the charger
2	<p><u>Load limiter characteristics test: -</u> A) Float charger B) Float mode of boost charger: Test Condition: -</p> <ul style="list-style-type: none"> • The current limit potentiometer is adjusted such that current limit starts beyond 100% load i.e. current beyond rated current. Now Load resistance is reduced and drooping characteristic of output voltage is verified.
3	<p><u>Efficiency test:</u> To be carried out on Float Charger & Boost Charger separately at max. Power rating. Test condition: -</p> <ul style="list-style-type: none"> • Float charger: - Efficiency test is carried out at nominal AC input voltage , DC output voltage adjusted to maximum voltage setting, by loading only the Float charger at 20%, 50%, & 100% load of rated current at Feeder Terminals & keeping the Boost charger 'OFF'. AC input power is measured by Digital/Analog Power Meter and DC output is measured by calibrated Voltmeter and Ammeter other than the provided in the Float charger. • Boost Charger: - Efficiency test is carried out as per above procedure for Boost Charger keeping float charger 'OFF' & adjusting maximum voltage setting at Battery Terminals with Boost Charger constant current setting at 20% 50% & 100% load of rated current with the help of suitable resistors at Battery Terminals. <p>Efficiency should be better than 75% at 20% load & better than 80% at 50 % & 100% load as per GTP.</p>
4	<p><u>High voltage test:</u> Test condition: -</p> <ul style="list-style-type: none"> • The power frequency voltage of 2 KV shall be applied between AC circuit & Earth, DC circuit & Earth and AC circuit & DC circuit for 1 Minute. During High Voltage Test, all low voltage circuits (Electronics circuit, Lamps etc.) are isolated and gate – cathode, anode – cathode terminals are shorted. Charger should withstand it and there shall not be any mal function or deformation and it should work satisfactory after the test.

5	<p><u>Temperature rise test: -</u> Test Condition: -</p> <ul style="list-style-type: none"> Rated mains supply is to be applied to charger. Float charger DC Output voltage to be set to maximum voltage setting & load current is to be adjusted to 100% rated load of float charger at feeder terminals & simultaneously Boost charger DC Output current is to be set to 100% rated load of boost charger by variation of set boost current potentiometer on front panel. Battery terminal voltage is to be adjusted to maximum voltage setting of Boost Charger by varying the resistive load connected to 'Battery Terminals'. Temperature readings of ambient temperature, Float & Boost Rectifier Stack heat sink, windings & cores of Float & Boost Rectifier Transformer & filter choke, & to be noted for every hour, till temperature rise is stable. After completion of this test Normal functioning of the battery Charger to be verified by carrying out the following tests: 1) High voltage. 2) Voltage regulation test. 3) Short circuit Test
6	<p><u>Short circuit test at no load and full load at rated voltage for sustained short circuit at load Terminals:</u> A) Float charger (Auto mode). B) Float mode of Boost charger (Auto Float) Test condition: -</p> <ul style="list-style-type: none"> This test is carried out on LOAD TERMINALS with Float charger & Float mode of Boost Charger. The output DC voltage at load terminal is adjusted maximum voltage setting with rated AC input volts. The load terminals are shorted with following test conditions. <ul style="list-style-type: none"> 1) No load at load terminals 2) Full load of rated current at Load Terminals. <p>In no load condition, the load terminals are shorted first and then charger is switched ON. Moreover, in full load condition, increase the load from rated current 100% to till short circuit at LOAD TERMINALS. The Battery Charger should sustain this short circuit with mains variation from -15% & +10% of nominal input volts and the Battery charger should function normal after removal of short circuit at load terminals.</p>
7	<p><u>Temperature Compensation Feature Demonstration test:</u> Auto Float Charger Test condition: -</p> <ul style="list-style-type: none"> To observe that DC output of Battery Charger changes proportional to 4-20 mA input signal available from temperature transducer. The required change in output voltage is 3mv per 1 °C (degree centigrade) per cell of 2volts of L. A. Battery. The temperature transducer produces 1mA signal per 2.5 °C change in ambient temperature. Therefore for 55 Cells (110V Battery Set), it will be 7.5mV x 55 Cells = 0.4125V per mA. The charger output voltage should decrease by 0.4125V for increase of 1 mA and vice-verse. The reference temperature is 27 °C at which 11mA signal will be available from transducer. The charger output should be set to 121V(i.e. rated output) at 11mA signal. The input signal should be changed from 4 mA to 20mA & DC output should be observed. The DC output should vary @ 0.4125Volts per mA. <p>Similarly, for 110 Cells (220V Battery Set), it will be 7.5mV x 110 Cells = 0.8250V per mA. The charger output voltage should decrease by 0.8250V for increase of 1 mA and vice-verse. The charger output should be set to 242V (i.e. rated output) at 11mA signal. The input signal should be changed from 4 mA to 20mA & DC output should be observed. The DC output should vary @ 0.8250Volts per mA.</p>
8	<p><u>Degree of protection test: -</u></p> <ul style="list-style-type: none"> Degree of protection shall be IP 42.

9	Measurement of ripple by Oscilloscope: - <ul style="list-style-type: none">• AC supply with variation ($\pm 15\%$) & Frequency variation ($\pm 3\%$) shall be supplied to the charger and ripple in the output voltage at 0, 50 & 100 % load shall be measured with the oscilloscope. It shall be within $\pm 3\%$.
10	Type tests of Rectifier Transformers <ul style="list-style-type: none">• All tests as specified in IS : 4540 and short circuit test as per IS : 2026.



Dated: 08.09.2020

TTR validity amendment-1

(Addendum to Technical Specification for validity of type test reports for major electrical equipments)

Sr. No.	Name of test/ Equipment	Type test reports validity (In Years)
i.	On Line Tap Changer (OLTC)	10
ii.	Power Transf. Bushing/ Reactor Bushing	7
iii.	Transformer/reactor fittings and accessories.	10
iv.	Circuit Breaker	10
v.	Isolators	10
vi.	Lightning Arrestors	10
vii.	Wave Trap	10
viii.	Instrument Transformer	7
ix.	Low Voltage (LV) & Medium Voltage (MV) Switchgear	10
x.	Cable & associated joints	10
xi.	Capacitors	10
xii.	Energy Meters [including smart meters & Availability Based Tariff (ABT) meters]	5
xiii.	Conductors & earth wire	10
xiv.	Insulators(Porcelain/ Glass)	10
xv.	Composite Insulators	5
xvi.	Power Line Carrier Communication (PLCC)/Fibre Optic (FO) cable/Optical Ground Wire (OPGW)	5
xvii.	Terminal connectors of all major equipments including transformers	10

Note: Type test reports shall be valid as on the last date of submission of bid.



Dated: 08.09.2020

TTR validity amendment-2

(Addendum to Technical Specification for validity of type test reports of *all the equipments*)

The validity of type test reports to be submitted with technical bid shall be considered as per following:

“Type test reports shall be valid as on the last date of submission of bid”