Government of India
Ministry of Railways
(Railway Board)

INDIAN RAILWAY STANDARD SPECIFICATION FOR DUAL BANK CHARGER WITH TWIN BANK LOW MAINTENANCE LEAD ACID BATTERIES FOR USE ON BLOCKLINE CIRCUIT (Tentative)

Serial No. S: 85-92

0. FOREWORD

0.1 This specification is issued under the fixed S.No. S:85 followed by the year of adoption as standard or in case of revision the year of latest revision.

0.2 This specification requires reference to the following Indian Railway Standards (IRS) and the Indian Standards (IS) Specifications:

IRS : S 23	Electrical Signalling and Interlocking equipments.
IS: 1248	Direct acting analogue instruments and their accessories.
IS: 2208	HRC Cartridge fuse links upto 650 volts.
IS: 1651-91	Specification for stationary cells and batteries, lead acid type (with tubular positive plates).
IS: 9000	Basic environmental testing procedures for electronics and electric items.
IRS : S 76-89	PVC insulating cables and wires for indoor railway signalling.
IS : 9224	Non-deteriorating fuses.
IS: 4064	Air break switches and Air break disconnectors.
IRS: S 86-92	Battery chargers for railway S&T installations.

0.3 Whenever in this specification any of the above mentioned specifications are referred by number only without mentioning the year of issue, the latest issue of that specification is implied, otherwise the particular issue referred to is meant.

0.4 This specification is intended chiefly to cover the technical provisions and does not include all the necessary requirements of the contract.

0.5 For the purpose of this specification, the terminology given in IRS: S 23 shall apply.

1. SCOPE

1.1 This specification lays down the requirements for continuously rated twin bank battery charger along with two sets of low maintenance lead acid secondary stationary batteries. The charger shall be of interlocked type with internal isolation available between the charging and discharging banks. The DC output from the charger shall be as specified by the purchaser. This dual bank battery charger shall charge one set of battery, while the other set of battery will be connected with the load for operating the block circuit. Subsequently, the discharged set of battery shall be put on charge by connecting it to the charger, while the charged battery set shall be connected to load by means of a switch provided on the charger.

1.2 The specification covers the general and performance requirements of dual bank battery charger along with two sets of low maintenance lead acid batteries along with technical requirements of individual components, like battery charger and batteries.

2. CONSTRUCTION OF THE CHARGER

2.1 The charger shall conform to drawings, dimensions and layout, if any specified by the purchaser.

2.2 Charger shall be of natural air cooled type and shall be suitable for indoor use in the cabins where the ambient temperature may reach upto 55ºC. The charger shall be of shelf mounting type or as specified by the purchaser.

2.3 The charger shall be of robust construction with chassis made up of cold rolled annealed mild steel sheet panels of thickness not less than 1mm. The charger shall be adequately ventilated.

2.4 Charger cubicle after having been given the anti-rust and anticorrosive treatment shall be provided with powder coating finish. Small metal parts such as nuts, bolts and washers shall be galvanized or suitably plated. All other parts of the charger shall be plated, painted or otherwise protected against corrosion.

2.5 The layout of the components and wiring shall be such that all parts are easily accessible for inspection, repairs and replacement.

2.6 The AC input portion shall be clearly isolated and protected to prevent accidental contact.

2.7 All cables and wires used for wiring shall conform to IRS:S 76-89 and shall be neatly positioned and adequately supported. Aluminium wires shall not be used for internal wiring. The colour scheme employed for wiring shall conform to normal conventions and shall be shown in the schematic diagram given in suppliers instruction manual.

2.8 All connections shall be soldered or made through crimped eyelets and shall be numbered with PVC numbering sleeves.

2.9 The schematic wiring diagram referred in 2.7 shall clearly show wiring for inter-connecting the main components of the charger. The diagram shall be drawn on an anodized plate of thickness not less than 0.6mm and shall be firmly fixed on the inside of the cover of the charger. The following components shall be provided on the front panel:

(i) Double pole ON/OFF 3-position switch:-

In the central position, this will work as 'OFF' switch and in the left and right positions 'trickle charge' and 'boost charge' respectively.

(ii) Bank selector switch

(iii) Current control switch

(iv) A dual range ammeter confirming to IS: 1248, of 0-100 mA and 0-1000 mA with a minimum scale of at least 2 mA in 0-100 mA range shall be provided.

3. TECHNICAL DATA FOR VARIOUS TYPES OF DUAL BANK BATTERY CHARGER SYSTEMS REQUIRED IN DIFFERENT TYPE OF BLOCK INSTRUMENTS

3.1 Technical details of dual bank battery charger system suitable for giving indication supply to single line token instruments (Neale's –tablet or ball type) is given below:

i) Input to the battery charger - 230V AC ±10% single phase.

ii) Output from the Battery charger at maximum CC pot position-

At 1Amp. load in the range - 28.8V to 30.6V
At 100mA load in the range – 25.8V to 27.6V

iii) Facility in the battery charger – for both boost and trickle charging with manual operation.

Trickle charge rate: 4.3V to 4.6V/cell at 100mA load
Boost charge rate: 4.8V to 5.1V/cell at 1 Amp load

iv) Facility in the battery charger – For both boost and trickle charging with manual operation.

v) Technical details of batteries in the system – Two banks consisting of twin cells of 4.0 volts – 12AH (min.) capacity at 100 hr. rate, low maintenance lead acid batteries. Size of the twin cell shall not exceed 246 mm (H) x 165 mm (W) x 103 mm (D).

Total number of twin cells required for each block section shall be three to six depending on voltage required in the range 14.4 – 30.6V at 1A load. Voltage shall be specified by the purchaser.

3.2 Technical details of dual bank battery charger system to be used for double line block instrument (SGE) or Podanur make is given below:

i) Input to the battery charger - 230V AC ± 10% single phase.

ii) Output from the Battery charger at maximum CC pot position-
At 1Amp. load in the range - 48.0V to 51.0V.
At 100mA load in the range -43.0V – 46.0V.

iii) Facility in the battery charger – for both boost and trickle charging with manual operation.

Trickle charge rate: 4.3V to 4.6V/cell at 100mA load
Boost charge rate: 4.8V to 5.1V/cell at 1 Amp load

iv) Facility in the battery charger – For both boost and trickle charging with manual operation.

v) Technical details of batteries in the system – Two banks consisting of twin cells of 4.0 volts – 12AH (min.) capacity at 100 hr. rate, low maintenance lead acid batteries. Size of the twin cell shall not exceed 246 mm (H) x 165 mm (W) x 103 mm (D).

Total number of twin cells required for each block section shall be six to ten depending on voltage required in the range 28.8 – 51.0V at 1A load. Voltage shall be specified by the purchaser.

3.3 Technical details of dual bank battery charger system to be used for single line push button tokenless block instrument or Daido block instrument is given below:

i) Input to the battery charger - 230V AC ± 10% single phase.

ii) Output from the Battery charger at maximum CC pot position-
At 1Amp. load in the range - 72.0V to 76.5V
At 100mA load in the range – 64.5V to 69.0V

iii) Facility in the battery charger – for both boost and trickle charging with manual operation.

Trickle charge rate: 4.3V to 4.6V/cell at 100mA load
Boost charge rate: 4.8V to 5.1V/cell at 1 Amp load

iv) Facility in the battery charger – For both boost and trickle charging.

v) Technical details of batteries in the system – Two banks consisting of twin cells of 4.0 volts – 12AH (min.) capacity at 100 hr. rate, low maintenance lead acid batteries. Size of the twin cell shall not exceed 246 mm (H) x 165 mm (W) x 103 mm (D).

Total number of twin cells required for each block section shall be six to ten depending on voltage required in the range 48.0 – 76.5V at 1A load. Voltage shall be specified by the purchaser.

4. TECHNICAL DETAILS FOR DUAL BANK SYSTEM USING SMALL STATIONARY CELLS

4.1 The design of the charger shall be such that the ripple DC of the charger circuit does not get mixed up with the pure DC outlet of the battery charger circuit. The ripple content shall not be more than 10%.

4.2 A current control potentiometer shall be provided for current adjustments.

4.3 There shall be a selector switch to choose one of the battery banks for charge and other battery bank for discharge. A non-deteriorating type fuse conforming to IS: 9224 of required rating shall be provided for protecting battery charger.

4.4 There shall be 3 pairs of positive and negative functional terminals with red and black colours. Amongst these 3 pairs, one pair shall be for battery bank ‘A’, second pair for battery bank ‘B’ and the third pair shall be for service (Load). The terminals shall be suitably shrouded in a metallic cover.

4.5 Normally either bank of battery shall be allowed to be discharged approximately to a depth of 50% of its capacity to ensure longer life of the set.

4.6 In this dual bank battery charger system, the charging rate is pre-set under normal circumstances and the selector switch is left in trickle charge position.

4.7 The battery terminals shall be leak proof with lead plated threaded brass/copper inserts for easy connection.

4.8 The battery connectors shall be of lead coated copper. The thickness of the lead coating on copper connectors shall not be less than 0.025mm.

4.9 Efficiency of the charger – At full load efficiency of the charger shall not be less than 60% in boost mode and CC pot at maximum position.

4.10 The DC output of the charger shall be smoothened such that rms ripple content of the output voltage for rated input and output shall not be more than 10%.

5 SWITCHES, METERS, FUSES AND INDICATIONS

5.1 Double pole three-way selector switch conforming to IS: 4064 (with centre OFF position) left position for trickle charge and right position for boost charge mode shall be provided.

5.2 4 pole two way selector switch conforming to IS: 4064 shall be provided to select either of the two battery banks, i.e. one for charging and another for discharging.

5.3 Dual range DC ammeter of suitable range to measure trickle and boost charging current shall be provided on front portion of the charger.

5.4 Indication lamp shall be provided for indicating the mode of charging i.e. trickle or boost mode and 'Mains On'. Indications can be provided by using LEDs also.

5.5 Non-deteriorating type of fuses conforming to IS: 9224 shall be provided for short circuit protection.

6 INSULATION RESISTANCE

Insulation resistance will be measured by a 500V DC megger and shall not be less than 10 meg.ohm for the charger as unit between the points below given:

(i) AC input terminal to earth.
(ii) DC output terminal to each.
(iii) AC input to DC output terminals.

7 HIGH VOLTAGE TEST

The equipment shall have to withstand 1 KV AC voltage for one minute without causing any damage to the charger.

8. LOAD TEST

For boost mode, testing shall be carried out at 1 Amp. Load and for trickle mode, testing shall be carried out at 100 milli amps load. The charger shall be kept on rated load for a period of 72 hours.

9. REQUIREMENTS OF LOW MAINTENANCE BATTERIES

9.1 The 4V, low maintenance lead acid rechargeable stationary battery shall have 2 cells in series built in a light and robust plastic container.

9.2 The positive plate shall be tubular. The negative plate shall be pasted type of lead alloy with low antimony content. Low antimony lead alloy with grain refining ingredients (e.g. Se, Cu and/or S) shall be used in the grid to

minimize antimony transfer and water loss during charging. Synthetic separators to specification No. IS: 6071 shall be used.

9.3 The cells shall be provided with suitable electrolyte level indicators. Cell lid shall be sealed with the container in such a way that there is no leak.

9.4 The design of batteries shall be such that the frequency of the topping up shall not be more than once in 3 months. The battery shall have high conductivity terminals and there shall be minimum water loss during charging.

9.5 For topping up, two lines should be marked on the window indicating the maximum and minimum levels.

9.6 The batteries shall be so designed such that grid corrosion is negligible and the designed life of batteries is between 4 to 5 years.

9.7 Batteries shall have high resistance to over charging and shall be spill proof.

10. ELECTRICAL CHARACTERISTICS OF THE BATTERIES

10.1 The batteries shall have capacity of not less than 12 AH at 100 hrs. rate to input voltage of 3.7 volts. The batteries shall withstand higher rate of discharge.

10.2 The batteries shall not release corrosive gases under normal conditions and shall perform satisfactorily upto ambient temperature of 55ºC.

10.3 The batteries shall be supplied with initial charging if required by the purchaser other wise they shall be dry charged. The amp. Hr. efficiency shall be as per clause 12.9.1 of IS: 1651-1991 and not less than 95%.

10.4 Loss of capacity on storage of fully charged battery for a period of 30 days shall not exceed 5%.

11. ACCEPTANCE TEST OF BATTERIES

11.1 (a) Air pressure test shall be conducted on at least two samples. Sealing of each cell of the battery shall be checked by compressed air at a pressure equal to 700 mm height of water column.

(b) Requirements: The air pressure shall not fall below 670 mm of water column in 15 sec. after the air supplied to cell is disconnnected.

11.2 (a) Non-spillability test: It shall be conducted on 2 Nos. of samples. The charged battery shall be subjected to static non-spillability test by keeping it upside down for a period of two hours.

(b) Requirements: There shall be no visible spillage of electrolyte during and at the completion of 2 hours.

11.3 Capacity test

11.3.1 Capacity at 100 hour rate: This test shall be conducted on two samples. The battery shall be initially charged as per the manufacturer's specification. The batteries then shall be subjected to a discharged at a steady current of (10xAH) mA ± 2mA. At the end of 100 hours, the voltage shall not be less than 3.7 Volts.

11.3.2 Capacity at 10 hour rate: This test when performed as per IS: 1651 of 1991, end voltage after the first discharge cycle shall not be less than 3.7 Volts.

11.4 Marking on the batteries:

(a) The batteries shall be marked with the following:

(i) Manufacturer's name and trade mark.
(ii) Month and year of manufacturing.
(iii) Nominal voltage and amp. hr. capacity.

11.5 Dimensional check: Dimension shall be measured.

12. TYPE TESTS

For the charger part of the system the following shall constitute type test:

(a) Visual inspection: The charger shall be examined for provisions of all facilities stipulated in this specification, correct wiring, proper mounting of components, marking, workmanship, finish etc. for which no tests are specified.
(b) Applied high voltage test (Cl.7)
(c) Insulation resistance test (Cl.6)
(d) Test for load (Cl.8.0)
(e) Performance test (Cl.12.3)
(f) Temperature rise test (Cl.8.10, Specn: IRS:S 86/92)
(g) Climatic test: The climatic test shall consist of :-
i) Dry heat test at 50ºC as per IS: 900 (Pt.III)
ii) Damp heat (cyclic) test for variant I for 7 cycles as per IS: 9000 (Pt.V) Sec.II.

The climatic test shall be carried out by setting the chargers in boost charge mode of operation. During the period of exposure in each test, the chargers shall be connected to supply mains of nominal input voltage.

Immediately after the damp heat test, the insulation resistance of the unit shall not go below 5 meg.ohm after complete recovery. Similarly, during last half hour of exposure under dry heat test, I.R. value of the charger shall not go below 5 meg. ohm.

At the end of each test and after recovery, the charger unit shall not show any sign of apparent damage or deterioration.

12.1 Acceptance test: The following shall constitute acceptance test for the dual bank battery charger:

(a) Visual Inspection (Cl.12 (a))
(b) Applied high voltage test (Cl.7.0)
(c) Insulation resistance test (Cl.6.0)
(d) Test for load (Cl.8.0)
(e) Performance test (Cl.12.3)

12.2 Routine test: The following shall constitute routine tests and shall be conducted by manufacturer on every battery charger and test results will be submitted during inspection:

a) Visual inspection
b) Insulation resistance test (Cl.6.0)
c) Test for load (Cl.8.0)
d) Performance test and test for protections (Cl.12.3)

12.2.1 The performance test may be carried out only at nominal input voltage during the routine test.

12.3 Performance test: The charger shall be tested for its output performance with regard to Watt efficiency, ripple content, trickle and boost mode of charging with nominal input connected on the input side and a variable load across the output. The charger shall meet the requirements of Cl.3, 4 & 5.

12.3.1 The performance observation is to be taken at 1A and 100mA load at 230V input (rated) in boost & trickle mode at A&B bank alternatively keeping CC pot in ideal condition (max.) irrespective of the output voltage.

12.4 Individual battery charger and batteries used in dual bank battery charging system shall be type tested. Type test once completed successfully and type approval granted shall be valid for a period of three years.

12.5 Type test on batteries: Type test on batteries shall be performed as per clause 12.1.1 of IS: 1651-1991 with the following additional requirements:

(a) Dimensions shall not be more than 246 mm (H), 165 mm (W)& 103mm (D). Weight of fully charged battery shall not exceed 2.5 Kg.
(b) Test for loss of capacity on storage: It shall not be more than 5%.
(c) Ampere hour and watt hour efficiency test: It shall not be less than 95%.
(d) Life cycle test: Low maintenance lead acid cells shall have a minimum life of 1100 cycles. Some sampling scheme as is done for lead acid cells for Railway signalling application shall be adopted for carrying out life cycle test. **

In addition to above requirement, the sample during type test shall meet all other requirements brought out in this specification.

12.6 Plan of tests: Eight battery samples and two dual bank battery chargers shall be subjected to all tests mentioned for type test requirement of battery charger respectively.

12.6.1 If more than one sample in any individual test(s) fails, the system shall be considered not to meet the requirements of this specification. If any single sample fails in any of these requirements, twice the number of random samples shall be drawn and shall be subjected to the particular test(s). No failure shall be permitted in the repeated test (s)

13. INFORMATION TO BE SUPPLIED BY THE PURCHASER

13.1 The following information shall be supplied by the purchaser:

i) Output voltage of the battery charger – type of block instrument for which required (Cl.3.0)
ii) No. of twin cells required (Cl. 3.0)
(iii)Drawing, dimensions and layout if desired (Cl.2.1)
(iv Whether batteries required with initial charge (Cl.10.3)

** During each cycle of test, the fully charged test cell shall be subjected to:

(a) Discharge @ 0.083 C10 = 3 hours
(b) Charge @ 0.055 C10 = 5 hours
Water bath 40 ± 3ºC

Test discharge at every 50th cycle
Cut off 75% C10.

14. Packing & Labeling

14.1 The charger shall be wrapped in bubble sheet and packed in wooden case or card box of sufficient strength so that it can withstand bumps & jerks encountered during transportation by road/rail. The empty space between bubble sheet and wooden case/ card box shall be filled with suitable filling material or thermocole.

14.2 Each wooden box or card box shall be marked with code numbers, contents and name of the manufacturers. The upside of the box shall be indicated with an arrow. Boxes should have standard signages to indicate the correct position and precaution “Handle with Care” with necessary instructions.

14.3 The charger shall be so packed as to permit convenient handling and to protect against loss or damage during transit and storage.

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