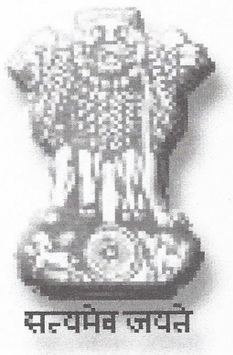

Government of India
Ministry of Railways
(Railway Board)

INDIAN RAILWAY STANDARD SPECIFICATION FOR TRACK FEED BATTERY CHARGER

No. S 89/2013

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Approved by **Name: Shri Mahesh Mangal** **Designation: Sr. Executive Director/Signal, RDSO**		
Abstract This document defines specification for Track Feed Battery Charger		

DOCUMENT CONTROL SHEET

NAME	ORGANISATION	FUNCTION	LEVEL
Vijay Kumar, DDSIG-1	RDSO	Member	Prepare
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Sh. Mahesh Mangal, Sr.EDSIG	RDSO	Approving Authority	Approve

Specification No.	Version	Amendment	Amendment Details	Issued On
IRS:S 89/93	---	---	---	13.08.1993
IRS:S 89/93	---	1	---	18.06.1999
IRS:S 89/93	---	2	New Clause added 1.2, 2.1.1, 2.8 (iii to iv), 4.10 & 6.0. Clause modified 2.1, 2.3, 2.5, 2.8 i & ii, 2.13, 3.3, 3.4, 3.5, 3.6, 3.10 e, 4.1, 4.8, 4.10, 4.11, & 5.	11.09.2006
IRS:S 89/93	---	3	New Clause added 2.9 vi to viii, 2.11, 2.15, 2.17, 3.7, Clause modified: 2.7, 2.9 I, ii, iii & v, 2.12, 2.13, 2.16, 3.2, 3.3 & 4.12.	19.09.2012
IRS:S 89/2013	**Ver 1.0**	---	Clause modified: 4.12	13.08.2013

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1. SCOPE

1.1 This specification covers the technical requirements of track feed battery chargers for charging 1 or 2 or 3 or 4 lead acid cells of 40/80AH AH used in track circuits.

1.2 The rating of the charger shall be 5A & 10A as required by the purchaser for 40 & 80AH battery respectively.

2. GENERAL REQUIREMENTS

2.1 The size of the charger shall be as under –

Length - 300 mm (max.)
Width - 200 mm (max.)
Height - 200 mm (max.)

2.2 The inside and outside surfaces of the charger casing shall be painted to prevent corrosion. All metallic parts used in fabrication shall be either painted or plated.

2.3 The cabinet colour shall be of pebble grey RAL 7032 and shall be electrostatic epoxy powder coated paint finish type.

2.4 The charger shall be air-cooled type having sufficient louvers provided for ventilation in such a way that dripping water does not get inside easily.

2.5 The outer casing of the charger shall be fabricated of MS sheet of at least 1.2 ± .09 mm (18 SWG) thickness as per IS: 513, 1994.

2.6 The charger shall be of robust construction and shall withstand bumps and shocks as encountered in transportation by rail or road in unpacked condition.

2.7 Louvers with opening less than 3mm dia in body sheet shall be provided to prevent of rodents, lizards etc. and give necessary ventilation.

2.8 A circuit diagram on an anodized plate shall be fixed conspicuously inside. All components shall be indelibly marked and their values/ratings indicated on the diagram.

2.9 Following components shall be provided on the front panel as shown in drawing no. SDO/RDSO/TFBC/001 with alteration 1.

i) An ON/OFF Rotary switch (CAM type) as per IS: 13947 (Pt. 3). The rating of the switch shall be at least 6A for both 5A and 10A battery chargers.

ii) A snap acting rotary cell selector switch (CAM type) of at least 16A rating conforming to IS: 13947 (Pt. 3) for selecting 1,2,3 & 4 cells in four positions.

iii) One pair of insulated input terminal -110V AC shall be marked and suitably protected. It shall be of rating 15A suitable for 2.5sq.mm size conductor wire.

iv) Charger fails (LED) indication – whenever charger output fails with AC input being available.

v) Potential free contact – To extend audio/visual alarm at remote place whenever charger output fails with AC input being available. Potential free contact shall be NC (back) contact of a relay.

vi) One pair of insulated output terminals – the negative terminal shall be of black colour while the positive terminal shall be of RED colour. These shall be of sufficient size to facilitate connection of 3/0.29 size single conductor wire or 2.5sq.mm size flexible wire.

vii) Power 'ON" RED LED indicator.

xiii) A green terminal marked 'Earth' for earthing of rating 15A and having similar size as mentioned for Red and Black terminals.

2.10 Provision shall be made to terminate the AC input leads on terminals provided on the equipment.

2.11 Charger shall be provided with suitable MOVs of rating 150V (14 mm) at the AC input in both common and differential mode as means for surge suppression.

2.12 All electrical components other than transformer shall be derated atleast to 50% of the rated value for improving reliability.

2.13 Solid state industrial grade components with operating range -25°C to +85°C or better shall be used.

2.14 All non-current carrying metal parts shall be bonded together and earthed.

2.15 Transformers and inductors/ chokes used shall be vacuum impregnated and shall be of natural air-cooled type and shall conform to IS: 6297. Class F or higher grade insulating material as per IS: 1271 and polyester enameled copper winding wire conforming to IS: 13730 (Pt. 3) shall be used for winding transformers and inductors/ chokes.

2.15.1 When tested in accordance with Cl.6.2.1.6 of IS: 6297 (Pt. 1) the transformer shall not show insulation resistance of lower than 100 M ohm when measured at an ambient temperature of 40°C and RH of 60%. Also the insulation resistance value shall not fall below 50 M ohm at the end of climatic tests. In case the temperature and humidity at the time of measurement are different, the IR value shall be computed using the graph in Annexure 'A'.

2.16 Blocking diode (stud type) of min. 400V PIV along with suitable heat sink arrangement shall be provided to prevent reverse feed from battery in case AC supply is not available. The blocking diode should be of rating 12A for 5A charger and 25A for 10A charger.

2.17 Isolated Metal Case Encapsulated Diode Bridge Rectifier Module should be used for rectification. PIV for the bridge rectifier shall be minimum 400V and current rating shall be minimum 25A. Appropriate heat sink arrangement shall be provided to ensure temperature rise within limits as specified in Para 4.12.

2.18 Each charger shall be provided with an anodized weather proof plate having following information.

a) Name or trade mark of the manufacturer
b) IRS specification No
c) Rated input voltage and frequency
d) Serial No. and year of manufacture
e) Rating of charger & AH capacity of the cells for which meant

3. PERFORMANCE REQUIREMENTS

3.1 The charger shall be designed and manufactured for continuous operation at rated load in the ambient temperature range of 0°C to 60°C with RH reaching up to 95%.

3.2 The charger shall be rated for 110V, AC input voltage at a frequency of 50 Hz ± 2 Hz. If the input voltage is different stabilized AC voltage of 110V shall be made available by the user. Additional input tapings of 90 and 100 V shall be provided to take care of voltage drop in cable for distant locations.

3.3 The charger shall be capable of charging a fully discharged cell. The charger output voltage shall be maintained between 1.6V/cell to 1.9V/cell at –

i) 2.5A load for 40AH battery and
ii) 5A load for 80AH battery

3.4 With 110V AC input and at 5/10A resistive load, the overall watt efficiency shall not be less than 50% when the charger is set for charging with maximum cell position.

3.5 No load current of the transformer used in the charger shall be <10% of input current at rated load and maximum cell position.

3.6 The no load to full load voltage regulation of the transformer when measured with the highest voltage taping on secondary side loaded to rated current (5A/10A) shall be less than 5% at maximum cell position.

3.7 The DC output of the charger shall be smoothed such that the rms ripple content of the output voltage when delivering the rated output current through a resistive load measured by an oscilloscope /true rms multimeter shall not be more than 5%.

3.8 The charger shall be tested for its output performance by connecting a resistance load across the output terminals.

4. TESTS

4.1 Type tests

The following shall comprise the type tests and shall be carried out only on one sample of either 5A or 10A rating in the following sequences. Type approval shall be granted for up to 5A or 10A depending upon the sample submitted –

SN	Description	Clause No.
a)	Visual inspection	(Cl 4.4)
b)	Insulation resistance test	(Cl. 4.5)
c)	High voltage test	(Cl. 4.6)
d)	Performance test	(Cl. 4.7)
e)	Temperature rise test	(Cl. 4.12)
f)	Continuous operation	(Cl.4.8)
g)	Climatic tests	(Cl. 4.9)
h)	Vibration test	(Cl. 4.10)

4.2 Acceptance test

The following shall comprise acceptance test –

SN	Description	Clause No.
a)	Visual inspection	(Cl 4.4)
b)	Insulation resistance test	(Cl. 4.5)
c)	High voltage test	(Cl. 4.6)
d)	Performance test	(Cl. 4.7)
e)	Temperature rise test	(Cl. 4.12)

4.3 Routine Test

The following shall constitute routine test and shall be conducted by manufacturer on every battery charger and test results shall be submitted during the inspection.

SN	Description	Clause No.
a)	Visual inspection	(Cl 4.4)
b)	Insulation resistance test	(Cl. 4.5)
c)	High voltage test	(Cl. 4.6)
d)	Continuous operation	(Cl.4.8)
e)	Performance test	(Cl. 4.7)

4.4 Visual Inspection

The charger shall be examined for provisions of all facilities stipulated in this specification, correct wiring, proper mounting of components, marking, workmanship and finish for which no tests have been specified.

The dimensions of the charger shall be conformed to clause 2.1.

4.5 **Insulation Resistance test**

This test shall be carried out

a) Before the high voltage test
b) After the high voltage test
c) After the climatic test.

The measurements shall be made at potential of 500V DC. The insulation resistance shall be measure between-

a) Input line terminals and the body of the equipment.
b) Output line terminals and the body of the equipment.
c) Input terminals and output terminals of equipment.

Value of the insulation resistance shall not be less than 10 Meg ohm for the charger and 100M.ohms for the transformer at an ambient temperature of 40°C and Relative Humidity of 60%. After the completion of the climatic tests, the value shall not be less than 5 Meg ohms and 50 Meg ohms for the charger and transformer respectively.

4.6 High Voltage Test

The charger shall withstand for one minute, a test voltage of 2000V, AC rms applied between power components and the body of the charger, which shall be earthed.

4.7 Performance test

The charger shall be tested to check the performance requirements specified under Clause 3.2 to 3.7.

4.8 Test for Continuous operation

The charger shall be subjected to a continuous operation for 240 hours at maximum rated input and 125% of the rated output current for type test and 08 hours for routine test. After this test, the charger shall not show any deterioration in its performance and shall meet the performance requirement as per Cl. 4.7.

4.9 Climatic test

4.9.1 Dry heat test

The charger shall be subjected to this test in accordance with IS: 9000 (Pt. III/Sec. 5) – 1977 at 60°C for a period of 16 hours. During the test, the charger shall be loaded with its rated capacity.

4.9.2 Damp heat (Cyclic) Test

For variant 1 for 7 cycles as per IS: 9000 Pt. V Section. 2 shall be performed.

4.9.3 Cold Test

The test shall be done at 0° C in un-energized condition for 2 hours duration as per IS: 9000 (Pt.II).

4.10 Vibration test

The charger shall be subjected to vibration test as given below:-

Freq. Range	08-350Hz
Amplitude	± 6 mm constant displacement or 15m/ sec.^{2} constant accélération
No. of axis	3
No. of sweep cycle	20
Total duration	105 minutes
If resonance is observed	10 min at each resonant freq.

Condition: After this test, electrical parameters shall be monitored in addition to physical checks as per Cl. 4.7.

4.11 **Sampling plan**

The following sampling plan shall be adopted for acceptance tests.

Lot size	Sample size for performance test	Sample size for Temperature rise test
2-8	2	1
9-15	3	1
16-25	5	2
26-50	8	2
51-100	13	3
101-150	20	3
151-200	32	3

4.12 Temperature Rise test

The cold resistance of transformer and choke winding shall be measured after conditioning the charger until three consecutive temperature readings taken at 30 minutes interval are constant and the constant temperature shall be taken as reference temperature T1.

The charger shall be connected to the AC supply mains and setting the input voltage at 110V and cell selector switch in four cell position. A resistive load shall be connected such that the rated DC current (5A/10A) flows through the load. The charger shall continue to draw the rated output current till such time the temperature equilibrium is reached i.e. the temperature variation between 3 successive readings taken at an interval of 30 minutes is less than 1 deg.C. Throughout the test, the rated load current shall be maintained. Once the temperature equilibrium has been reached the temperature of the rectifying diodes, resistors, thyristor, zener diodes, electric junction shall be measured by means of thermometer (thermo couple type) without disconnecting the load. The thermo couple used for determining the temperature rise to the different components shall be attached to the back of a small

blackened disc of copper or brass 15 mm in diameter and 1 mm thick which is flush with the surface of components. Then the charger shall be switched off and hot resistance of the windings of main transformer/chokes shall be measured within one minute of switching off.

The temperature rise of the winding shall be computed by the following formulae:

$$\Delta T = \frac{R2 - R1}{R1}(234.8 + T1) - (T2 - T1)$$

ΔT is the temperature rise.
R1 resistance of winding at the beginning of the test.
R2 resistance at the end of the test.

T1 is the room temperature at the beginning of the test
T2 is the room temperature at the end of the test.

Maximum temperature rise above ambient (T2) of different components shall be as given below -

S.N	Components	Max. permissible temperature rise above ambient temperature
1	Transformer & choke	50 °C
2	Silicon diodes, Zener diodes and resistors	40°C

5. PACKING

Manufacturer shall be responsible for safe transportation of battery charger, which should be packed and delivered in good condition to consignee at his depot. If there is any damage, manufacturer shall replace the damaged battery charger free of cost.

6. INFORMATION TO BE SUPPLIED BY THE PURCHASER

Rating of charger – 5A or 10A

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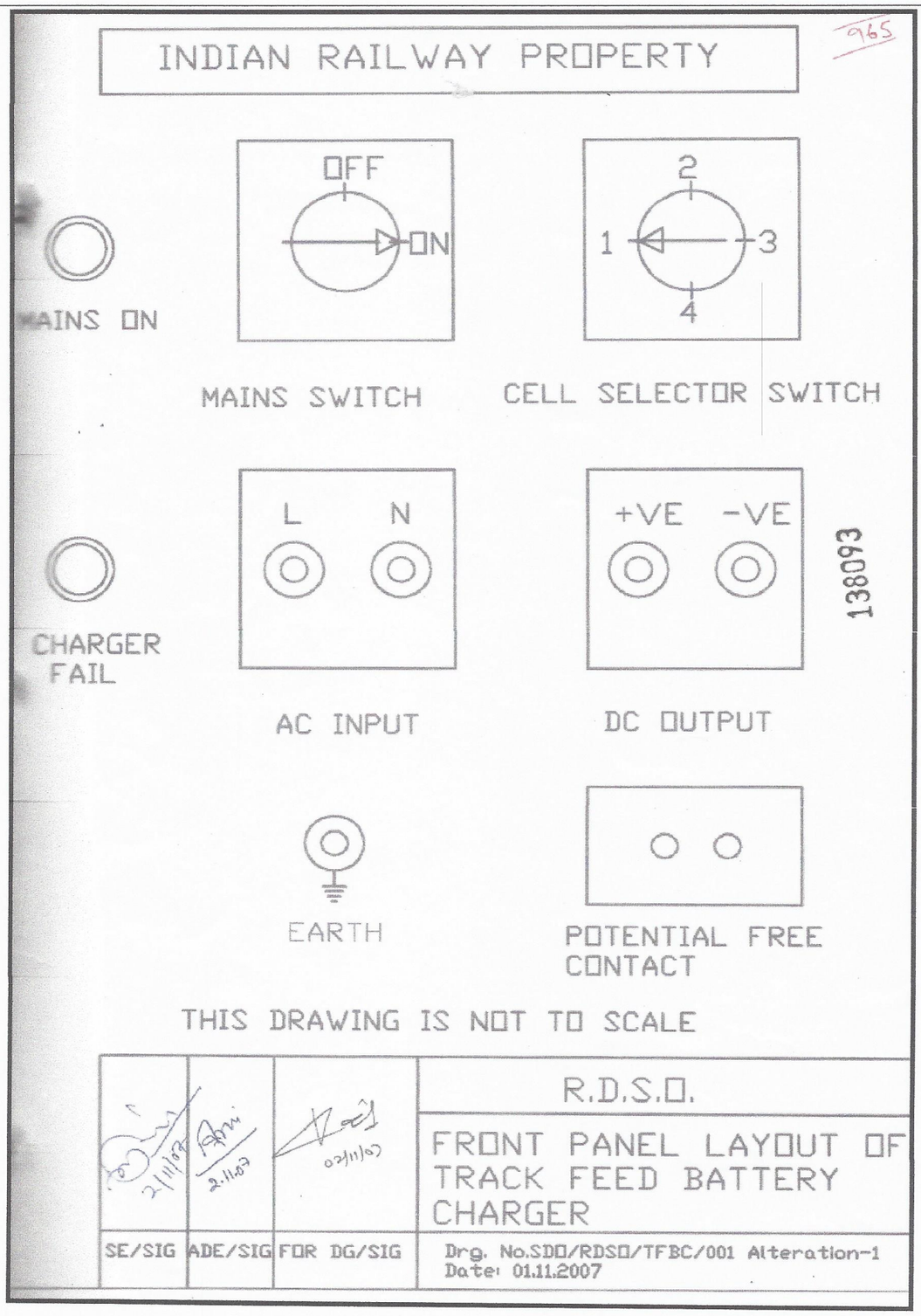
INDIAN RAILWAY PROPERTY
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OFF
ON
2
1
3
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MAINS ON
MAINS SWITCH
CELL SELECTOR SWITCH
L
N
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138093
CHARGER FAIL
AC INPUT
DC OUTPUT
EARTH
POTENTIAL FREE CONTACT
THIS DRAWING IS NOT TO SCALE
R.D.S.O.
FRONT PANEL LAYOUT OF TRACK FEED BATTERY CHARGER
SE/SIG
ADE/SIG
FOR DG/SIG
Drg. No.SDO/RDSO/TFBC/001 Alteration-1
Date: 01.11.2007

COMPUTATION OF IR VALUE WITH RESPECT TO RT AND RH