

MOTOR FOR ELECTRIC POINT MACHINE



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**INDIAN RAILWAYS STANDARD SPECIFICATION
FOR
MOTOR FOR ELECTRIC POINT MACHINE**

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MOTOR FOR ELECTRIC POINT MACHINE

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Abstract This document specifies technical specifications for Motor for Electric Point Machine. The specific technical requirements of IP-67 compliant Motor for Electric Point Machine are also covered in this document.		

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AMENDMENTS

VERSION	CHAPTER/Annexure	Amendment	Effective date
IRS: S 37/1970		FIRST ISSUE	1970
IRS: S 37/1982		Revision 1	1982
IRS: S 37/1982		Amendment 1	-
IRS: S 37/1982		Amendment 2	1990
IRS: S 37/1982		Amendment 3	-
IRS: S 37/2022	Features of 400 V AC Immunity and IP 67 protection are added in the existing specification.	Amendment 4	2022

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0. FOREWORD

- 0.1 This specification is issued under the fixed Serial No. S 37; the final number indicates the year of original adoption as standard, or in the event of revision, the year of last revision.
- 0.2 This specification requires reference to the following Indian Railway Standard Specifications (IRS) and Indian Standard Specification (IS) and shall also be complied with to the extent applicable:

IRS: S 23	Electrical Signaling and Interlocking Equipment
IRS: S 24	Non-trailable Electric Point Machine with plunger type of locking.
IS/IEC 60034-1:2004	Rotating Electrical Machines, Part-I: Rating and Performance
IS: 1271	Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service.
IS: 2106	Environmental test for electronic and electrical equipment.
IS: 9000	Basic environmental testing procedures for electronic and electrical items
IS/IEC 60034-5 : 2000	Indian Standard of Rotating Electrical Machines (Added for IP-67 point motor.)

- 0.3 Whenever reference to any of the above mentioned Specifications appears in this Specification, it shall be taken as a reference to the latest issue of that Specification.
- 0.4 This specification is intended chiefly to cover the technical provisions and the provisions relating to supply of materials and so does not include all the necessary provisions of a contract.

1. SCOPE

- 1.1 This Specification covers the requirements of 110V DC motor to be used with Electric Point Machine.
- 1.2 This specification covers point motor having IP-67 protection feature and AC immunity of 160 V or 400 V.
- 1.3 Vendor has to specify the “AC immunity level” of the motor and also to specify whether the motor is IP-67 compliant while applying for registration.

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2. TERMINOLOGY

- 2.1 The terminology referred to in this specification is covered by the definitions given in IRS specification S 23*.
- 2.2 The terms referred to in this specification but not covered by IRS S 23 are defined below:
- 2.2.1 **Rating:** A statement of operating limits assigned to the machine by the manufacturer.
- 2.2.2 **Short Time Rating:** A rating which specifies the load at which the motor, starting at the ambient temperature, may be operated for the period and under the conditions specified on the rating plate, while complying with the requirements of this Specification.
- 2.2.3 **Overload:** Any condition of load in excess of the rated load; usually the amount of the excess is expressed as a percentage excess torque for motors.
- 2.2.4 **Momentary over load:** An over load for the duration which is so short as not to affect appreciably the temperature of the motor.
- 2.2.5 **Totally Enclosed Motor:** A motor so constructed as to prevent the free exchange of air between the inside and the outside of the enclosing case. Such an enclosure is not necessarily air tight.
- 2.2.6 **IP-67 compliant Motor:** The Motor shall be constructed to provide IP-67 features as per IS/IEC 60034-5:2000 protocol as to prevent any entry of dust and moisture ingress. Protocol shall be maintained as per international standards which define the level of protection from water and dust.

3. MOTOR ENCLOSURE

- 3.1 The motor shall be totally enclosed type.

4. RATED VOLTAGE

- 4.1 The rated voltage of the motor shall be 110V DC.

5. RATING OF MOTOR

- 5.1 The rating shall be short time, 10 minutes rating.

6. OPERATING REQUIREMENTS

- 6.1 The Motor when connected to an Electric Point Machine shall be capable of complying with the Operating Requirements given in IRS: S 24. It shall also be capable of operating the Point Machine as per IRS: S 24 between the limits of 75% and 125% of the rated voltage.

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- 6.2 The motor shall be capable of functioning normally even after remaining in submerged condition for 24 hours in case of IP-67 Compliant Point Motor.

7. TYPE OF MOTOR

- 7.1 Motors shall be either permanent magnet type or series wound type with split fields.
- 7.2 The insulation for the motor shall be class 'B' in accordance with IS: 1271.
- 7.3 The motor shall be capable of rotation in both directions.

8. DIMENSIONS

- 8.1 The main dimensions of the motor shall be as specified by the Purchaser (see Appendix-A) and such that it forms an integral part of the Point Machine and can be readily removed there from.

9. CABLE CONNECTION

- 9.1 The cable entry shall be of ample size, conveniently located for access to the terminals and arranged to protect the cable from mechanical injury.
- 9.2 Water tight male-female Tin plated copper connectors shall be used for electrical connections for IP-67 compliant motor. The connector shall conform to BS EN 60309-2 / BS 4343:1992 and/or IEC 309 – 1/2. For metal cable gland EN 62444:2013 shall be followed.

10. DESIGN

- 10.1 The bearing shall be such that the lubricants used cannot reach the brushes, commutator or windings.
- 10.2 IP-67 Compliant Motor (as per requirement)
- 10.2.1 The design shall be such that to protect against water and dust ingress as per IP-67 of IS/IEC 60034-5:2000.
- 10.2.2 The arrangements adopted for making the motor water tight shall be such that opening of cover for cleaning of commutator & replacement of carbon brush should not affect IP-67 protection after fixing the cover.
- 10.2.3 The sealing arrangement used in the motor for IP-67 protection shall be long lasting and shall not lose the effectiveness during codal life of Point Motor.

11. MOMENTARY OVERLOAD

- 11.1 The motors rated in accordance with this standard shall be capable of withstanding on test (under gradual increase of torque) without injury, 60%

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of the full load torque as over load for 15 seconds after having attained the temperature rise corresponding to the rated load.

11.2 During the test, the voltage shall be maintained at the rated value.

12. TEMPERATURE RISE

12.1 The temperature rise of motors when tested under rated conditions and in accordance with the requirements of this specification shall not exceed the limits given in Table-1.

12.2 Temperature measurement shall be carried out by any of the methods indicated in clause 8.5 of IS/IEC: 60034-1: 2004.

12.3 At the start of the temperature test of the motor, the temperature of the winding shall be substantially the same as that of cooling air.

12.4 The duration of the temperature test shall be 10 minutes.

TABLE 1
Limits of the temperature rise

	Parts of Motor	Temperature Rise
1	Insulated windings	50° C
2	Iron Parts in contact with insulated winding	50° C
3	Commutators	50° C
4	Iron Cores and other parts not in contact with insulated windings and uninsulated windings.	The temperature rise shall in no case reach such a value that there is a risk of injury to any insulated materials on adjacent parts.

13. COMMUTATORS, BRUSH GEAR AND SLIP RINGS

13.1 The Motor shall work with fixed brush setting from no load to the momentary overload specified in Clause 11.1 without injurious sparking or injury to the commutators, brushes or slip rings.

14. MARKING AND IDENTIFICATION

14.1 Marking and identification shall conform to IRS Specification No. S 23*

14.2 Each motor shall be provided with an engraved name plate giving following information:

a) IRS Number

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- b) Type of motor.
 - c) Manufacturer's Name.
 - d) Serial Number and Year of manufacture of Point Motor.
 - e) Rating.
 - f) Rated voltage or voltage range.
 - g) Rated output in watts.
 - h) Approximate current in amperes at rated output.
 - i) Approximate full load speed in revolutions per minute at rated output.
 - j) Immunity level (160V AC or 400V AC).
 - k) Clearly engrave on the Name plate "IP 67" (if the motor is IP- 67 compliant).
- 14.3 A wiring diagram of connections shall be supplied mounted on conspicuous place on the cover of the motor.

15. TERMINALS

- 15.1 Terminals shall be of size M 6 and shall conform to IRS: S23 part-II/88.
- 15.2 Terminals shall be marked for identification purposes in accordance with the diagram of connections.

16. FINISH

- 16.1 The finish of the various parts of the machine shall conform to IRS Specification S 23 - Electrical Signaling & Interlocking Equipment.

17. INSPECTION AND TESTING**17.1 Type Tests-**

- 17.1.1 One sample shall be subjected to type tests mentioned in Clause 17.1.2. The sample shall successfully pass these tests and also satisfy the insulation resistance values specified in Clause 19.2. In case of failure, a fresh sample shall be called for and again subjected to these tests.
- 17.1.2 Type tests shall include all the tests referred to in Clause 17.3 and the following environmental tests in the under mentioned sequence:
- (a) Dry Heat test- (at $85^{\circ}\text{C} \pm 3^{\circ}\text{C}$) for 16 hours as per IS: 9000 (Part –III/Sec 1 to 5).
 - (b) Cold test- (Chamber temperature of $-10^{\circ}\text{C} \pm 3^{\circ}\text{C}$) (For 16 hours as per IS: 9000 Part II/ Sec.1to4).
 - (c) Damp Heat (cycling) test - (one cycle of 24hours) as per IS: 9000 (Part V/Sec1& 2).
 - (d) Salt Mist test – as per IS: 2106 (Part XVIII).
 - (e) Water Spray test- as per IS: 2106 (Part XI).

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- (f) Dust ingress test: This test shall be performed as per IS/IEC 60034-5:2000, to comply IP-67, before Water Immersion test. Ingress of dust shall be totally prevented. The protection is satisfactory if there is no ingress of dust powder.
- (g) Water Immersion Test: This test shall be performed as per IS/IEC 60034-5:2000, to comply IP67 protection. The motor shall be kept submerged under water at a depth of 1 meter for 24 hours, no water should ingress. It shall be taken out and operated after recovery period of 10 minutes with thoroughly wiping externally using cotton cloth to verify its functionality. Measurement of operating parameters and insulation resistance test shall be done as per Clause 17.3 (a) and SN: 04 of Clause No.19.2. The values of operating current and insulation resistance shall be within specified limits. This Clause shall be applicable for IP-67 compliant motor only.

Note-

1. After each of the tests mentioned above, it should be checked up that the motor rotates freely when connected electrically. In the case of cold, damp heat, salt mist and water spray tests a recovery period of two hours should be allowed. The voltage should be increased gradually from Zero till the rotation sets in. The voltage should under no case exceed 40% of the rated voltage.
2. Insulation resistance values shall be measured after dry heat, cold and damp heat tests. Details of the same may be seen in clause 19.2.

17.2 **Routine Tests-** These tests shall be conducted by the manufacturer on every motor manufactured and proper record of these routine Tests shall be maintained by the manufacturer which shall be submitted during inspection.

The Routine tests shall comprise of following:

- a) Tests under full load condition of current, power input and speed at rated voltage and frequency.
- b) Insulation resistance test (Clause 19.1).
- c) High voltage test (Clause 18).
- d) A.C. immunity test (Clause 20).
- e) In case of IP-67 Motor, the manufacturer shall submit an undertaking that they have tested all the point motors for IP-67 protection compliance. In case of failure of any motor within five years from date of supply, the motor shall be replaced by the firm free of cost.

17.3 **Acceptance test-** Acceptance test shall be made on 2% of a batch, subject to a minimum of one motor, at the rated voltage and shall comprise-

- (a) Operating requirements (Clause- 6).
- (b) Temperature rise (Clause12)
- (c) Momentary overload (Clause 11.1)

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- (d) Insulation resistance (Clause 19.1).
- (e) High voltage (Clause-18).
- (f) A.C. immunity test (Clause 20).
- (g) Water immersion test as per clause 17.1.2 (g) for submerged duration of 04 hours instead of 24 hours with 10 minutes recovery shall be conducted in addition to Clause no. 17.3. (This test shall be applicable for IP-67 compliant motor only)

18. HIGH VOLTAGE TEST

18.1 High voltage test shall be conducted as follows-

	Test Voltage	Duration
Between field winding and body with the armature isolated.	2000 V AC (rms) at 50 Hz.	1 minute for Type test.
Between armature and body with field isolated.	1000 V AC (rms) at 50 Hz.	1 minute for Type test.

Note: High Voltage Test between field winding and body shall be conducted only in case of series wound motors.

18.2 Duration of the High Voltage test for routine and performance tests shall be between five and ten seconds.

19. INSULATION RESISTANCE TEST

19.1 The insulation resistance shall be measured with a DC voltage of 500V and the value obtained shall not be less than 10 Mega-ohm. For this purpose, the terminals of field and armature windings shall be connected together and the insulation resistance measured between the common terminal and the body. The insulation resistance test shall be carried out before and after high voltage test.

In case of permanent magnet motors, the insulation resistance shall be measured only between the terminals of armature windings and the body.

19.2 The insulation resistance shall also be measured after the following environmental tests and the values obtained shall not be less than as indicated below-

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SN	Name of Test	Recovery period	I.R. Value between both fields and body with armature isolated (Minimum)	I.R. value between armature and body with fields isolated (Minimum)
1	Dry Heat Test	2Hours	5 Mega-ohm	1Mega-ohm
2	Cold Test	2 Hours	1Mega-ohm	1Mega-ohm
3	Damp Heat	2 Hours	100 kilo-ohm	There shall not be direct shorting.
		48 Hours	250 kilo-ohm	-do-
		7 days	1Mega-ohm	1Mega-ohm
		14 days	5Mega-ohm	1Mega-ohm
4	Water Immersion Test (for IP-67 compliant motor)	10 minutes	1Mega-ohm	1Mega-ohm
		48 hours	5 Mega-ohm	1 Mega-ohm

In case of permanent magnet motors, the insulation resistance shall be measured only between the terminals of armature windings and the body.

20. AC IMMUNITY TEST

- 20.1 The operating characteristics of the motor shall be verified by conducting a brake test and recording the values of speed and torque at rated voltage and rated current. There corded value of speed shall not vary by more than $\pm 10\%$ of the nominal specified speed of the motor. The torque developed on the motor shaft during brake testing shall be calculated by multiplying the tension difference between the two spring balances with the effective radius of brake drum. The output of the motor shall then be calculated with the help of the readings of torque and speed. The calculated output of motor shall not vary by more than $\pm 5\%$ from the nominal specified output.
- 20.2 To check the AC immunity level of the motor, 10% of the tension difference obtained by the method indicated in Clause 20.1, under rated conditions, shall be applied on the motor shaft through the same brake drum. An AC voltage shall then be applied across the motor terminals gradually as well as abruptly. The AC voltage, at which the motor just starts rotating, shall be considered as the AC immunity level of the motor. The minimum AC immunity level of the motor shall be 160V (rms) at 50 Hz.
- 20.3 The AC immunity level of the motor shall be 160V AC at 50 Hz OR it shall be 400 V AC at 50 Hz as mentioned by the manufacturer.

MOTOR FOR ELECTRIC POINT MACHINE**21. REJECTION**

21.1 The motor or any part thereof that does not comply fully with the requirements of this Specification and/ or any other specification and/or drawing as approved by the Purchaser , may be rejected.

22. PACKING

22.1 The packing shall be done in accordance with Clause 17 of IRS Specification S-23.

23. WARRANTY

23.1 The warranty of the product shall be in accordance with Clause 18 of IRS: S 23. For IP67 Motor warranty period shall be 5 years.

24. ISO Clause

All the provisions contained in RDSO's ISO procedures laid down in Document no. QO-D—8.1-11 Ver. 1.7 titled "Vendor changes in approved status" and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.

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Information to be supplied by the Purchaser-

- A-1 Overall dimensions of the motor (Clause 8.1).
- A-2 Size and position of fixing bolt holes (Clause 8.1).
- A-3 Dimensions ,height from base level and any other details of the portion of the shaft protruding outside the casing of the motor (Clause 8.1).
- A-4 Rated out-put in watts. (Clause 14.2).
- A-5 Whether permanent magnet type or split field series type.
- A-6 AC immunity of point motor (160V AC OR 400 V AC)
- A-7 Requirement of IP-67 motor, Yes/No

(Note : Clause no. A-7 added for IP-67 compliant motors)