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INDIAN RAILWAY STANDARD SPECIFICATION FOR ELECTRIC SIGNAL MACHINE (TENTATIVE)

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AMENDMENTS

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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

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INDIAN RAILWAY STANDARD SPECIFISCATION FOR ELECTRIC SIGNAL MACHINE (TENTATIVE)

Serial No. S 25-97

0.FORWORD.

0.1 This specification is issued under the fixed serial No. S 25, the final number indicates the year of original adoption as standard or in the case of revision the year of last revision.

ADOPTED 1963, REVISED 1997

0.2 This specification requires reference to the following Indian Railway Standard and British Standard specifications:-

IRS : S 23 Electrical signalling and Interlocking Equipment.

IS : 9000 Basic environmental testing procedure for electronic and electrical items.

IRS : S 39 Motors for Electric signal Machine.

BS : 376: Part 2 Railway Signalling Symbols: Wiring Symbols and written circuits.

0.3 Wherever, in this specification, any of the above mentioned specification is referred to 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 the provisions relating to supply of the material and so does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This specification applies to the Electric Signal Machine to Drawing No. SA 23851-52 for operation of semaphore signals-2 aspect Lower Quadrant and 2 or 3 aspect Upper Quadrant to Drawing Nos. SA 8558 and SA 8578 respectively.

1.2 This specification gives details of rated voltage, general requirements, operating characteristics, motor design and type and acceptance tests.

1.3 This specification does not cover the wiring and protective device used in conjunction with the Electric Signal Machine.

2. TERMINOLOGY

2.1 The terminology referred to in this specification is covered by the definitions given in I.R.S. specification No. S 23.

2.2 The terms referred to in this specification but not covered in I.R.S. specification No. S 23, are defined below:-

2.2.1 'Signal Machine' is an electrically operated machine used for working a semaphore signal. It consists of an electric motor, hold off mechanism, circuit controller, train of gears, driving shaft, friction clutch etc.

2.2.2 'A Totally enclosed Motor'- is a motor so enclosed as to prevent circulation of air between the inside and outside of the case, but not sufficiently to be termed 'Air-tight.'

2.2.3 'Time of Operation'- is the time required to operate a semaphore signal through an arc of 0° to 45° or 45° to 90° .

2.2.4 'Top of post Mounting Machine'- is an electric signal machine for mounting at the top of signal post and is one in which the semaphore signal fits directly on its 'semaphore shaft.'

2.2.5 'Snubbing Device'-is a device employed to regular the movement of semaphore arm while returning to its restrictive position in order to reduce the shock on the mechanism.

2.2.6 'Friction clutch'- is a device employed to minimize the physical shock of stopping the mechanism at the end of its stroke.

2.2.7 'Semaphore shaft'- is the shaft of signal machine on which the semaphore arm or the operating crank is mounted.

2.2.8 '10 minutes rating'- The output at which a motor can work for 10 minutes and comply with IRS: S 39.

2.2.9 'Hold-off Device'- is an electromagnetic device which holds the semaphore signal in its proceed or caution position and allows the arm to return to a more restrictive position under the action of gravity if the current in the coil of the electro-magnet is reduced or interrupted.

3. OPERATING CHARACTERISTICS.

3.1 The rated voltage and current of the machine shall be as follows:

Type of Machine	Rated voltage DC	Maximum rated current		
		Motor (Amps)	Hold off (Amps)	
			With solid core	With laminated core
Low voltage	10V	1.6	0.020	0.050
High voltage/Hand Generator	110	0.6	0.015	0.040

3.2 The time of operation of semaphore signal shall not exceed 10 seconds at rated voltage and 12 seconds at 85 percent of rated voltage.

4. GENERAL REQUIREMENTS.

4.1 The Signal Machine shall be manufactured according to the design approved by the purchaser.

4.2 The machine shall be of robust construction and protected from unauthorized interference.

4.3 The machine shall be designed to prevent movement of the semaphore arm due to vibration or any external force applied to the mechanical connections. This shall be arranged mechanically.

4.4 It shall be possible to mount the machine at the top of a circular post 140 mm outer dia, or lattice or girder post. Suitable clamps shall be designed and provided as specified by the purchaser.

4.5 Means shall be provided for vertical and horizontal adjustment for alignment of the machine on the mounting as necessary.

4.6 The case or any other part of the machine when clamped on the signal post shall not interfere with the indications of semaphore arm or lights.

4.7 Adjustment of contacts and arrangement of circuits governing signal motor shall cause the semaphore signal to display indications corresponding to the position of the controlling unit.

4.8 The design of the mechanism shall be such that failure of power supply or any part to properly perform its function shall cause the semaphore signal to assume or remain at its most restrictive aspect.

4.9 Suitable means shall be provided to absorb the undue shock at the end of the stroke of semaphore signal. This device shall operate efficiently under all weather conditions.

4.10 Movement of semaphore signal while returning to its restrictive position shall be controlled to prevent any undue shock on the mechanism. Suitable snubbing device shall be provided.

4.11 The semaphore shaft shall be made of steel, not less than 32 mm diameter.

4.12 Outer end of the shaft shall be of square section of a size suitable for the semaphore spectacle.

4.13 The direction of rotation of semaphore shaft shall be indicated by an arrow mark adjacent to it on the machine case.

4.14 The construction of the hold-off device shall be such that there shall be no undue accumulation of lubricating oil, dirt or rust in the air gap. Magnetic coils shall be so fitted and connected that they can be easily replaced.

4.15 The electro- magnetic coil of hold off device shall comply with the requirements of the IRS specification No. S 23.

4.16 Electrical contacts shall be easily accessible, independently adjustable and so arranged that they do not butt against moving parts, or cause undue friction.

4.17 Electrical contacts shall be of low resistance, quick acting, self aligning and wiping type and shall conform to IRS specification No. S 23.

4.18 In addition to the regular contacts for controlling the signal motor and hold-off device, sufficient number of additional contacts shall be provided for controlling external circuits as specified in drawing no. SA 23955.

4.19 Bearing shall be of ample dimensions to ensure durability and conform to IRS specification No. S 23. Semaphore shaft bearing shall be so constructed as to prevent entrance of water.

4.20 Provision shall be made for proper and convenient lubrication of the bearing surfaces and moving parts of the machine wherever necessary.

4.21 Exposed oil holes, cups or grease nipples shall be provided with weather-proof spring loaded covers.

4.22 The design shall be such as to prevent condensation in the machine.

4.23 An air clearance of not less than 12 mm shall be provided between any exposed current-carrying part and other metallic parts.

4.24 With the exception of motor commutator, a surface leakage distance of not less than 6 mm shall be provided between any two exposed current-carrying parts.

4.25 The insulating materials used shall conform to IRS specification No. S 23.

5. MACHINE CASE.

5.1 Machine case shall be weather-proof and shall properly house without crowding the apparatus and wiring contained therein, suitably arranged for convenient ready access.

5.2 Suitable gasket shall be provided on the machine case between the case and its door.

5.3 Arrangement shall be provided for rigidly securing and padlocking doors of the machine case.

5.4 The door or cover when open shall permit easy access to all parts.

5.5 Machine case shall be provided with an eye bolt fixed on top of its case for convenience in handling.

5.6 Suitable weather-proof cable entrance in machine case shall be provided.

5.7 The cable entrance shall be provided with a flexible conduit of suitable size.

5.8 Ducts of channels for internal wiring shall be of ample size & form part of machine case.

6. MOTOR

6.1 Motor shall be of totally enclosed type and shall comply with IRS : S 39.

6.2 Motor enclosure shall be a strong metallic weather-proof case, the cover of which shall be equipped with suitable fastenings and when open shall permit access to terminals, commutator and brushes.

6.3 Motor shall be D.C. series wound of 10 minutes rating.

6.4 Motor shall be attached to and form an integral part of the machine and shall be readily removable therefrom.

6.5 Motor bearing shall be so designed that lubricants used cannot reach the brushes, commutator or windings.

6.6 The cable entry shall be of ample size, conveniently located for access to the terminals and arranged to protect the cable from mechanical injury.

7. TERMINALS

7.1 Terminals shall be of size M5 or M6 of nut type and shall conform to IRS : S 23.

7.2 Terminals shall be so located as to be easily accessible.

7.3 Terminals for external connections shall, as far as practicable, be located near the cable entry.

7.4 Terminals shall be marked for identification purpose in accordance with the diagram of connections.

8. WIRING

8.1 Internal wiring shall be neatly arranged and shall conform to IRS specification No. S 23.

8.2 The conductors for the internal wiring shall be insulated and shall be of tinned copper, stranded having a cross-sectional area of not less than 2 sq. mm and not less than three strands. Both ends of each separate conductor shall be labeled and provided with an eyelet of suitable type.

8.3 Common connections shall be capable of being disconnected readily for test purposes.

8.4 Wiring diagram with symbols to BS : 376 part 2 and explanations, if any in English shall be securely attached to the inner face of the cover of the mechanism case and protected from the effects of lubricants and moisture.

9. PERFORMANCE

9.1 Signal machine shall be capable of starting the semaphore signal arm from any point in its arc of travel with 8.3 kg-m torque at 85 percent of the rated voltage at its terminals.

9.2 The machine shall be capable of operating satisfactorily between 85 percent and 125 percent of the rated voltage applied at its terminals.

9.3 At any point in the arc of travel of the signal arm, if the torque required to just move the arm towards the 'OFF' position is T1 and that required to just move the arm towards 'ON' position is T2, then the frictional torque given by (T1-T2)/2 shall not exceed 1.65 kgm, the test being carried out with the signal arm having complete fittings and connected to the signal machine.

9.4 Hold off device shall hold the mechanism in 'OFF' position when a minimum of 75 percent of rated voltage is applied at its terminals.

9.5 Hold off device shall release the mechanism to permit the semaphore signal to assume its most restrictive aspect when the voltage is not less than 25 percent of the rated voltage.

9.6 The snubbing circuit resistance shall be suitably adjusted so that the return time of the signal arm from 90° to 0° is between 10 to 12 seconds and from 'OFF' to 'ON' in LQ working is between 6 to 8 seconds.

10. MANUFACTURE

10.1 The manufacturer shall ensure that in addition to all the provisions of this specification, the requirements of any drawings and/or specifications referred to by the purchaser are fully complied with.

10.2 Workmanship, limits and fits, interchange-ability and other general requirements shall be in accordance with IRS specification No. S 23, wherever applicable.

11. MARKING AND IDENTIFICATION

11.1 Marking and identification shall be done in accordance with IRS specification No. S 23.

11.2 The name plate of the machine shall also show the rated voltage of the motor suffixed by the letters "D.C."

12. FINISH

12.1 The finish of the various parts of the machine shall conform to IRS specification No. S 23.

13. INSPECTION & TESTING.

13.1 Type Tests.

13.1.1 One sample shall be subjected to type tests mentioned in clause 13.1.2. The sample should successfully complete these tests and also satisfy the insulation resistance values specified in clause 15.3. In case of failure, a fresh sample shall be called for and again subjected to these tests.

13.1.2 The following shall constitute type tests :-

(a) Operating characteristics (Clauses 3.1 and 3.2)
(b) Torque test (Clause 9.1)
(c) Operating voltage test (Clause 9.2)
(d) Frictional torque test (Clause 9.3)
(e) Tests on hold-off device (Clauses 9.4 and 9.5)
(f) Test for return time of Electric signal machine (Clause 9.6)
(g) Coil resistance test as per drawing no. SA 23915 (with solid core) or drawing no. SA 23989 (with laminated core).
(h) High voltage test (Clause 14.1)
(i) Insulation resistance test (Clauses 15.1 and 15.2)
(j) Contact pressure as per drawing no. SA 23851-52.
(k) Induced High Voltage test (Clause 16.1)
(l) Life test (Clause 13.4)
(m) Climatic tests: Climatic tests as per IS: 9000 are to be conducted in the under mentioned sequence:
    (i) Dry Heat test at 85 °C ± 3 °C for 16 hours.
    (ii) Cold test at -25 °C ± 3 °C for 16 hours.
    (iii) Damp heat (cyclic) test:
    One cycle of 24 hours (12 + 12 hours)
    (iv) Salt atmosphere test as per procedure 2 (three cycles instead of specified four cycles)
    (v) Driving rain test for two hours.

(n) Insulation Resistance test after climatic tests (clause 15.3).

13.2 Acceptance Tests

13.2.1 The following shall constitute acceptance tests which shall be carried out in the sequence given below-

(a) Operational test (Clause 13.5)
(b) Operating characteristics (Clauses 3.1 and 3.2)
(c) Torque test (Clause 9.1)
(d) Operating voltage test (Clause 9.2)
(e) Frictional torque test (Clause 9.3)
(f) Tests on hold off device (Clause 9.4 and 9.5)
(g) Test for return time of Electric Signal Machine (Clause 9.6)
(h) Coil resistance test as per drawing no. SA 23915 (with solid core) or Drg. No. SA 23989 (with laminated core)
(i) High voltage test (Clause 14.1)
(j) Insulation resistance test (Clauses 15.1 and 15.2)
(k) Contact pressure as per drawing no. SA 23851-52

13.3 Routine Tests

13.3.1 The following shall constitute routine tests:-

(a) Operating characteristics (Clauses 3.1 and 3.2)
(b) Torque test (Clause 9.1)
(c) Operating voltage test (Clause 9.2)
(d) Frictional torque test (Clause 9.3)
(e) Tests on hold off device (Clause 9.4 and 9.5)
(f) Test for return time of Electric signal machine (Clause 9.6)
(g) Coil resistance test as per drawing no. SA 23915 (with solid core) or Drg. No. SA 23989 (with laminated core)
(h) High voltage test (Clauses 14.1 & 14.2)
(i) Insulation resistance test (Clauses 15.1 and 15.2)
(j) Contact pressure as per drawing no. SA 23851-52

13.4 Life test

The signal machine with signal arm having complete fittings shall be operated continuously for 1,50,000 cycles at the rate of one or two cycles per minute. No part of the machine shall show any sign of erratic behaviour and at the end of the test, the machine shall pass the test for operating characteristics as laid down in clauses 3.1 and 3.2.

13.5 Operational test

The signal machine with signal arm having complete fittings shall be operated continuously for 50 cycles of operations at the rate of one or two cycles per minute. No part of the machine shall show any sign of erratic behaviour and at the end of the test, in case of LQ machines, the signal arm shall be moved with external force to check satisfactory working of normal locking mechanism which will prevent such movement.

14. HIGH VOLTAGE TEST

14.1 The signal machine shall withstand for one minute a test voltage or 2000V (RMS) applied between all parts of the electric circuits and other metallic parts insulated therefrom without puncture and arcing. The test voltage shall be of approximately sinusoidal wave-form and of any frequency between 50 Hz and 10 Hz. The test shall be carried out once and only once.

14.2 For the purpose of routine test, the test voltage indicated in clause 14.1 shall be applied for one second.

15. INSULATION RESISTANCE TEST

15.1 This test shall be carried out immediately after the High voltage test specified in clauses 14.1 and 14.2 at a potential of not less than 500 volts D.C.

15.2 The insulation resistance shall be measured between individual insulated circuits and earth. The minimum value for each individual insulated circuit shall be not less than 10 megohms.

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

S.No.	Name of test	Recovery period	Insulation Resistance value
1	Dry Heat Test	2 hours	5 Megohms
2	Cold Test	2 hours	1 Megohm
3	Damp Heat Test	2 hours 48 hours 5 days	½ Megohm 1 Megohm 2 Megohms

16. Induced High Voltage Test

16.1 The inter-turn insulation of motor coils incorporated in the signal machine shall be subjected to an induced high voltage test as follows :-

A voltage shall be induced in the coil under test of such a value that it produces a potential difference of 0.5 volt between each turn, subject to a maximum of 1000 volts, e.g. in testing a coil of 500 turns, the primary of the testing transformer shall be so energized that the voltage induced in the coil under test is 250 volts. This test shall be conducted during the manufacturing process, and is not required to be done on the assembled signal machine.

17. REJECTION

17.1 The signal machine or any part thereof that does not comply with any of the requirements of this specification and/or of any other specification and or of drawings as approved by the purchaser will be rejected.

18. PACKING

18.1 The packing shall be done in accordance with IRS specification No. S 23.

19. WARRANTY

19.1 The warranty of the product shall be in accordance with IRS specification No. S 23.

APPENDIX 'A'

INFORMATION TO BE SUPPLIED BY THE PURCHASER

1. Number of aspects and quadrant of operation of arm (clause 1.1).
2. Operating voltage of the machine (Clause 3.1).
3. Mounting arrangement : (Clause 4.4)

   Mounting on a circular post of 140 mm
   Or
   Lattice or Girder post.

APPENDIX –'B'

INFORMATION TO BE SUPPLIED BY THE TENDERER

1. Type of signal machine (LQ/UQ) and rated voltage.
2. Current at rated voltage.
3. Current of hold off device at rated voltage and type of core material.
4. fixing arrangement and dimensions of fixing centers.
5. Total weight of the machine and accessories.
6. Overall dimensions.

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