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Indian Standard

AUTOMOTIVE VEHICLES — INSTRUMENT SYSTEMS — ELECTRICAL SPEEDOMETER — PERFORMANCE REQUIREMENTS

UDC 629.113.053.2 + 629.113.056.2:001.42

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NEW DELHI 110002

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Price Group 3
AMENDMENT NO. 1 JULY 2006
TO
IS 13654 : 1993 AUTOMOTIVE VEHICLES —
INSTRUMENT SYSTEMS — ELECTRICAL
SPEEDOMETER — PERFORMANCE REQUIREMENTS

(Page 3, clause 7.6.3) — Substitute the following for the existing matter:

"The variation between observed and initial values shall be within ±2 percent after the test, when tested for indication error as per 7.2."

(Page 3, clause 7.7.2) — Substitute the following for the existing matter:

"The permissible variation between the observed value after the test from the initial value before the test shall be within ±2.0 percent of full scale value, when tested for indication error as per 7.2."

(TED 11)

Reprography Unit, BIS, New Delhi, India.
FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Instruments Sectional Committee had been approved by the Transport Engineering Division Council.

This Indian Standard is one in the series of standards being brought out for automotive instruments.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'.

Automotive Instruments Sectional Committee, TED 10
Indian Standard

AUTOMOTIVE VEHICLES — INSTRUMENT SYSTEMS — ELECTRICAL SPEEDOMETER — PERFORMANCE REQUIREMENTS

1 SCOPE

1.1 This standard covers the requirements for electrical speedometer used in automotive systems working on 6 V/12 V/24 V power source. It combines also the rate of distance travelled per unit time measurement.

1.2 The mechanical type of speedometers are covered in IS 11086 : 1984.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500 (Part 1)</td>
<td>Part 1 Inspection by attributes and by count of defects (first revision)</td>
</tr>
<tr>
<td>9000 (Part 2/Sec 3) 1977</td>
<td>Basic environmental testing procedures for electronic and electrical items: Part 2 Cold test, Section 3 Cold test for non-heat dissipating items with gradual change of temperature</td>
</tr>
<tr>
<td>9000 (Part 3/Sec 3) 1977</td>
<td>Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test, Section 3 Dry heat test for non-heat dissipating items with sudden change of temperature</td>
</tr>
<tr>
<td>9000 (Part 5/Sec 2) 1981</td>
<td>Basic environmental testing procedures for electronic and electrical items: Part 5 Damp heat (cyclic) test, Section 2 12+12h cycle</td>
</tr>
<tr>
<td>9000 (Part 12) 1981</td>
<td>Basic environmental testing procedures for electronic and electrical items: Part 12 Dust test</td>
</tr>
<tr>
<td>11086 : 1984</td>
<td>Speedometers and odometer systems for automotive applications</td>
</tr>
</tbody>
</table>

3 DEFINITIONS

Wherever applicable the definitions shall be in accordance with IS 11086 : 1984.

4 DESIGN AND CONSTRUCTION

4.1 The speedometers shall be designed to withstand the service conditions given in Table 1.

Table 1 Service Conditions for Speedometer

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Temperature</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 V to 8 V dc for 6 V systems</td>
<td>— 10°C to 85°C</td>
<td>Shall be free from water or water sprays</td>
</tr>
<tr>
<td>9 V to 15 V dc for 12 V systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 V to 28 V dc for 24 V systems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.1.1 Sensor Unit

In the case of electrical speedometer the signal is taken from the sensor unit. A typical circuit diagram is shown in Fig. 1 comprising a battery printed circuit board (PCB) for speedometer and odometer respectively.

4.2 The shape, graduations and printing of details on the speedometer shall be agreed to between the purchaser and the supplier.

4.3 Provision for lamp for lighting the dial is optional. A plastic casing is recommended for speedometers.

4.4 A separate stepper motor for driving odometer shall be used.

5 WORKMANSHIP AND FINISH

5.1 The plastic parts shall be free from detrimental burrs, pikes, pits, cracks and shrankages. The metallic parts shall be electroplated.

6 SAMPLING

Unless otherwise agreed upon, the sampling plan shall be in accordance with IS 2500 (Part 1) : 1973.
7 TESTS

7.1 The following tests shall be carried out on speedometers:
   a) Indication error,
   b) Fluctuation of pointer,
   c) Insulation resistance,
   d) Damp heat (cyclic) test,
   e) Temperature resistance,
   f) Vibration test,
   g) Dry heat test,
   h) Dust resistance,
   i) Impact resistance,
   j) Cold test,
   k) High voltage, and
   l) Endurance.

7.2 Indication Error

7.2.1 Install the parts in regular service condition and raise the speed from 10 km/h to 80 percent of the full range. Measure pointer for fluctuations in double amplitude.

7.2.2 The speedometer shall be accurate within ±4 percent of the last two-thirds of full scale readings.

7.3 Fluctuation of Pointer

7.3.1 Install the parts in regular service condition and raise the speed from 10 km/h to 80 percent of the full range. Measure pointer for fluctuation in double amplitude.

7.3.2 The double amplitude fluctuation shall not exceed 2 percent of full scale value.

7.4 Insulation Resistance

7.4.1 Measure the insulation resistance between the case and conductor body in speedometer using a 500 V insulation resistance tester at room temperature and at normal humidity.

7.4.2 The insulation resistance shall be at least 1 mega ohm.

7.5 Damp Heat (Cyclic) Test

7.5.1 The damp heat (cyclic) test shall be carried out according to IS 9000 (Part 5/Sec 2): 1981 not followed by exposure to cold. The number of conditioning cycles shall be 2.

7.5.2 After this test, the speedometer shall satisfy the tolerance of ±2.5 percent of the full range and the variation in the observed value from the initial value shall not exceed ±4 km/h.

7.6 Temperature Resistance

7.6.1 Thermal Cycle Test

Thermal cycle test shall be carried out with the
parts inoperative, the sequences shall be as follows:

- a) Heating at 70°C ± 3°C for 6 h
- b) Cooling at room temperature... 6 h
- c) Cooling at 0°C (only for speedometer... 2 h)
- d) Stabilization at room temperature... 2 h

7.6.2 Two cycles as per 7.6.1 shall be carried out.

7.6.3 The variation between observed and initial values shall be within ± 2 percent after the test for the dimensions of plastic parts and indication error of the system.

7.6.4 High Temperature Test

When heated in a chamber to 70°C ± 3°C for 24 h, the dimensional variation of plastic parts and the indication error of the system shall be within ± 2 percent of the initial values.

7.6.5 Low Temperature Test

When cooled down to 0°C for 48 h, the dimensional and indication error of the systems shall not vary by more than ± 2 percent of the initial values, when brought back to ambient condition.

7.7 Vibration Test

7.7.1 Install the parts in regular service conditions and test in accordance with the conditions given in Table 2.

7.7.2 The permissible variation between the observed value from the initial value shall be within ± 2.0 percent of full scale value.

7.8 Dry Heat Test

7.8.1 The dry heat test shall be carried out according to IS 9000 (Part 3/Sec 3) : 1977 with a gradual change of temperature under the following conditions:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Duration of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>85°C ± 3°C</td>
<td>4 h</td>
</tr>
</tbody>
</table>

7.8.2 After this test, while the speedometer is still at the high temperature the speedometer shall satisfy the tolerance of ± 2.5 percent of full range and the variation in the observed value from the initial value shall not exceed ± 4 km/h.

7.9 Dust Resistance

7.9.1 Speedometer shall be tested as per IS 9000 (Part 12) : 1981. After the test the equipment shall remain under the following standard atmospheric conditions until temperature equilibrium is reached:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Relative humidity</th>
<th>Air pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>15°C to 35°C</td>
<td>45 to 75 percent</td>
<td>860 to 1060 mbar</td>
</tr>
</tbody>
</table>

The relevant equipment specification may however prescribe a standard recovery period for a given type of equipment.

7.9.2 The insulation resistance after the test shall not be less than one mega ohm, when measured with 500 V insulation resistance tester.

7.10 Humidity Resistance

7.10.1 Install the parts in regular service condition. Apply the test voltage as given below and actuate the parts for four hours at 40°C ± 2°C, 95 to 98 percent humidity and speedometer speed at 50 percent of full range. Inspect for insulation resistance and indication error.

| Test voltage for 24 V system: 28 ± 1.0 V |
| Test voltage for 12 V system: 14 ± 0.5 V |
| Test voltage for 6 V system: 7 ± 0.5 V |

Table 2 Vibration Test Conditions

(Class 7.7.1)

<table>
<thead>
<tr>
<th>Test Parameters</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature, °C</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Voltage, V</td>
<td>8 V to 16 V, 15 V for 12 V, 28 V for 24 V systems</td>
</tr>
<tr>
<td>Speed, km/h</td>
<td>80 percent full range</td>
</tr>
<tr>
<td>Frequency, cycles/minute ( Hz )</td>
<td>1 500-2 000 (10-55-10 Hz)</td>
</tr>
<tr>
<td>Vertical acceleration, g</td>
<td>4-4 (peak to peak)</td>
</tr>
<tr>
<td>Time, h</td>
<td>1 h in each axis</td>
</tr>
<tr>
<td>Frequency, cycles/min ( Hz )</td>
<td>1 500-2 000 (10-55-10)</td>
</tr>
<tr>
<td>Longitudinal acceleration, g</td>
<td>4-4 (peak to peak)</td>
</tr>
<tr>
<td>Time, h</td>
<td>2</td>
</tr>
<tr>
<td>Frequency, cycles/min ( Hz )</td>
<td>Resonance</td>
</tr>
<tr>
<td>Acceleration, g</td>
<td>4-4 (peak to peak)</td>
</tr>
<tr>
<td>Time, h</td>
<td>0.5</td>
</tr>
</tbody>
</table>
7.10.2 The permissible variation between the observed value from the initial value shall be within ± 2 percent of full scale value.

7.11 Impact Resistance

7.11.1 Allow the speedometer in packed condition to drop at least three times on a concrete floor from a height of one metre. Inspect for fracture, crack, deformation along with indication of failure.

7.11.2 The permissible variation between the indicated value from the initial value shall be within ± 2·0 percent of full scale value.

7.12 Cold Test

7.12.1 The cold test shall be carried out as in IS 9000 (Part 2/Sec 3) : 1977 with a gradual change in temperature under the following conditions:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Duration of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10°C ± 3°C</td>
<td>2 h</td>
</tr>
</tbody>
</table>

7.12.2 After this test, while the speedometer is still at the low temperature, the speedometer shall satisfy the tolerance of ± 2·5 percent of the full range and variation in the observed value from the initial value shall not exceed ± 4 km/h.

7.13 High Voltage Test

7.13.1 Install the parts in regular service condition. Apply voltage at 60°C so as to increase stepwise by one volt at a time allowing to remain for two hours at each step as given below:

- Operating voltage for 24 V system: 20-28 V
- Operating voltage for 12 V system: 9-15 V
- Operating voltage for 6 V system: 4-8 V

7.13.2 There shall be no failure (fracture) of parts till 9 V for 6 V system, 17 V for 12 V system and 32 V for 24 V system.

7.14 Endurance Test

7.14.1 Install the parts in regular service condition, put the speedometer in continuous operation till the odometer reads 100 000 km at room temperature and an optional speed within the range 50 to 80 percent of full range of speedometer.

7.14.2 The permissible variation between the observed value from the initial value shall be within ± 2·0 percent of the full scale value.

7.14.3 The gauge shall also be capable of withstanding battery reversal without damage.

8 TESTS FOR SENSOR UNITS

8.1 The following tests are to be carried out on sensor units of the speedometer.

8.2 Using an oscilloscope, the output wave form, amplitude of wave form against voltage are observed.

8.2.1 The output wave form of sensor unit is to be checked to ascertain the quality of the output. If distributed input is given to the system it will affect the performance of the system. So the output wave form shall be free from any noise or ripples. Some of the output wave forms of sensors are given below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Output Wave Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical</td>
<td>Square (Amplitude will not vary, only the frequency will vary according to the speed)</td>
</tr>
<tr>
<td>Hall effect</td>
<td>Square (Amplitude will not vary only the frequency will vary according to the speed)</td>
</tr>
<tr>
<td>Tacho Generator</td>
<td>Sinusoidal (The frequency and amplitude will vary according to the speed)</td>
</tr>
</tbody>
</table>

NOTE — For Tacho generator type the speedometer shall be designed to accommodate the maximum and minimum variation of the output.

8.3 Indication error shall be within permissible tolerance.

8.4 Temperature Resistance

8.4.1 Thermal Cycle Test

Thermal cycle test shall be carried out in the following sequence with the parts soaked at 70°C ± 3°C.

<table>
<thead>
<tr>
<th>Soaking at 70°C ± 3°C</th>
<th>6 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling at room temperature</td>
<td>6 h</td>
</tr>
<tr>
<td>Cooling at 0°C</td>
<td>2 h</td>
</tr>
<tr>
<td>Stabilizing at room temperature</td>
<td>2 h</td>
</tr>
</tbody>
</table>

8.4.2 Two cycles as per 7.4.1 shall be carried out on the sensor units.
8.4.3 The indication error of the systems, the dimensional change of plastic parts shall be within ±2.5 percent of full scale value for 12 V and 24 V systems.

8.4.4 High Temperature
When heated to 70°C ± 3°C for 100 h, the dimensional variation of plastic parts, indication error of the system shall not exceed ±2.5 percent.

8.4.5 Low Temperature
When cooled to 0°C for 100 h in a chamber, the dimensional variation and the indication error of the systems shall be within ±2.5 percent of full scale value.
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