**Government of India**
**Ministry of Railways**
**(Railway Board)**

# INDIAN RAILWAYS STANDARD SPECIFICATION FOR INDICATION SUPPLY TRANSFORMER (STEP DOWN) FOR RAILWAY S&T INSTALLATIONS

**Serial No.**

## 0. FOREWORD

0.1 This specification is issued under the fixed serial No. S-83 followed by the year of adoption as standard in the case of revision.

**ADOPTED 1992**

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

| | |
|---|---|
| IS: 9000 | Basic environmental testing procedure for electronic and electrical items. |
| IS: 6297 (Pt.I & II) | Transformers and inductors (power audio, pulse * switching) for electronic equipment. |
| IRS:S 23 | Electrical Signalling & Interlocking equipment. |

0.3 Wherever reference to any of the above mentioned specification is referred, it shall be taken as a reference to the latest issue of that specification, otherwise the particular year of issue referred to has to be taken as reference.

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

## 1. SCOPE

1.1 This specification covers the requirements of 250VA and 500VA rating transformers meant for supplying power to indication lamps in signalling installations.

1.2 The transformer is suitable for lightning SL-5 signal lamps as well as pencil type 24V, 1.2W lamps used in operating panel for a panel interlocked station.

1.3 The transformers shall be provided with two identical 12V tappings on the secondary side capable of being connected in series to give 24V AC output.

## 2. TERMINOLOGY

2.1 The terminology, referred to in the specification is covered by the definitions given in IRS specification No. S 23.

2.2 The terms referred to in this specification, but not covered by IRS:S 23 are defined in the relevant clauses.

## 3. REQUIREMENTS

3.1 General

3.1.1 The transformer shall conform to the dimensions given in drawing No. SDO/2682.

3.1.2 The transformer shall be air cooled type and suitably ventilated and shall be so constructed as to provide adequate protection against out-door weather conditions.

3.1.3 The transformer shall be manufactured in accordance with best engineering practice.

3.1.4 All materials used in the manufacture of the transformer shall be suitable for tropical use.

3.1.5 All exposed metal parts of the transformer including laminations shall be protected against corrosion.

3.1.6 Terminals and associated screws shall be of brass and shall be of the top screw pillar type securely fixed.

3.1.7 The transformer shall conform to category 3 (Cl 3.1) of IS: 6297 (Pt.I) -1971 and grade II (Table I) of IS: IS: 6297 (Pt.II) -1973. Class 'B' insulting material shall be used. The transformer shall be vacuum impregnated. Copper wires conforming to IS: 4800 (Pt.IV) shall be used for winding of the transformers, unless otherwise specified.

3.2 Electrical

3.2.1 The rated input voltage of the transformer shall be 230V AC.

3.2.2 The transformer shall have separate electrically isolated input and output windings.

3.2.3 The primary winding of the transformer shall be rated for nominal voltage of 230V 50Hz and shall be provided with tappings of 200, 210, 220 & 240V. Two electrically isolated secondary windings each rated for 12V and capable of delivering half the rated power shall be provided such that these can be connected in series aiding for 24V operation.

3.2.4 The transformer shall be rated 250V or 500A as specified by the purchaser and shall be suitable for continuous operation.

3.2.5 The design of the transformer shall be compact and shall be provided with a casing so as to prevent access to rodents and insets etc. The casing shall be made of cold rolled annealed mild steel sheet of thickness not less than 1.5mm. The casing shall be treated with Zinc Chromate primer followed by electrostatic epoxy powder coating paint finish. Passivation shall be done through seven-stage process. Provision of chromate shall be made in the casing for incoming and outgoing wires.

3.2.6 HT terminals shall be provided with suitable caps to prevent electrical shocks to the maintenance staff. The terminals shall be so provided that these do not have a tendency to rotate while tightening and loosening the nuts.

3.2.7 An earth terminal shall also be provided to the casing of the transformer and shall be marked as earth.

3.2.8 The power efficiency of the transformer at the rated load at nominal input voltage shall not be less than 85%.

## 4. MARKING

4.1 The appropriate voltage shall be legibly and indelibly engraved near the input and output terminals.

4.2 Suitable marking shall be made near the earth terminal.

4.3 A rating plate, clearly and indelibly marked with the following information shall be firmly and conspicuously fixed on the outside of the case.

a) Name or trade mark of the manufacturer.
b) Serial number and year of manufacture
c) Input and output voltage
d) Rated power output in VA
e) Rated frequency.
f) Any other details as agreed to between the purchaser and the manufacturer.

## 5. TEST AND PERFORMANCE REQUIREMENTS

5.1 Unless otherwise specified, all the tests shall be carried out under prevalent atmospheric conditions.

5.2 Type test

5.2.1 The following shall constitute type tests

A minimum number of three samples are required for type tests to be carried out in the sequence below.

| | |
|---|---|
| a) Visual inspection | (Clause 5.5) |
| b) Applied high voltage test | (Clause 6.1) |
| c) Insulation resistance test | (Clause 6.2) |
| d) Open circuit test | (Clause 6.3) |
| e) Voltage regulation test | (Clause 6.4) |
| f) Temperature rise test | (Clause 6.5) |
| g) Induced high voltage test | (Clause 6.6) |
| h) Overload test | (Clause 6.8) |
| i) Drop test | (Clause 6.9) |

5.1.1 All samples shall successfully pass all the tests given in Clause 5.2.1 for proving conformity with the requirements of this specification. If any of the samples fails in any of the type tests, the purchaser or his nominee at his discretion may call for fresh samples not exceeding twice the original number and subject them again to al the tests. The failure shall be permitted in the repeat test.

5.1.2 Type approval shall be accorded if the samples pass the above tests. Such approval once given shall be valid for a period of three years, provided there is no change either in the quality of material used or in the method of manufacture.

5.3 Acceptance tests

5.3.1 The following shall constitute the acceptance tests and shall be carried out in the sequence given below.

a) Visual inspection (Clause 5.5)
b) Applied high voltage test (Clause 6.1)
c) Insulation resistance test (Clause 6.2)
d) Open circuit test (Clause 6.3)
e) Voltage regulation test (Clause 6.4)
f) Temperature rise test (Clause 6.5)
g) Induced high voltage test (Clause 6.6)

5.3.2 Acceptance tests shall be carried out on transformers selected at random as per the sampling plan given in the table below. N1 is the size of the first sample. In case the number of transformers failing in one or more tests is loss than or equal to the corresponding acceptance number (C1), the lot shall be considered as conforming to the requirement. If the number of failure is greater than or equal to rejection number (C2), the lot shall be rejected. If the number of failures is between C1 and C2 further samples or N2 pieces shall be taken and subjected to all the tests. If the total number of failures in the two samples is less than C2, the lot shall be accepted, otherwise, the lot shall be rejected.

Table

| Lot size | First sample N1 | Second sample N2 | Combined sample N1 + N2 | Acceptance No. C1 | Rejection No. C2 |
|---|---|---|---|---|---|
| Under 25 | 3 | 6 | 9 | 0 | 2 |
| 25-50 | 7 | 14 | 21 | 0 | 3 |
| 51-100 | 10 | 20 | 30 | 0 | 3 |
| 101-200 | 13 | 26 | 39 | 0 | 5 |
| 201-300 | 20 | 40 | 60 | 1 | 5 |
| 301-500 | 25 | 50 | 75 | 1 | 6 |
| 501-800 | 35 | 70 | 105 | 2 | 7 |
| 801-1300 | 50 | 100 | 150 | 3 | 10 |

5.4 Routine test

5.4.1 The following shall constitute routine tests

a) Visual inspection (Clause 5.5)
b) Applied high voltage test (Clause 6.1)
c) Insulation resistance test (Clause 6.2)
d) Open circuit test (Clause 6.3)
e) Voltage regulation test (Clause 6.4)

5.4.2 The manufacturer shall certify that all the routine tests have been successfully carried out on all the transformers offered for inspection. He shall produce these test results at the time of inspection.

5.5 Visual inspection

5.5.1 The transformer shall be visually inspected to ensure compliance with the requirements of clause 3 & 4 of this specification.

## 6. ELECTRICAL PERFORMANCE

6.1 Applied high voltage test

6.1.1 The transformer shall withstand for one minute without puncture or spark or any damage to the insulation, application of sinusoidal AC 2000V (rms) 50 Hz when applied between following points:

6.2 Insulation resistance test

6.2.1 The insulation resistance shall be measured by suitable means after application of DC voltage of 500V for one minute approximately between points as indicated in Cl. 6.1.1

6.2.2 The test shall be carried out

a) Before the high voltage test
b) After the high voltage test
c) After induced high voltage Tessa
d) After the temperature rise test
e) After the climatic tests

6.2.3 If the measurement is made at an ambient temperature of 40 deg. C and relative humidity of 60% the value of insulation resistance shall not be less than 100 Meg ohms. There shall not be any appreciable change in the measure value of insulation resistance before and after applied high voltage test and after induced high voltage test. When measured after the temperature rise test, the insulation resistance shall not be less than the limit mentioned above. Similarly, when the test is repeated after the climatic test, the insulation resistance shall not be less than 50 Meg ohm when measured at a temperature of 40 deg. C and relative humidity of 60%.

6.2.4 In case the prevalent values of temperature and relative humidity at the time of measurement are different from those specified above, the IR values shall be obtained from Table 'A' given below>

Value of insulation resistance at different temperatures and relative humidity.

| RH (%) | 25ºC (M.ohms) | 30ºC (M.ohms) | 35ºC (M.ohms) | 40ºC (M. ohms) |
|---|---|---|---|---|
| 60 | 100 | 100 | 100 | 100 |
| 65 | 100 | 90 | 85 | 60 |
| 70 | 80 | 70 | 65 | 60 |
| 75 | 60 | 53 | 47 | 43 |
| 80 | 42 | 36 | 33 | 30 |
| 85 | 29 | 25 | 22 | 18 |
| 90 | 20 | 16 | 13 | 10 |
| 95 | 15 | 10 | 7 | 5 |
| 100 | 10 | 6 | 3 | 1 |

Note:

1. The value of insulation resistance has been taken as 100 M.ohms at a temperature of 40 deg.C and RH of 60%. Values of IR at different temperature and RH may be obtained from the table.
2. To obtain the value or IR corresponding to 500 M.ohm or 1000 M. ohms or 50 M.ohm at 40 deg. C & 60% RH, a multiplying factor of 5.0, 10.0 & 0.5 respectively may be used.

3. The value of insulation resistance for extreme conditions of temperature and humidity shall not be less than 1 M.ohm even if the value at 60% RH and 40 deg. C temperature is less than 1000 M.ohm.

6.3 Open circuit test

6.3.1 230V AC at 50 Hz shall be applied on primary side between terminals '0' and 230V and the voltages across different tappings on the secondary side shall be measured, which shall be within ± 1.5% of the nominal value of the respective tapping.

6.3.2 The open circuit secondary voltage and the primary no load current of the transformer shall be measured with the primary winding connected to 230V, 50 Hz supply and the secondary winding open circuited. The open circuit secondary voltage of the secondary windings shall be within ±1.5% of the nominal tapping voltage. The primary no load current shall not exceed 10% of the rated full load primary current.

6.4 Voltage regulation test.

6.4.1 The test shall be carried out using 0 and 230V tappings on the primary winding and by connecting the secondary winding in series for 24V AC output.

6.4.2 Nominal voltage of 230V, 50 Hz shall be applied across the 0 and 230V terminals of the primary winding, where as the secondary windings shall be made to deliver the rated load for 24V output.

6.4.3 Under the conditions given above the secondary windings shall be made to deliver rated current at 24V through a resistive load after suitably adjusting the primary winding voltage. The load shall then be disconnected and the secondary voltage (V) shall be measured keeping the primary voltage at the same level.

6.4.4 The percentage regulation shall be calculated by

$$\frac{V-24}{} = 100$$

The calculated value shall not be more than 5%. V

6.5 Temperature rise test

6.5.1 This test shall be carried out at the prevailing room temperature for the purpose of acceptance test whereas for type test it will be done at an ambient temperature of 70 deg. C during the dry heat test. During the test, the transformer shall be mounted so as to be protected from draught and shall not be subjected to radiation from warmer objects.

6.5.2 The cold resistance (R1) of the winding under test shall be measured at the reference temperature (T1) i.e. room temperature or the chamber temperature as the case may be.

6.5.3 Rated load shall be connected across the secondary winding terminals corresponding to the secondary winding voltage of 24V. For the purpose of type test, the transformer shall be kept energised for a period of 16 hours whereas for acceptance test the period may be reduced to 6 hours. Immediately after disconnecting the load, hot resistance (R2) shall be measured preferably within one-minute duration of disconnection.

6.5.4 The temperature rise ($\sigma T$) of the windings under test shall be computed from the corresponding hot and cold resistance values by using the formula.

$$\sigma T = \frac{R2 - R1}{R1} = (234.5 + T1) - (T2 - T1)$$

Where R1 & R2 are DC resistances

6.5.5 The temperature rise of any winding shall not exceed 55 deg.C.

6.6 Induced high voltage test

6.6.1 A test voltage of double the rated value at frequency of 100 Hz or more shall be applied across the terminals of primary winding marked 0 and 230V keeping the secondary winding terminals open. This voltage shall be raised from 1/3 of the maximum value to the value as is consistent with accurate reading of the indicating instrument. The full test voltage shall be maintained for one minute and shall then be reduced to the one third of the value before being switched off.

6.6.2 At the end of the test, the transformer shall be tested for the following.

a) Insulation resistance (Cl. 6.2)
(It shall not be less than the minimum value specified in Clause 6.2.3).

b) Open circuit test (Cl. 6.3)
(The no load current shall be within the value specified in Clause 6.3.2)

6.7 Over load test

6.7.1 The transformer shall withstand without any damage 100% over load at the secondary winding terminals for 2 minutes with rated input voltage connected across the primary winding.

6.7.2 The transformer shall suffer no damage at the end of the test. The transformer then shall be subjected to the tests as given in Clause 6.6.2.

6.8 Environmental test

6.8.1 The transformer shall be subjected o the climatic tests as per IS 9000 as per the sequence and severity indicated below. The requirement as given in cloumn 5 of the table shall be satisfied.

| Climatic Cycle | Severity | | Test to be done | Required result |
|---|---|---|---|---|
| | Temperature | Duration | | |
| Dry heat | 70 ± 2ºC during exposure, the transformer shall be loaded as per clause 6.4 | 16 hrs. | 1. Applied high voltage test (Cl. 6.1)<br>2. Insulation resistance test (Cl. 6.2) | Shall withstand<br>Shall be greater than 100 mega ohms |
| First damp heat (accelerated) | 55 ± 2ºC RH 90 - 95% | 16 hrs | Insulation resistance test (Cl. 6.2) | Shall be greater than 100-mega ohm. |
| Cold | - 10º c | 2 hrs | Insulation resistance test (Cl. 6.2) | Shall be greater than 100-mega ohm. |
| Two cycles of | 55 ± 2ºC | 16 hrs (2 | Insulation resistance | Shall be greater than 01 |

| | | | | |
|---|---|---|---|---|
| damp heat | RH 90 - 95% | hrs each) | test (Cl. 6.2) | mega ohm. After recovery period of 24 hrs insulation resistance shall be greater than 10. |

6.9 Drop Test

6.9.1 One of the sample transformers shall be dropped and allowed to fall freely from a height of 100 mm on a hard concrete smooth surface at least 2 times on each of the six faces except the face provided with the terminals. The transformer shall suffer no mechanical damage by way of bending of casing and shearing of the fixing nuts and bolts on the holes.

## 7. PACKING:

7.1 The transformer shall be suitably packed in suitable cartoon as to withstand transit hazards.

7.2 Empty space/s if any shall be filled up by suitable packing material.

## 8. INFORMATION TO BE SUPPLIED BY THE PURCHASER

8.1 Drawing, if any, for dimensions (Cl. 3.1.1)

8.2 Power rating (Cl. 3.2.4)