Government of India
Ministry of Railways
(Railway Board)

INDIAN RAILWAYS STANDARD SPECIFICATION FOR Colour Light Signal Transformer (Tentative)

Serial No. S 59

0. Foreword

0.1 This specification is issued under the fixed serial No. S-59 followed by the year of adoption as standard or in the case of revision, the year of last revision.

ADOPTED 1977

0.2 This specification requires reference to the following specifications:

IRS: S 23	Electrical Signalling & Interlocking Equipment.
IS: 589	Basic Climatic and Mechanical Durability tests for components for Electronic and Electrical equipment.
IS: 4800 (Pt. I)	Enamelled round winding wires part I - conductor data

0.3 Wherever in this specification, nay of the above mentioned specifications is referred to by number only without mentioning the year of issue, the latest issue of that specification s implied otherwise, the particular issue referred to is meant.

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 lays down the requirements and tests for Colour light signal transformer used in conjunction with colour light signals.

2. Terminology

2.1 For the purpose of this specification, terminology given in IRS:S 23* shall apply.

3. Requirements

3.1 General

3.1.1 The transformer shall conform to the drawings approval by the purchaser.

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

3.1.3 The transformer shall be manufactured in accordance with the 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 plated, painted or otherwise protected against corrosion.

3.1.6 Terminals and their associated screws shall be of brass, gun metal or phosphor bronze and shall be of the top screw pillar type. They shall be rigidly and securely fixed.

3.1.7 Unless otherwise specified, copper wires conforming to IS: 4800 (Pt.I)-68 shall be used for the windings of the transformer.

3.2 **Electrical**

3.2.1 The rated input voltage of the transformer shall be 110V ac.

3.2.2 The transformer shall have separate input and output windings.

3.2.3 The primary winding of the transformer shall have tapping at 0 and 110V. The secondary winding of the transformer shall have tapping at 0,0.5,1,13,14.5 and 16B being nominal voltages on no load.

3.2.4 The continuous rate doutput of the transformer shall be 40VA.

3.2.5 The transformer shall be designed for a standard frequency of 50Hz.

4. **Marking**

4.1 The appropriate voltages shall be legibly and indelibly engraved at the based of input and output terminals.

4.2 A rating plate, clearly and indelibly marked with the following information shall be firmly and conspicuously attached on the outisde of transformer:

a) Name or trade mark of the manufacturer,
b) IRS No.
c) Input and output voltages,
d) Rated frequency,
e) Rated output in volt-amperes,
f) Serial number,
g) Year of manufacture.

5. **Tests and Performance Requirements**

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

5.2 Type tests

5.2.1 The following shall constitute type tests. A minimum number of 5 samples shall be required for the type tests, the sequence of tests being as given in Appendix A.

a) Visual inspection (Cl. 5.5)
b) Insulation resistance test (Cl. 5.6)
c) Open circuit test (Cl. 5.7)
d) Voltage regulation test (Cl. 5.8)
e) Applied high voltage test (C. 5.9)
f) Induced high voltage test (Cl. 5.10)
g) Temperature rise test (Cl. 5.11)
h) Dry heat test (Cl. 5.12)
i) Damp heat test (Long term exposure) - Cl. 5.13
j) Salt mist test (Cl. 5.14)

5.2.2 All samples shall successfully pass all the type tests 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 all tests or to the test (s) in which failure (s) occurred. No single failure shall be permitted in the repeat test (s) for proving conformity with the requirements of this specification.

5.3 Acceptance tests

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

a) Visual inspection (Cl. 5.5)
b) Insulation resistance test (Cl. 5.6)
c) Open circuit test (Cl. 5.7)
d) Voltage regulation test (Cl. 5.8)
e) Applied high voltage test (C. 5.9)
f) Induced high voltage test (Cl. 5.10)
g) Temperature rise test (Cl. 5.11)

5.3.2 The acceptance tests shall be carried out on a limited number of samples in accordance with the sampling procedure given in Appendix B.

5.4 Routine test

5.4.1 The following shall constitute routine tests:

a) Visual inspection (Cl. 5.5)
b) Insulation resistance test (Cl. 5.6)
c) Open circuit test (Cl. 5.7)
d) Applied high voltage test (C. 5.9)

5.4.2 The manufacturer shall certify that all the routine tests have been successfully carried out on the transformers offered for inspection.

5.5 Visual inspection - The transformer shall be visually inspected for checking conformity with the requirements of clause 3.1 and clause 4 of this specification.

5.6 Insulation Resistance test - The insulation resistance shall be measured by applying a test potential of not less than 500V DC for one minute between the core and each winding and also between the windings. The insulation resistance shall not be less than 100 meg ohms.

5.7 Open Climatic test: The open circuit secondary voltage and the primary no load current of the transformer shall be measured with the primary winding connected to 110V, 50Hz supply mains and with the secondary winding open circuited. The measured vale of secondary voltage at different tapping of the secondary winding shall not vary beyond ±2 .5% of the values mentioned in Cl. 3.2.3.

The primary no-load current shall not exceed 5mA.

5.8 This test shall be conducted at secondary terminals marked 0 and 16V. The primary voltage shall be adjusted so that a voltage of 12V is observed across a 3.33 amps resistive load connected across the two terminals of secondary winding. The load shall then be disconnected and secondary voltage on no load observed. Let this voltage be V. The percentage voltage regulation shall then be calculated as:

Percentage Voltage Regulation = V-12/V x 100

The percentage regulation calculated as above shall not exceed 15%.

5.9 Applied high voltage test - The transformer shall withstand for one minute without puncture of arching application of AC voltage of 2000V (rms) AT ANY FREQUENCY BETWEEN 50 AND 100 Hz applied between each winding and the core or case. The winding not under test shall be connected to the core or case. The test voltage shall be of substantially sinusoidal waveform. The test voltage shall be raised gradually at a rate not exceeding 500V per second.

When this test is carried out as a routine test, the test voltage shall be applied for one second only.

5.10 **Induced high voltage test**

5.10.1 The transformer shall withstand without breakdown the application of a test voltage of 220V at a frequency not less than 100 Hz applied to the primary winding with the secondary winding open circuited. The test voltage shall be raised from 780V to 220V as rapidly as is consistent with accurate reading o the voltmeter. The full test voltage shall be maintained for one minute and shall then be rapidly reduced to 70V before being switched off.

5.10.2 At the end of the test, the insulation resistance and the primary no-load current of the transformer shall be checked. The primary no-load current shall not exceed 5mA and the insulation resistance shall not be less than 100 meg ohms.

5.11 **Temperature rise test**

5.11.1 For the purpose of type test, this test shall be carried out at an ambient temperature of 85 deg. C. For the purpose of acceptance test, this test shall be carried out at the prevailing room temperature.

5.11.2 The transformer shall be mounted so that it is protected from draughts and s not subjected to radiation from warmer objects. The thermometer used for measuring the ambient temperature shall be protected against trivial temperature changes by means of an oil bath or any other suitable thermal delay device.

5.11.3 For the purpose of type test, the cold resistance of the winding shall be measured after conditioning the transformer for at least 3 hours unit 3 consecutive temperature readings taken at 30 minutes interval are constant. This constant temperature shall be taken as the reference temperature T1. For the purpose of acceptance test the period of conditioning may be dispensed with.

5.11.4 A resistive load shall then be connected across 0 and 16V terminals of the secondary winding. The load and the primary input voltage shall be adjusted such that a current of 3.33 A flows in the load with a voltage of 12V across it. The transformer shall then be operated continuously for a period of six hours. The hot resistance of the two windings shall be measured within one minute after the completion of the test run.

5.11.5 The temperature rise of the transformer shall be computed by subtracting the temperature eof the ambient air (T1) around the transformer from the temperature of the winding (T2) using the formula:

$$\frac{R1}{R2} = \frac{1 + \sim T1}{1 + \sim T2}$$

Where

~ = temperature coefficient of the material of the winding wire.
R1 = dc resistance at T1 dg.C, and
R2 = dc resistance at T2 deg.C

5.11.6 The temperature rise of any winding shall not exceed 5 deg.C.

5.12. **Dry Heat test**

5.12.1 The transformer shall be subjected to the dry heat in accordance with Cl. 7.2 of IS: 589* in unpacked condition.

*Basic climatic and mechanical durability test for components for electronic and electrical equipment.

5.12.2 The temperature of the test chamber shall be maintained at 85 deg C ± 2 deg.C during the test. The duration of exposure shall be 16 hours.

5.12.3 During the exposure, a load of 3.33A shall be connected across 0 and 16V terminals of the secondary winding; the primary voltage being so adjusted that the voltage across the …..is 12V.

5.12.4 At the end of the exposure, the transformer shall be removed from the chamber and allowed to remain under standard atmospheric conditions for recovery for not less than one hour nor more than two hours.

5.12.5 After recovery, the transformer shall be checked and it shall not show signs of any apparent damage or deterioration. The marking shall be legible. The primary no load current shall not exceed 5mA. The insulation resistance shall not be less than 100 meg. Ohms.

5.13 **Damp heat test (Long term exposure)**

5.13.1 The transformer shall be subjected to the damp heat test (long term exposure) in accordance with Cl. 7.3 of IS 589* in unpacked condition.

*Basic climatic and mechanical durability test for components for electronic and electrical equipment.

5.13.2 The duration of exposure shall be 10 days.

5.13.3 During the exposure, the transformer shall be loaded as mentioned in Cl. 5.12.3.

5.13.4 At the end of the exposure, the transformer shall be removed from the chamber and allowed to remain under standard atmospheric conditions for recovery for not less than one hour nor more than two hours.

5.13.5 After recovery, the transformer shall be checked and it shall not show signs of any apparent damage or deterioration. The marking shall be legible. The primary no load current shall not exceed 5mA. The insulation resistance shall not be less than 10 meg. Ohms.

5.14 **Salt Mist test**

5.14.1 The transformer shall be subjected to the salt mist test in accordance with Cl. 7.10 of IS: 589 in unpacked and normal operating condition.

5.14.2 The duration of exposure shall be 4 days.

5.14.3 During the exposure, the transformer shall be loaded as mentioned in Cl. 5.12.3.

5.14.4 At the end of exposure, the transformer shall be removed from the chamber and cleaned with tap water after which the transformer be dried for one hour at 55 ± 2 deg.C, and then allowed to cool under standard atmospheric conditions for recovery.

5.14.5 After recovery, the transformer shall be checked and it shall not show signs of any apparent damage or deterioration. The marking shall be legible. The primary no load current shall not exceed 5mA.

6. Packing

6.1 The transformer shall be so packed as to permit convenient handling and to protect against loss or damage during transit and storage.

Appendix A
(Clause 5.1.2)

Sequence of type tests

All 5 samples

Visual inspection (Cl. 5.5)

Insulation resistance test (Cl.5.6)

Open Circuit test (Cl. 5.7)

Voltage Regulation Test (Cl. 5.8)

Applied High Voltage Test (Cl. 5.9)

Induced High voltage test (Cl. 5.10)

Temperature rise Test (Cl. 5.11)

Appendix B

(Clause 5.3)

B-1 **Lot**

B-1. In any consignment, all the transformers of the same type manufactured by the same factory during the same period, shall be grouped together to constitute a lot.

B-1.2 From each lot a certain number of transformers (as specified in Table 1) shall be selected at random and subjected to the tests specified in Cl. 5.3 or to tests as agreed between the purchaser and the manufacturer.

B-2 **Criterion for conformity**

B-2.1 The actual number of transformers to be selected from a lot shall be in accordance with Table 1. In this table, N1 is the size of the first sample. If the number of failures found in this sample is less than or equal to Cl, the lot shall be considered to be conforming to this specification and accepted. If the number of failures is greater than or equal to C2, the lot shall be rejected. If the number of failures is between C1 & C2, further samples of N2 pieces shall be taken and subjected to all 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-1 Sampling Plan

Lot Size	N1	N2	(N1+N2)	C1	C2
Under 25	3	6	9	0	2
25 to 50	7	14	21	0	3
51 to 100	10	20	30	0	3
101 to 200	13	26	39	0	
200 to 300	20	40	60	1	5
301 to 500	25	50	75	1	6
501 to 800	35	70	105	2	7
801 to 1300	50	100	150	3	10
1301 and above	75	150	225	5	12