



सत्यमेव जयते

**TECHNICAL SPECIFICATION
FOR
LED SIGNAL LIGHTING UNITS
FOR
SUBSIDIARY COLOUR LIGHT SIGNALS
(ROUTE, SHUNT, CALLING ON and TUNNEL SIGNALS)
FOR
RAILWAY SIGNALLING**

SPECIFICATION NO. RDSO/SPN/153/2023 Revision 5.0

**SIGNAL & TELECOM DIRECTORATE
(SIGNAL)**

**RESEARCH DESIGNS & STANDARDS ORGANISATION
LUCKNOW-226011**

DOCUMENT DATA SHEET

Designation
RDSO/SPN/153/2023 Revision 5.0
Title of Document
Technical Specifications for LED Signal Lighting Units for Subsidiary Colour Light Signals (Route, Shunt, Calling-on and Tunnel Signals) for Railway Signalling.
Author
Ajay Verma, Executive Director/Signal-II
Approved by
Rajendra Dhambel, Principal Executive Director/S&T

This document specifies technical specification and inspection criteria for LED Signal Lighting Units for Subsidiary Colour Light Signals (Route, Shunt, Calling-on and Tunnel Signals) for Railway Signalling.

DOCUMENT CONTROL SHEET

NAME	ORGANISATION	FUNCTION	LEVEL
Shri Ajay Verma	RDSO	Member	Prepare
Shri Rajendra Dhambel	RDSO	Approval	Approve

REVISIONS/AMENDMENTS

Version	Amendment	Effective date
RDSO/SPN/153/1998	FIRST ISSUE	January 1999
RDSO/SPN/153/1999	Revision 1	February 2000
RDSO/SPN/153/2002	Revision 2	April 2002
RDSO/SPN/153/2002	Amendment 1	October 2002
RDSO/SPN/153/2004	Revision 3	January, 2007
RDSO/SPN/153/2004	Amendment 1	July, 2007
RDSO/SPN/153/2004	Amendment : DC Version withdrawn	07/11.11.2008
RDSO/SPN/153/2011	Revision 4.1	January, 2012
RDSO/SPN/153/20 23	Revision 5.0	01/04/2023

TABLE OF CONTENTS		
Sl. No.	Item	Page No.
0	Foreword	7
1.0	Scope	7
2.0	Abbreviations used	7
3.0	Terminology	8
4.0	General Requirements	8
5.0	Technical Requirements	9
6.0	Design Criteria	9
7.0	LED Signal for use in tunnels in Metro Railway, Kolkata	13
8.0	Tests & Performance Criteria	14
9.0	Inspection Criteria	15
10.0	Information To Be Given By Purchaser	17
11.0	Scope Of Supply	17
12.0	Warrantee	17
13.0	Marking	17
14.0	Documentation	18
15.0	Packing	18
16.0	Infringement of Patent Rights	18
17.0	ISO Procedure	19
	Annexure I	20
	Annexure II	21

TECHNICAL SPECIFICATION FOR LED SIGNAL LIGHTING UNITS FOR SUBSIDIARY COLOUR LIGHT (Route, Shunt, Calling-ON and Tunnel) SIGNALS FOR RAILWAY SIGNALLING.

0. FOREWORD

- 0.1 This specification is issued under the fixed serial number RDSO/SPN/153/ 2023 Rev. 5.0.
- 0.2 This specification requires reference to the following Indian Railway Standards / British Standards / International Standards specifications:
- (i) RDSO / SPN / 144 / 2006: Safety and reliability requirements of electronic signalling equipment.
 - (ii) STS/E/Relays/AC Lit LED Signal/09-2002: Tentative specification for universal plug-in type, tractive armature AC lamp proving relay (metal to carbon) for 110V AC LED signal lamp.
 - (iii) IRS: S23: Indian Railway Standard specification for electrical and electronic based signaling and interlocking equipment.
 - (iv) BS 1376:1974: Specification for colours of light signals.
 - (v) CENELEC Standard EN 50126: Railway applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS).
 - (vi) CENELEC Standard EN 50129: Railway applications – Communication, Signalling and processing systems – Safety related electronic systems for signaling.
 - (vii) IEC 127: International Standard for miniature fuses.
- 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 the specification is implied, otherwise the particular issue referred to is meant.
- 0.4 This specification is intended to cover the technical provisions and it does not include all the necessary provisions of a contract.
- 0.5 This specification supersedes specification number RDSO/SPN/153/ 2011 Rev. 4.1(Draft).

1.0 SCOPE

- 1.1 This specification covers the general and technical requirements of Subsidiary LED Signal Lighting Units for Railway Signalling application in RE & Non-RE areas of Indian Railways.
- 1.2 The LED Signal lighting units covered in this specification include that of Subsidiary Signal i.e. Route, Calling ON & Shunt Signals. Specification also covers LED signals for use in tunnels in Metro Railway, Kolkata.

2.0 ABBREVIATIONS USED

RDSO: Research Designs & Standards Organisation

CENELEC: European Committee for Electrotechnical Standardization

IEC: International Electrotechnical Commission

BS: British Standards

RE: Railway Electrification

LC: Level Crossing

ASM: Assistant Station Master

MTBF: Mean Time between Failures

CLS: Colour Light Signalling

ECR: Lamp Proving Relay

LED: Light Emitting Diode

UV: Ultra Violet

OK: Okay

PCB: Printed Circuit Board

ABS: Acrylonitrile Butadiene Styrene

NO/NC: Normally Open/Normally Close

C-ON: Calling-ON signal

AC/DC: Alternating Current/Direct Current

3.0 TERMINOLOGY

3.1 The terminology used in this specification is covered by the definitions given in IRS: S 23.

3.2 The terms referred to in this specification but not covered in IRS: S 23, are defined below:

Blanking & Non-Blanking failure modes of LED signals for tunnels of Metro Railway, Kolkata-

In **blanking mode**, a Tunnel LED Signal Lighting Unit shall extinguish when input current drawn by the current regulator falls outside specified limits of rated input current or illumination falls to a value which is not less than 40% of nominal illumination due to a failure or any other reason. In such case, current regulator should not draw input current more than 30 mA at maximum rated voltage.

In **non-blanking mode**, a Tunnel LED Signal Lighting Unit shall remain lit when input current drawn by the current regulator falls outside specified limits of rated input current or illumination falls to a value which is less than 40% of nominal illumination due to a failure or any other reason. In such case, input current drawn by current regulator shall be limited to less than 40 mA to ensure dropping of ECR. Limit on input current shall apply when illumination has deteriorated to a value, which is not less than 40% of nominal illumination.

4.0 GENERAL REQUIREMENTS

4.1 The minimum visibility distance for LED Signal lighting Units for use in Tunnel Signals in Metro Railway shall be 400 m.

The minimum visibility distance of Direction type Route Indicator with three lit LED Signal lighting units shall be 400 m in clear day light with peak sunrays at rated voltage.

The minimum visibility distance of LED signal lighting units, other than Route Signal lighting units, shall be 200 m in clear daylight with peak sunrays at rated voltage.

4.2 LED Signal lighting units shall also be visible to a driver stopping at the foot of the signal.

4.3 LED Signal lighting units shall be so designed that they fit in the existing colour light signal housings as per Table-I given below or as specified by the Purchaser.

Signal	LED Signals used for Tunnels in Metro Railway	Calling-ON Signal	Route Indicator	Position Light Shunt Signal
Reference Drawing No.	MRC/SG/MISC/S/3-82 Alt - 1	SA : 24351 S : 23463	SA : 23401 S : 23407	SA : 23840 S : 23841

- 4.4 LED signal lighting units shall only be used with LED ECRs as per RDSO specification STS/E/Relays/AC Lit LED Signal/09-2002 as applicable.

5.0 Technical requirements

5.1 Colour Co-ordinates:

Colour co-ordinates of LED Signal lighting Units shall be as follows:

Red, Green & Lunar White Aspect: Class 'C' of BS: 1376

Yellow Aspect: Class 'B' of BS: 1376

Colour co-ordinates graph as per BS: 1376 is given in Annexure I.

5.2 OPERATING PARAMETERS

Operating parameters of various types of LED Signal lighting Units when used with ECRs as per RDSO specification STS/E/Relays/AC Lit LED Signal / 09-2002 shall be as per Table - II given below:

SN	Parameter	Subsidiary Signal		
		C-ON Signal	Route Lighting Unit	Shunt Lighting Unit
1	Rated voltage at input	110V $\pm$ 20%	110V $\pm$ 20%	110V $\pm$ 20%
2	Current at rated voltage per unit at Input terminals	150 mA +10% -20%	25 mA $\pm$ 5% (rms)	55 mA $\pm$ 5% (rms)
3	Illumination measured at 1.5 m from LED Signal Lighting Unit in axial direction at rated voltage.	50 LUX -10% +40%	50 LUX -10% +40%	30 LUX -10% +40%
4	Colour	Yellow	Lunar White	Lunar White

Note:

- All values given in Table- II shall be read as nominal value $\pm$ tolerance limits.
- The parameters for LED signal aspects for use in tunnels in Metro Railway, Kolkata are given later in this specification

6.0 DESIGN CRITERIA

6.1 LED SIGNAL LIGHTING UNIT

- 6.1.1 LED signal lighting units for use in Tunnels shall be so designed that in all designed conditions of its lighting, except for failure in non blanking mode, it should ensure pick up of ECR and input current drawn by its current regulation circuit should be more than specified maximum pick up current of ECR with ECR connected in circuit.
- 6.1.2 Signal Lighting Unit for use in Tunnel Signal shall remain lit or extinguish as per the Blanking or Non Blanking failure mode selected in case of deterioration of illumination or when input current drawn by the current regulator falls outside specified limits of rated input current due to a failure or any other reason as stipulated in Cl. 3.2.

- 6.1.3 In case of Direction type Route Indicator, Route signal lighting units shall be so designed that with two healthy and three defective lighting units in circuit, ECR should drop and total input current drawn by the Route Indicator Signal should be less than specified minimum release current of ECR.
- 6.1.4 In case of Position light Shunt Signal, shunt signal lighting units shall be so designed that with one healthy and one defective lighting unit in circuit, ECR should drop and total input current drawn by the Shunt Signal should be less than specified minimum release current of ECR.
- 6.1.5 LED Signal Lighting Units of Direction type Route Indicator and Position light Shunt Signal shall extinguish when input current drawn by the current regulator falls outside specified limits of rated input current or illumination falls to a value less than 40% of nominal illumination due to a failure or any other reason. In such case, an LED Signal Lighting Unit should not draw more than 2 mA.
- 6.1.6 Five route signal lighting units shall be wired in parallel in case of Direction type Route Indicator and two shunt signal lighting units shall be wired in parallel for Position light Shunt Signal. After wiring all the units of Direction type Route Indicator or Position light Shunt Signal, as the case may be, total input current drawn by the signal should be within +5%, -10% of sum of nominal input current of signal lighting units in circuit.
- 6.1.7 Calling ON signal lighting unit, shall extinguish when input current drawn by the lighting unit falls outside specified limits of rated input current or illumination falls to a value less than 40% of nominal illumination due to a failure or any other reason. In such case, input current drawn should not be more than 30 mA.
- 6.1.8 Dispersion angle of signal lighting units, measured as per Annexure II, shall be as given in Table –III below. Illumination shall be measured at every 1° from axis of LED signal lighting unit to 50 % power points. There should be continuous spread of illumination.

	Calling-ON signal lighting units and for Signals used for tunnels in Metro Railway, Kolkata.	Route signal lighting units	Shunt signal lighting units
At 50% power points	4° to 10°	10° ± 2°	15° ± 2°

- 6.1.9 Signal lighting units shall not light up to 60 V.
- 6.1.10 Fluctuation in input voltage shall not result in latching of signal to Blanking/ Non Blanking failure mode.
- 6.1.11 The LED Signal Units shall work satisfactorily (Input current will remain in the limits as specified in Clause 5.2 or Cl. 7.3, as the case may be) in ambient temperature varying from -10°C to +70°C and a relative humidity up to 95% at 40°C ± 2°C as specified in RDSO/ SPN/144/2006.
- 6.1.12 The LED Signal Unit shall not reflect sunlight/headlight of loco as it may give misleading aspect to the driver.

- 6.1.13 Light from LED signal lighting unit, when projected on a white target at 1.5 m from LED signal lighting unit, the target shall be uniformly illuminated within half power points and shall be free from dark circles.
- 6.1.14 LED Signal Lighting Units shall have a display area of 125 mm $\pm$ 1 mm diameter for Calling ON signals and 85 mm $\pm$ 1 mm diameter for Route and Shunt signals.
- 6.1.15 LED signal lighting unit shall be provided with a curved transparent cover of UV stabilized polycarbonate material having a thickness of 2.5 mm $\pm$ 0.5 mm. LED signals for use in tunnels in Metro Railway, Kolkata shall have UV stabilized cover of polycarbonate material or UV stabilized polycarbonate lenses on inner surface.
- 6.1.16 Body of LED signal lighting unit shall be made of industrial grade plastic like ABS or fiber glass. Metallic body parts may be used where these facilitate heat dissipation. LED Signal Unit shall get fitted securely on the existing signal housings without any modification on them. A gasket made of EPDM (**Ethylene Propylene Diene Monomer**)-20 rubber shall be provided and pasted on the rim with the help of Anaerobic adhesive to the LED unit.
- 6.1.17 Body of LED signal lighting unit shall be hermetically sealed.
- 6.1.18 Number of LEDs used should not be less than 30 for Calling ON, 16 for Route and 13 for Shunt signal lighting units. Variation from stipulated number shall be considered based on merits of the design.
- 6.1.19 Design shall be such that failure of an LED shall not vary illumination by more than 5% of nominal illumination for Calling-On signal lighting units and 10% of nominal illumination for Route and Shunt signal lighting units. This tolerance for LED signals for use in tunnels of Metro Railway, Kolkata shall be 20%.
- 6.1.20 LEDs in the unit shall be arranged in more than one array so that in the eventuality of failure of an array, whole unit does not become blank. LEDs in the arrays shall be interleaved so that effect of failure of any array is spread out. Route and Shunt signal lighting units and main LED units for use in tunnels in Metro Railway, Kolkata may have one array.
- 6.1.21 LED Signals for use of road traffic shall be used without ECR.
- 6.1.22 Sensing of illumination, if used, shall activate after signal lighting unit is completely lit to prevent hunting.
- 6.1.23 LEDs used in LED signal lighting units shall be of high performance quality and from reputed manufacturers as stipulated by RDSO. The maximum junction temperature of an LED shall not be less than 100 deg. and epoxy used in the LED shall have UV inhibitors.
- 6.1.24 Manufacturer shall maintain proper accountal of LEDs being used. The record shall include various details like source of supply, procurement invoice no. & date, quantity, incoming rejection, lot-wise consumption etc. which may be verified by inspecting officials.
- 6.1.25 At least 10% LEDs of every procured lot shall be tested before use to check electrical/optical characteristics as per LED manufacturer's data sheet. Lot-wise test record shall be maintained, which may be verified by inspecting officials.

- 6.1.26 Number of LEDs and their Part no. shall not be changed without prior approval of RDSO.
- 6.2 CURRENT REGULATION CIRCUIT
- 6.2.1 Current regulation of LED signal lighting unit shall be within 2% for input voltage range as specified in Cl. 5.2 (or Cl. 7.3 as the case may be).
- 6.2.5 Current regulation circuit shall be so designed that normally LEDs of an LED array are driven within average drive current range recommended by the LED manufacturer and in no circumstances LEDs of an array shall be driven by current more than the maximum current recommended by the LED manufacturer. Details of the same shall be submitted at type approval stage.
- 6.2.6 An MOV of rating 175 V shall be there at the input of the current regulation circuit to take care of power surges.
- 6.2.7 A line filter circuit in a failsafe manner shall be provided at the input of the current regulation circuit.
- 6.2.8 At input stage of LED Signal lamp two bridge rectifier circuits in parallel with each limb having two diodes in series should be provided (total 16 diodes for complete bridge rectifier) to provide redundancy in case of failures.
- 6.2.9 Electrolytic capacitors in power circuit shall be used in series parallel combination to achieve failsafe redundancy.
- 6.2.10 If there is any external resistance in the design, it shall be of SMD type and in series parallel combination to achieve failsafe redundancy.
- 6.2.11 Coils/transformers, if used in current regulation circuit shall be fire retardant and conform to 'H' class.
- 6.2.12 There shall be no terminals for DC lighting as DC lighting ceases to exist.
- 6.2.13 There shall not be any discrete jumpers. Integrated aligned rugged jumper selection arrangement shall be provided for blanking /non-blanking options. It shall not be mechanically feasible to simultaneously select both blanking and non-blanking mode. All selections shall be covered under single transparent cover with minimum gap at top to avoid loosening of selection arrangement due to vibrations.
- 6.3 A fuse terminal block as per RDSO specification no. RDSO/SPN/189/2004 ver. 1 (or latest) with glass fuse of 0.63 Amp rating as per IEC 127 with fuse blown indication using neon lamp should be supplied alongwith the built in current regulator for use in signal lighting circuits. The current in case of indications due to fuse blown condition should not exceed 02 mA.
- 6.4 The electronic components and switches used shall be of Industrial grade and shall comply Cl. 5.1 of RDSO/ SPN/144/2006, as applicable. The operating temperature rating of the capacitors used shall be up to 105 deg. C or more. Glass fuse shall be as per IEC 127. The voltage rating of capacitors should be more than double that of nominal incidental peak voltage.
- 6.5 All Units shall meet the requirements as mentioned in clauses 2.3, 2.5, 5.2 & 6 of RDSO/SPN/ 144/2006.

- 6.6 Total harmonic distortion over full operating voltage range for LED signals shall be less than 20%.
- 6.7 Parts of body of any signal lighting unit as visible from front after fitting in CLS unit shall be black. Any permanent means e.g. backside of body, collar etc. of colour of the aspect may be used to indicate aspect colour for Tunnel signal lighting units. Rest signal lighting units shall be of black colour.

7.0 LED SIGNAL FOR USE IN TUNNELS IN METRO RAILWAY, KOLKATA

- 7.1 For use inside tunnel in Metro Railway, Kolkata, LED lighting units shall be so designed that they fit into existing colour light signal units of Metro Railway (Drg. No. MRC/SG/MISC/S/3-82 Alt-1 of Metro Railway).
- 7.2 General and technical requirements shall conform to clauses 4.1, 4.2, 4.3 & 5.1 of this specification.
- 7.3 Operating parameters:
Operating parameters of various types of LED lighting units when used with ECR's as per RDSO specification STS/E/Relays/AC lit LED Signal/09-2002 shall be as follows:

SN	Parameter	Main Signal for use in tunnels		
1	Rated voltage at Input terminals	110V $\pm$ 20 % AC (rms), 50Hz		
2	Current at rated voltage per unit at Input terminals	140 mA $\pm$ 20% (rms)		
3	Illumination measured at 1.5m from LED Signal Lighting Unit in axial direction at rated voltage	80 LUX -10% +40%	80 LUX - 10 % + 40 %	80 LUX - 10 % + 40%
4	Colour	Red	Yellow	Green

- 7.4 DESIGN CRITERIA
- 7.4.1 LED Signal lamp shall be so designed that in all designed conditions of its lighting, it should ensure pick up of ECR and input current drawn should be more than specified maximum pick up current of ECR with ECR connected in circuit.
- 7.4.2 Green and Yellow aspect shall be designed to extinguish in case of failure resulting in non-correspondence with ECR. In such case, input current shall be limited to ≤ 10 mA to ensure dropping of ECR to avoid double aspect due to cascading circuit. In case of extinguishing of lamp due to an intermittent failure, it shall not restore automatically if failure disappears and shall restore only on re-setting of the signal.
- 7.4.3 In case of Red aspect, design should not force blanking. In such case input current drawn by the LED Signal shall be limited to less than Drop Away current of LED ECR to ensure dropping of ECR. In case of extinguishing of lamp due to an intermittent failure, it should not restore automatically if failure disappears and would restore only on resetting the signal.
- 7.4.4 Design criteria shall meet clauses 6.1.8, 6.1.9, 6.1.10, 6.1.11, 6.1.12, 6.1.13, 6.1.15, 6.1.16, 6.1.17, 6.1.19, 6.1.20, 6.1.22, 6.1.23, 6.1.24, 6.1.25, 6.1.26.
- 7.5 The LED signal lighting units shall have a display area of 85 ± 1 mm diameter for Red, Yellow and Green aspects. Variations in this may be permitted based on the merits of the design.

- 7.6 No. of LED's used should not be less than 16 for Red and Yellow and should not be less than 7 for Green aspect. Variations from stipulated nos. shall be considered based on merits on the design.
- 7.7 Current regulator circuit for LED signal units for use in Metro Railway, Kolkata should be housed inside signal lighting unit. Built in provision for non-blanking feature in Red LED signal aspect and blanking feature in Green LED signal aspects should be there. Yellow LED aspect should have selectable option for blanking/non blanking mode. Other criteria for current regulator unit shall conform to cl. 6.2.4 and 6.2.5.
- 7.8 Compliance to Cl. 6.4, 6.5, 6.6 and 6.7 of this specification shall also be applicable for LED units used in tunnels in Metro Railway, Kolkata.

8.0 TESTS & PERFORMANCE CRITERIA

- 8.1 The LED signal lighting unit shall pass the climatic tests as per Sl. No. 1, 2, 3, 4, 5, 6, 7 & 12 of Cl. 9.3 of specification RDSO / SPN / 144 / 2006. LED signal lighting unit shall be considered as out-door track side electronic equipment. For vibration test, up to & including 75 Kg. weight categories shall apply.
- 8.1.1 The LED signal lighting unit shall pass driving rain test as per Sl. No. 9 of Cl. 9.3 of specification RDSO / SPN / 144 / 2006. These units shall be tested after fixing in an enclosure similar to colour light signal housing without hood and with backdoor open.
- 8.1.2 After test as per every Sl. No. of Cl. 9.3 of specification RDSO / SPN / 144 / 2006, as specified above, no LED should fail; there should not be any damage in the unit or visual change in colour. Also input current and illumination shall not change by more than $\pm 5\%$ of original values and will be within specified values as per clause 5.2. After completion of all tests, colour co-ordinates shall remain within specified class as per clause 5.1.
- 8.2 Applied high voltage test for LED signal lighting unit:
The equipment shall withstand for one minute without puncture and arcing a test voltage of 2000Volts rms applied between body and all AC line terminals looped together.
(For testing with part of body which is used as heat sink, test voltage shall be 1500Volts rms). The test voltage shall be alternating of approximately sinusoidal waveform of any frequency between 50 Hz and 100 Hz. In case of LED signal lighting unit, it should not generate any spark during the test.
- 8.3 Insulation Resistance Test for LED signal lighting unit and current regulator: This test shall be carried out-
- (a) Before the high voltage test
 - (b) After the high voltage test
 - (c) After completion of the climatic test
- The Insulation Resistance shall be measured between the body and the current carrying terminals looped together at a potential of 500 V DC. There shall not be appreciable change in the values measured before and after high voltage test and these values shall not be less than 100 Mega ohms. After completion of climatic test, the insulation resistance shall not be less than 10 Mega ohms for the equipment at a temperature of 40°C and relative humidity 60%.

8.4 Dispersion Angle test: This shall be measured as per Annexure II.

8.5 FAIL SAFETY

- i) LED signal lighting Units shall be so designed that any short/open or any other defect in any of the component will not lead to unsafe / undesirable situation.
- ii) There shall never be any possibility of change in colour of signal light unit with variation in temperature, current, voltage and ageing to unsafe side i.e. in any usual / unusual circumstances.
Red to Yellow or Green
Yellow to Green
Lunar White to Yellow or Green
- iii) LED signal lighting Units and current regulator shall comply Cl. 3 & 4 of specification RDSO / SPN / 144 / 2006, as applicable.
- iv) Fail safety validation shall be done by an independent agency which has credentials & experience for similar validations. Fail safety validation shall be done as per CENELEC standards EN 50126 & EN 50129 for Safety Integrity Level 4.

8.6 Burning in test: LED signal lighting unit shall be kept continuously ON for minimum 168 hrs at 60 °C at rated voltage. There shall not be any difference in operating parameters before and after burning in test.

8.7 Thermal cycling and power cycling tests: All PCBs and power supply modules shall be subjected to thermal cycling and power cycling tests respectively as per Cl. 9.3 of specification RDSO / SPN / 144 / 2006. Proper test record having traceability to respective PCB/module shall be maintained by the manufacturer.

8.8 Calculation details of MTBF as per Part stress method shall be furnished by the manufacturer at the time of initial approval.

9.0 INSPECTION CRITERIA

9.1 TYPE TESTS

For type test, 05nos. of Route, 02 nos. of Shunt and 02 nos. of Calling-on of LED signal lighting units shall be subjected to following tests as applicable. In case of Tunnel signals 02 nos. of aspects of each colour shall be Type tested for relevant clauses of this specification.

- (i) Visual inspection & dimensional check (Clause 4.3, 6.1.13, 6.1.14, 6.1.15, 6.1.16, 6.1.17, 6.1.18, 6.1.20, 6.1.23, 6.2.1, 6.2.2, 6.2.3, 6.4, 6.5, 6.7, 7.1, 7.5, 7.6, 7.7, 7.8).
- (ii) Colour co-ordinates (Clause 5.1)
- (iii) Operating Parameters (Clause 5.2, 7.3)
- (iv) Output current regulation of current regulator (Clause 6.2.4)
- (v) Compatibility with ECR (Clause 4.4, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7, 7.4.1, 7.4.2, 7.4.3)
- (vi) Ambient temperature test (Clause 6.1.11)
- (vii) Climatic tests (Clause 8.1, 8.1.1, 8.1.2)
- (viii) UV Stabilization test on cover (Clause 6.1.14)
- (ix) Effect of reflected light (Clause 6.1.11)
- (x) Visibility test (Clause 4.1, 4.2)

- (xi) Fail safety (Clause 4.4, 5.1, 5.2, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7, 6.1.9, 6.1.10, 6.1.19, 6.1.20, 6.1.22, 6.1.23, 6.2.4, 6.2.5, 6.3, 6.5, 6.6, 6.7, 8.5, 8.8)
 - (xii) Applied high voltage test (Clause 8.2)
 - (xiii) Insulation resistance test (Clause 8.3)
 - (xiv) Minimum lighting voltage (Clause 6.1.9)
 - (xv) Dispersion Angle test (Clause 6.1.8)
 - (xvi) Fluctuation in input voltage (Clause 6.1.10)
- 9.1.1 An open blown out model of offered LED signals shall also be submitted for initial type test.
- 9.1.2 Documents as per Cl. 14.0 shall be submitted along with samples.
- 9.1.3 Fail safety is not required for subsequent maintenance approvals provided there is no change in circuit design.
- 9.2 ACCEPTANCE TEST
- 9.2.1 Out of a lot, 20% of the samples shall be subjected to following tests:
 - (i) Visual inspection & dimensional check (Clause 4.3, 6.1.13, 6.1.16, 6.1.17, 6.1.18, 6.1.23, 6.4, 6.5, 6.7, 7.1, 7.5, 7.6, 7.7, 7.8)
 - (ii) Operating Parameters (Clause 5.2, 7.3)
 - (iii) Minimum lighting voltage (Clause 6.1.9)
 - (iv) Compatibility with ECR (Clause 4.4, 6.1.1, 6.1.3, 6.1.4, 6.1.6, 7.4.1)
- 9.2.2 Minimum five samples from those which have passed tests as per Clause 9.2.1 shall be subjected to following tests.
 - (i) Ambient temperature test (Clause 6.1.11)
 - (ii) Colour co-ordinates (Clause 5.1)
 - (iii) Output current regulation of current regulation circuit (Clause 6.2.4)
 - (iv) Insulation resistance test (Clause 8.3 (a))
 - (v) Dispersion Angle test (Clause 6.1.8)
 - (vi) Fluctuation in input voltage (Clause 6.1.10)
- 9.2.3 Acceptance tests as per Cl. 9.2.2 (ii) to (vi) shall be conducted after ambient temperature test. Operating parameters, minimum lighting voltage, compatibility with ECR shall also be conducted after ambient temperature test.
- 9.2.4 Failure in any of the tests is not acceptable.
- 9.3 ROUTINE TEST
- 9.3.1 Following routine tests besides other tests, as deemed fit to ensure quality, reliability and compliance of this specification shall be done by the manufacturer on all the units:
 - (i) Thermal cycling & power cycling tests (Clause 8.7)
 - (ii) Visual inspection & dimensional check (Clause 4.3, 6.1.14, 6.1.17, 6.1.18, 6.1.19, 6.1.24, 6.4, 6.6, 6.8, 7.1, 7.6, 7.8)
 - (iii) Burning in test (Clause 8.6)
 - (iv) Colour co-ordinates (Clause 5.1)
 - (v) Operating Parameters (Clause 5.2, 7.3)
 - (vi) Output current regulation of current regulation circuit (Clause 6.2.4)
 - (vii) Compatibility with ECR (Clause 4.4, 6.1.1, 6.1.3, 6.1.4, 6.1.6)
 - (ix) Insulation resistance test (Clause 8.3 (a))

(x) Minimum lighting voltage (Clause 6.1.9)

(xi) Dispersion Angle test (Clause 6.1.8)

9.3.2 Tests as per Cl. 9.3.1 (iv) to (x) shall be conducted after Burning in test.

10.0 INFORMATION TO BE GIVEN BY PURCHASER

(i) Type of LED signal lighting unit –

Calling-on LED signal lighting unit, Route LED signal lighting unit, Shunt LED signal lighting unit,

(Five route LED signal lighting units are required for one Direction type route indicator & three shunt LED signal lighting units are required for a Position light shunt signal)

Metro Railway, Kolkata tunnel use - LED signal Red, and Yellow and Green aspect.

(ii) Type of housing (Ref. Cl. 4.3)

11.0 SCOPE OF SUPPLY

Scope of supply shall include the following material, if not asked otherwise by the purchaser –

In case of Subsidiary Signal, one Route, Shunt and Calling-On Signal shall be supplied with one spare fuse.

In case of use in tunnels in Metro Railway, Kolkata, every aspect shall be supplied with built in current regulator, fuse blown indicator as per Cl. 6.3 with one spare fuse.

12.0 WARRANTY

The supplier shall give a warranty of 60 months for all types of LED signal lighting units & other supplies except fuses.

12.1 In case, LED signal lamps fail within 24 months of supply, vendor will jointly inspect the defective lamps with the railway after getting telephonic/written information from the railway. Defective lamps will be collected and replaced by the vendor free of cost by new lamps within 45 days of information by the railway. New LED lamps will be supplied after RDSO inspection.

12.2 In case, railway does not inform the vendor about the defective LED lamps within 60 days of expiry of 24 months, vendor's liability will be limited to rectification of the defective lamps.

12.3 During rest of the warranty period, the defective LED lamps shall be sent by the railway to the vendor which will be rectified by the vendor and tested by the vendor for routine tests as per Clause 9.3.1 (ii) to (x). Rectified LED lamps will be returned by the vendor within 45 days of receipt of defective lamps along with their routine test reports. Rectification / replacement record and failure analysis of ALL rectified/ replaced LED lamps shall be maintained by the vendor and submitted to RDSO every quarterly.

13.0 MARKING

13.1 Clauses 12.1 and 12.2 of specification RDSO / SPN / 144 / 2006 shall be complied.

13.2 The words Indian Railway Property shall be engraved /embossed on every unit in letters of 5 mm size (minimum) at a conspicuous place.

13.3 The anodized name plate shall be firmly attached to every unit and shall show the following information:

- a. Name or trademark of the manufacturer
- b. Serial number of the unit
- c. Version No. of the unit*
- d. RDSO's specification number
- e. Name and aspect of the signal
- f. Operating voltage- 110V AC
- g. Month and year of manufacture

*In case of an alteration in the design of a unit, new version number shall be assigned.

14.0 DOCUMENTATION

Following documents shall be supplied with each set of 10 units subject to a minimum of 1 set of documents: -

(a) Two copies of Installation and maintenance manual. This should also include following information:

- (i) Guaranteed performance data, technical and other particulars
 - (ii) Schematic block diagram showing mounting arrangement of various components & details of each type of assembled PCB
 - (iii) Details of Hardware e.g. schematic diagrams of the system circuits/ components, details for each type of assembled PCB and part list
 - (iv) Mechanical drawings of every unit
 - (v) Part no. and manufacturer's data sheet of LEDs used
 - (vi) Trouble shooting procedure alongwith test voltages and waveforms at various test points in the PCBs.
 - (vii) Dos & Don'ts (Pocket size laminated cards)
- (b) Pre-Commissioning check list.

15.0 PACKING

- 15.1 All the units and their sub assemblies shall be individually wrapped in bubble sheet and packed in individual card board boxes. The empty spaces shall be filled with suitable filling material. Alternatively, these may be packed in thermocole boxes. The units shall be finally packed in a wooden case or card boxes of sufficient strength so that it can withstand bumps and jerks encountered in a road/ rail journey.
- 15.2 Every box shall be marked with code numbers, contents and name of manufacturer. The upside shall be indicated with an arrow. Boxes should have standard signages to indicate the correct position and precaution "Handle with Care" with necessary instructions.
- 15.3 The units and their sub assemblies shall be so packed as to permit convenient handling and to protect against loss or damage during transit and storage.

16.0 INFRINGEMENT OF PATENT RIGHTS

Indian Railways shall not be responsible for infringement of patent rights due to similarity in design, manufacturing process, use of components used in design, development of manufacturing of LED signal and any other factor which may cause such dispute.

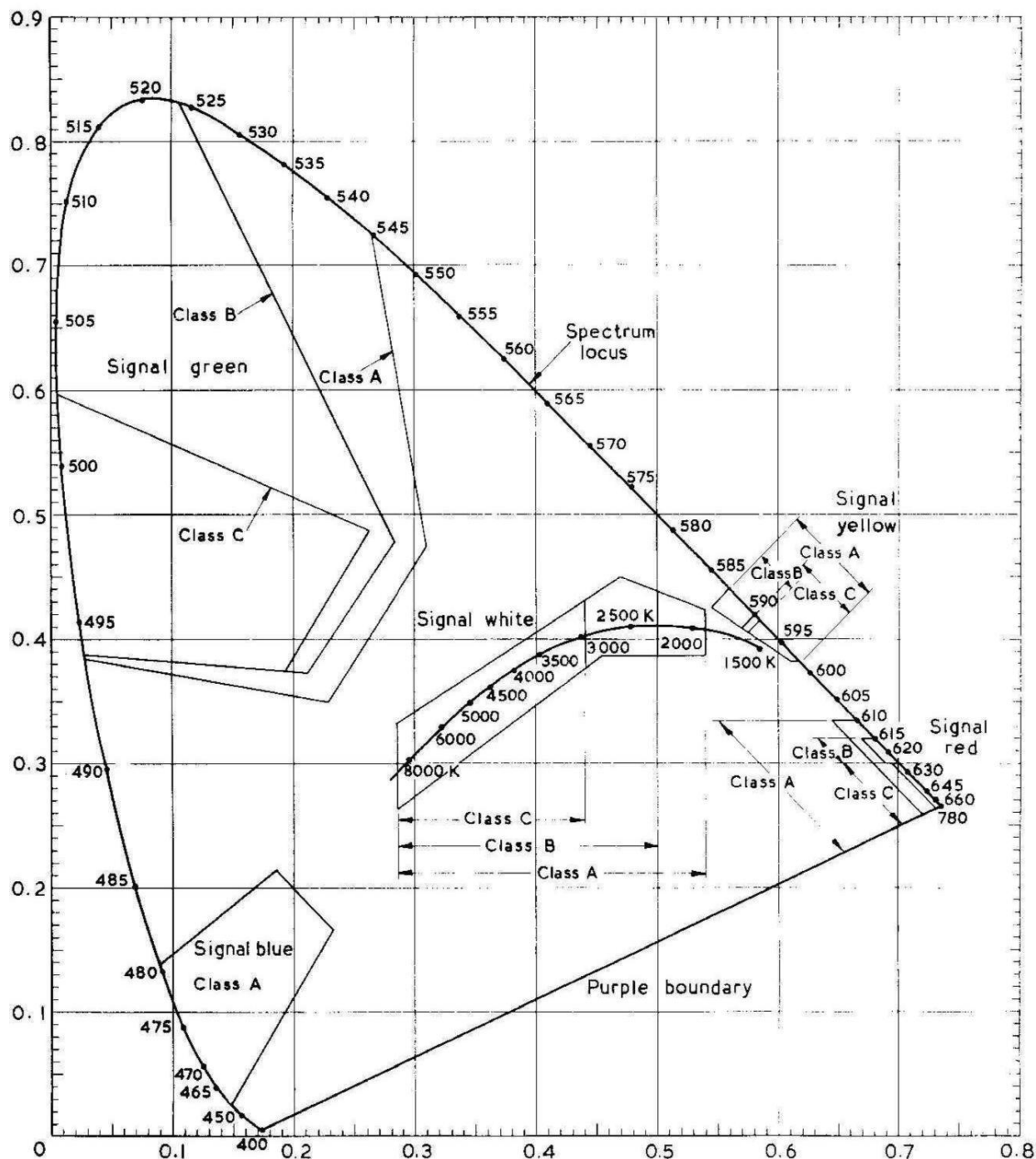
17.0 ISO PROCEDURE

All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11 (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.

Annexure I

BS 1376 : 1974

y



Chromaticity Limits for a Signal Colour

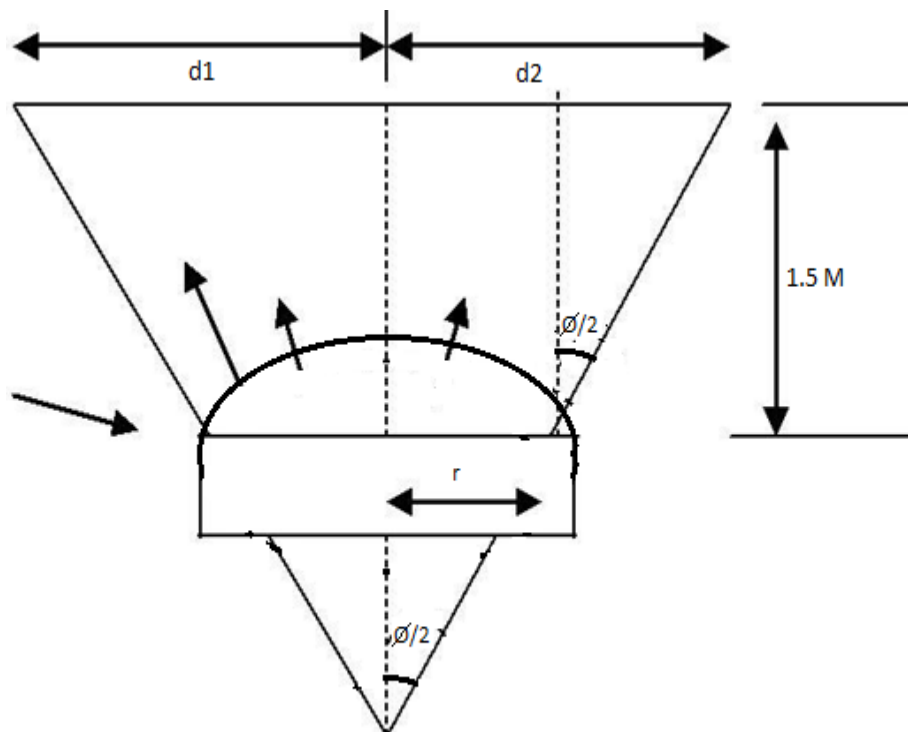
Annexure II

Measurement procedure for Dispersion Angle

1. Light up the aspect at the nominal voltage on 110 V and place it on the test bench.
2. The Dispersion Angle shall be calculated by measuring the half intensity points of the dominant wavelength at 1.5 m from LED signal lighting unit in axial direction on both the sides and taking average of the distances, d_1 & d_2 in meters

$$\{d = (d_1 + d_2) / 2\}$$
3. The half intensity, point is where half of the normal illumination at rated voltage falls. The Dispersion Angle shall be calculated using the formula–

$$\tan^{-1} \frac{d-r}{1.5} = \emptyset/2$$
4. 'r' is the distance from centre of the unit to the outer most LED provided in the unit.



5. **Dispersion Angle = $\emptyset$**