सत्यमेव जयते

भारत सरकार, रेल मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TECHNICAL SPECIFICATION

FOR

BATTERY OPERATED LED BASED

FLASHING TAIL LAMP FOR RAILWAY VEHICLES

SPECIFICATION NO. RDSO/SPN/200/2010 Revision: 2.0

Number of pages: 21

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Abstract

This document specifies technical specification and inspection criteria for Battery Operated LED Based Flashing Tail Lamp For Railway Vehicles.

DOCUMENT CONTROL SHEET

NAME	ORGANISATION	FUNCTION	LEVEL
Rajneesh kumar	**RDSO**	**Member**	**Prepare**
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AMENDMENTS

Version	Amendment	Effective date
2002/TR/281/1/TL(Rev.0)	FIRST ISSUE	2002
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SPECIFICATION FOR BATTERY OPERATED LED BASED FLASHING TAIL LAMP FOR RAILWAY VEHICLES

SPECIFICATION NO: RDSO/SPN/200/2010 Rev.2.0

0 FOREWARD

0.1 This specification is issued under the fixed serial number RDSO/SPN/ 200/ 2010.

0.2 The purpose of this specification is to develop a portable lightweight, rugged, reliable, maintainable and user-friendly tail lamp as a last vehicle indicator and warning to train crew of approaching trains.

0.3 This specification is meant for specifying technical requirements of LED based flashing tail lamp for railway vehicles for provision on last vehicle of coaches or wagons. Each train is required to be equipped with one LED based flashing tail lamp on the last vehicle of the train. The specification covers the general and technical requirements of LED based flashing tail lamp. It also specifies various tests to ensure consistency of quality of equipment. The tail lamp unit must have the highest reliability under severe environmental conditions of operations of coaching and freight trains i.e. dust, humidity, high ambient temperature, shocks and vibrations. This specification supersedes earlier specifications on tail lamp.

0.4 Other relevant specifications

(a) IEC 60086 for primary batteries
(b) RDSO/SPN/144/2006 (Rev.2) for safety and reliability requirement of electronic signaling equipment.
(c) BS 1376:1974: Specification for colours of light signals

0.5 Wherever in this specification any 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.

0.6 This specification is intended to cover the technical provisions and it does not include all the necessary provisions of a contract.

1.0 SCOPE

1.1 The specification covers the general features, performance requirements and test methods of LED based flashing tail lamp for railway vehicles to be affixed on the last vehicle of the train.

1.2 The user requirement based specification includes in its ambit all components required to be assembled into the ultimate product named Battery operated LED based flashing Tail lamp.

1.3 The customized tail lamp shall be manufactured to principal dimensions in accordance with sketch (Annexure No. I, I/1) designed to be mounted on the 'L bracket' of last vehicle of the train (coach or wagon). It should not be possible to remove the tail lamp from this bracket without unlocking the lamp.

1.4 The tail lamp shall be powered by four commercially available dry cell batteries type LR-20 and would provide adequate life in terms of burning hours as specified in Cl. 2.2.2 under normal working conditions on the Indian Railways. The tail lamp should be compatible to work with R-20 type dry cell batteries also.

2. TECHNICAL REQUIREMENTS:

2.1 Colour Co-ordinates:
Red Aspect: Class 'C'of BS: 1376
Colour co-ordinates graph as per BS: 1376 is given in Annexure-II.

2.2 OPERATING PARAMETERS:

2.2.1 Performance parameters:

The L.E.D. type battery operated tail lamp shall meet the under-mentioned performance parameters:

S. No	Parameters	Flashing Red Aspect
1	No of flashes per second	$2 \pm 10\%$ for foggy weather ≤ 4 for normal weather
2	Pulse duty cycle	≥ 38 % for foggy weather ≥ 20 % for normal weather
3	Rated Voltage (volts)	6
4	Minimum Operating Voltage (volts)	2.7V
5	Minimum illumination measured at 1.5 m.in axial direction (LUX)	110
6	Radiating area (Approx.)	3850 sq. mm
7	Dispersion angle (As per annexure-III)	4^o to 7^o

2.2.1.1 Variation in dispersion angle may be agreed provided visibility and other requirements of this specification are complied.

2.2.1.2 Illumination shall be measured in steady mode. To enable the measurement in steady mode, suitable provision shall be provided in the lamp which shall not be visible or easily accessible to the user. Normally lamps shall be provided with flashing colour aspect and steady mode shall be operated for measurement only.

2.2.2 Cell Life Requirement:

The L.E.D. type battery operated tail lamp shall meet the under-mentioned Cell Life requirement parameters.

S. No	Parameters	Flashing Red Aspect
1	Minimum normal Cell life with L R – 20 cells upto low battery indicator (LBI) for a continuously operated tail lamp.	200 hrs. for foggy weather, 400 hrs. for normal weather
2	Minimum normal Cell life with R – 20 cells upto low battery indicator (LBI) for a continuously operated tail lamp.	100 hrs. for foggy weather, 200 hrs. for normal weather
3	Min. operating battery life after low battery indicator (LBI)	12 hrs.

(Note: Min. Cell life should be as high as feasible subject to compliance of other specified criteria.)

2.2.2.1 Cell life shall be measured with new cells. Lamp should live the specified life when it is continuously operated. No deterioration in illumination is permitted during normal cell life. For specified min. operating battery life after low battery indicator (LBI), 25% fall in illumination from its original value is permitted.

2.2.3 **VISIBILITY**

The visibility of the tail lamp should be 1.6 kms along longitudinal axis and 100 m at 6 degree angular displacement from longitudinal axis. This is expected to take care visibility at 800 meters at usual viewing angles or curves.
For carrying out the test, Tail lamp should be kept at 1.5 meter above rail level and viewed at local sun set time under conditions of clear weather and against the sun.

2.3 DESIGN CRITERIA

2.3.1 The battery operated flashing tail lamp shall be manufactured out of materials of highest grade and purity, to meet required parameters and be free from defects of workmanship, material or design.

2.3.1.1 The electronic components, PCB and connectors used shall be of Industrial grade and from reputed makes and shall comply Cl. 5.1 and 6.0 of RDSO Specification No. RDSO/SPN/144/2006 (latest) as applicable. The operating temperature rating of the capacitors used shall be more than 100 deg. C. The switches used shall be of 'Military' grade and shall be procured directly from OEM or their authorized

representative. Manufacturer shall submit data sheet of all of these components in this regard. The rating of all electronic components used shall be marked and be readable clearly on components.

2.3.1.2 Number of LEDs used should not be less than 6 with display area of about 70 mm mm diameter. Every individual LED shall be provided with a lense to achieve illumination and dispersion angle as specified in Cl. 2.2.1 or better. Variation from stipulated number and display area may be considered based on merits of the design subject to compliance of other requirements of this specification.

2.3.1.3 LEDs in the lamp 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. All LEDs shall be configured in such a way that failure of any LED shall not affect the working of the unit.

2.3.1.4 As the tail lamp is to be used out- doors under all weather conditions, it shall not use components which are prone to rusting. Whenever metallic components are to be employed, bronze, copper, stainless steel or anodized alloy should be used. All metallic electrical contacts shall be made of phosphorous bronze, brass or copper. Screws, nuts (other than those used for metallic contacts), hinges and other metallic components provided in the equipment should be of chrome plated mild steel, brass or stainless steel. The screws should be of adequate thickness and ruggedness.

2.3.2 The external appearance of the tail lamp shall be of Post Office RED colour.

2.3.2.1 The lamp shall comprise of Light module and Battery compartment. Light module shall have flashing red colour light.

The body of the lamp shall be made of industrial grade plastic like ABS in such a way that water cannot enter inside from top or sides. A guarantee shall be given by the manufacturer that no re-constituted or recovered material has been used for the manufacture of modules.
A suitable plastic molded red reflector shall be mounted on the body for visibility in case of failed operation.
A conceptual sketch of the lamp is enclosed as Annexure-I, I/1.

2.3.2.2 The Battery compartment shall be so designed to accept both - 4 Nos. R-20 dry cells or 4 Nos. LR-20 alkaline cells as per IEC 60086. The battery compartment should have isolation from light module and its electronic circuitry so that leakage of dry cell does not affect the electric circuit/ components.

There should be no need to use any type of screwdriver or to deal with any wires for the purpose of replacement of batteries. The battery compartment cover should have hinges to remain attached on one side with sliding lock or threaded knob on the other side. Any other arrangement or the cover can also be accepted depending on its user-friendliness for replacement of batteries, ruggedness and durability.

A three position toggle switch to - (i) switch power off denoted by OFF, (ii) switch RED aspect on for normal weather denoted by NORMAL WEATHER and (iii) switch

RED aspect on for foggy weather denoted by FOGGY WEATHER, in such manner that the switch becomes inaccessible after being mounted on the bracket of last vehicle. The switch shall be 'MIL' grade and able to withstand at least 20000 operation at normal current, one operation being reckoned as one make and one break. Switch shall be robust in nature to withstand jerks etc.

2.3.3 Light module shall comprise of LEDs and polycarbonate clear lense/cover. All LEDs inside the light module shall also be provided with individual lense. Polycarbonate clear lense/cover shall be surrounded by a projection protruding for few millimeters. A half round hood of about 10 to 15mm shall also be provided over polycarbonate clear lense/cover. No electronic component except LEDs shall be visible from the lense. Separate electric circuits for operation in normal weather and foggy weather should be provided. Conformal coating on PCB of LEDs as visible from outside should be of red colour.

2.3.4 Light from LED based tail lamps, when projected on a white target at 1.5 m from LED signal lighting unit, shall illuminate the target uniformly within half power points and that shall be free from dark circles.

2.3.5 The LED based tail lamps shall be provided with a curved transparent cover of UV stabilized polycarbonate material having a minimum thickness of 2.0 mm ± 0.5mm.

2.3.6 LED module of LED based tail lamps shall be hermetically sealed.

2.3.7 The LED based tail lamps shall have insulation resistance of more than 100-M ohms. The Insulation Resistance shall be measured between the body of lamp and the current carrying terminals looped together at a potential of 500 V DC.

2.3.8 LEDs used in the LED based tail lamps shall be of high performance quality and from NISCHIA/Japan or AVAGO/USA. The minimum junction temperature of a LED shall not be less than 100 deg. LEDs of other reputed makes may be agreed subject to those complying the requirements of this specification. LEDs shall be procured directly from OEM or their authorized representative.

2.3.9 Normally LEDs of the LED based tail lamps shall be driven within average drive current range recommended by the LED manufacturer and in no circumstances LEDs shall be driven by current more than the maximum current recommended by the LED manufacturer. Details of this shall be submitted at type approval stage.

2.3.9.1 Components including number of LEDs and their Part no. shall not be changed without prior approval of RDSO.

2.3.10 Reverse polarity protection shall be suitably provided. Design shall be such that it does not employ any fuse.

2.3.11 The illumination shall not be less than minimum illumination specified in the clause 2.2.1 in the operating voltage range i.e. normal battery to low battery cut off stage.

2.3.12 On each lamp, non-ferrous metallic labels or non-erasable screen printing on the body shall be provided with following details.

Serial No., Month & Year of Mfg.
Specification No. & Version No.*
Manufacturer's Name.

*In case of an alteration in the design of a unit, new version number shall be assigned.
A brief detail about information conveyed by the pilot red LED and a brief *Do's & Don'ts* shall be written using non erasable screen printing on rear of the battery cover for guidance of the user.

2.3.12.1 Switch positions as given in clause 2.3.2.2 and indications of pilot RED LED (i.e., LED Lit-Lamp OK, LED Flashing- Battery Low, Switch o & LED not lit-Lamp defective) shall be indicated at their respective positions.

2.3.12.2 All markings/indications shall be easily legible and durable. Where the marking is by use of labels, the labels shall be non-ferrous metallic and shall be firmly fixed and shall not be capable of being removed by hand. Durability of marking shall be checked by rubbing the marking by hand with a piece of cloth soaked with petroleum spirit. This requirement shall also be met after completion of climatic test.

2.3.12.3 On every lamp, manufacturer's name or trademark shall be embossed or engraved. The words Indian Railway Property shall also be engraved /embossed on every unit in letters of 5mm size (minimum) at a conspicuous place.

2.3.13 Weight:

The complete tail lamp shall be designed to weigh less than 750 grams excluding batteries.
(Note: Weight should be as less as feasible for portability without compromising ruggedness and strength to meet the service life.

2.3.14 One pilot Red LED, 3.0 mm size shall be provided to indicate that the tail lamp is in perfect fettle and is working, and shall turn on only when the toggle power switch is put on. Location should be such that it is visible from the front side of the lamp.

2.3.15 The pilot red LED provided as per Clause 2.3.14 above, shall also serve as *low battery indication*, and shall begin to flash as per no. of flashes and duty cycle specified in Cl. 2.2.1, if the battery has discharged to a level such that not less than 12 burning hours life is left.

2.3.16 The tail lamp shall be designed and constructed so that it is foolproof against vandalism/miscreants in respect of its operation by providing suitable locking arrangement once it has been fastened on the bracket of the last vehicle. The locking arrangement with bracket shall be such that only authorized person can remove the lamp from the bracket after unlocking it. The toggle switch provided shall not be accessible for operation after tail lamp has been fixed on the bracket.

2.3.17 The tail lamp shall be so designed and constructed that that change of batteries or replacement of any module is possible only when the lamp has been taken off the 'bracket' provided on the last vehicle.

2.3.18 The equipment and its mounting arrangement shall be of robust design and shall withstand satisfactorily vibrations and shocks normally encountered in service. The body shall be so designed that any angular displacement from the longitudinal axis does not exceed 0.5 degrees, when mounted on a bracket.

The unit shall normally be mounted on a steel bracket in an upright position. The unit shall however be designed to give its rated performance in any displaced position, including upside- down position.

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

3.0 ENVIRONMENT

The tail lamp is normally required to be used as an outdoor last vehicle indicator on railway passenger coaches & goods wagons operating up to 160 kmph. under all weather conditions ranging from damp coastal to hot arid climate and subject to rain, dust and vibrations that accompany such service. Environmental parameters that the proposed unit shall be designed to withstand are as follows.

3.1 Ambient temp Min 10 degrees c below freezing point
Max. 60 degrees c above freezing point

Test for above will be conducted in energized condition for 4 hours each at minus 10^0C (-3^0C, $+0^0$C) and plus 60^0C ($+3^0$C, -0^0C). During and after each of these tests, no LED shall fail & there should not be any damage in the unit or visual change in colour. Also after 1 hour of recovery period of each of these tests, deterioration in illumination, if any, shall not be more than 5% of original value subject to compliance of minimum illumination criteria as per clause 2.2.

3.1.1 Ambient temperature severities test shall be conducted with either specified cells or a separate Power Supply. During test for any ambient temperature severity, malfunction or leakage of cells shall not be considered as failure of the tail lamp. In such case, test for that ambient temperature severity shall be repeated with new cells after properly cleaning the battery compartment from inside.

4.0 TESTS:

4.1 Climatic tests**:** The LED based tail lamps shall be able to withstand following environmental tests as per IS: 9000:

SN	Name of test	Part & Section of IS:9000	Max. Recovery period

1	Change of temperature test at lower temp. –10 ± 3^0C and upper temp +70±2^0C (3 Cycles and duration of exposure 7 hrs after the stability in chamber has been reached)	Part-XIV/Section 2	2 hours
2.	Dry heat test at 70 °C ± 2°C , (1 cycle of 16 hours)	Part-III/ Section 3	2 hours
3.	Cold test at - 10°C ± 3°C, (1 cycle of 16 hours)	Part-II/Section 3	2 hours
4.	Damp heat cyclic test (Six cycles, Upper temperature 40°C ± 2°C, relative humidity at all times shall not be less than 98%)	Part-V/Section 2 Variant 1	2 hours
5.	Salt Atmosphere test (3 cycles of 22 hour, Upper temperature 35°C ± 2°C, relative humidity 93% +2%, -3%)	Part-XI/ Procedure 3	4 hours
6.	Driving rain test for four hours	Part-XVI (Test condition 'C',)	-
7.	Dust Test for the period of 2 hours.	Part-XII	2 hours
8.	Vibration test	5 to 350 Hz, Acceleration: 3g, 20 sweep cycles on 3 axes, total duration 105 min, if resonance is observed- 10 min at each resonance frequency (IS: 9001 Pt. XIII)	-

All tests shall be conducted in energized condition of the unit. During and after each of these tests, no LED shall fail & there should not be any damage in the unit or visual change in colour. Also after recovery period of each of these tests, deterioration in illumination, if any, will not be more than 5 % of original value subject to compliance of minimum illumination criteria as per clause 2.2. Insulation resistance shall not be less than 100-M.ohms. After completion of all tests, colour co-ordinates shall remain within specified values.

4.1.1 Climatic tests shall be conducted with either specified cells or a separate Power Supply. During any climatic test, malfunction or leakage of cells shall not be considered as failure of the HS lamp. In such case, that test shall be repeated with new cells after properly cleaning the battery compartment from inside.

4.2 Dispersion Angle test: This shall be measured as per Annexure III.

4.3 **Burning in test:** The LED based tail lamps shall be kept continuously ON for minimum 24 hrs. at 60 °C at rated voltage. There shall not be any difference in performance parameters before and after burning in test.

4.4 **Drop Test:** The test lamp shall withstand free drop from a height of 1.5 meters above an RCC Platform of 75 mm thickness or on a steel plate 12mm thick. For the purpose of the drop test, the units shall be powered with 4 numbers of alkaline LR-20 cells

each and units shall continue to function effectively, satisfy all parameters after ensuring two drops. Appearance of cracks on the body may not be deemed as disqualification as long as units continue to function. The units, however, shall not disintegrate.

4.5 **Life test for switch**: This test shall be performed on one sample, loaded with cells. Every switch position shall be operated for at least 20000 operations in type test and 1000 operations in acceptance test at the rate of 25 to 35 operations per minute. There should not be any problem in switch operation or its functioning.

4.6 Test for hermetic sealing of LED compartment with associated electronic circuit. Lamp without cells shall be submerged in water as per S.No.8 of Cl. 9.3 (Water Immersion test) of RDSO/SPN/144/2006 (Rev.2). Position of lamp shall be kept same as that of a mounted lamp. After completion of test, battery compartment should be wiped with a soft dry cloth to clean water ingress in battery compartment, if any, before putting cells to check electrical performance. After checking electrical performance, LED compartment shall be opened by removing hermetic sealing or any other means to check water ingress. There should not be water ingress in the compartment.

5.0 TEST PLAN

5.1 Type tests

For type test four samples shall be submitted along with two sets each of new LR-20 and R-20 cells. Burning-in test should be conducted on all the samples. Cell life requirement test will be conducted with both LR-20 and R-20 cells on one sample each. Test for hermetic sealing of LED compartment with associated electronic circuit is a destructive test and may be conducted on one sample after completion of life test with LR 20 cells. Rest tests may be conducted on two samples. All the samples subjected to type tests shall individually pass the type tests**.**

The unit shall be subjected to the following tests-

i) Visual inspection (as per clause 2.3 as feasible through visual inspection)
ii) Colour co-ordinates (as per clause 2.1)
iii) Operating Parameters (as per clause 2.2)
iv) Ambient Temperature Severities test (as per clause 3.1)
v) Climatic tests (as per clause 4.1)
vi) Visibility test (as per clause 2.2.3)
vii) Low Battery Indication Test (as per clause 2.3.14, 2.3.15)
viii) Insulation test (as per clause 2.3.7)
ix) Burning in test (as per clause 4.3)
x) Drop test (as per clause 4.4)
xii) Reverse polarity protection test (as per clause 2.3.10)
xiii) Current drain & design parameters' test (as per clause 5.1.2)
xiv) Life test for switch (as per clause 4.5)
xv) Verification of marking (as per clause 2.3.12)
xvi) Weight test (as per clause 2.3.13)

xvii) Test for hermetic sealing of LED compartment with associated electronic circuit. (as per clause 4.6)

5.1.1 Vendor shall submit make, grade and data sheet of all electronic components and switches alongwith samples for type test. Vendor shall also submit chemical composition and relevant IS or international specification of all metallic components used and housing of Tail lamp.

5.1.2 Vendor shall submit design parameters like voltages for LBI, input current, power consumption etc. along with their tolerances to achieve specified operating parameters.

5.2 **Routine Tests:**

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. Parameters measured after Burning-in test shall be recorded and enclosed with every unit:-

i) Visual inspection of each unit (as per clause 2.3 as feasible through visual inspection)
ii) Colour co-ordinates (as per clause 2.1)
iii) Performance Parameters (as per clause 2.2.1)
iv) Low Battery Indication Test (as per clause 2.3.14, 2.3.15)
v) Burning-in test (as per clause 4.3)
vi) Current drain & design parameters' test (as per clause 5.1.2)
vii) Verification of marking (as per clause 2.3.12)
viii) Weight test (as per clause 2.3.13)
ix) Visibility test (as per clause 2.2.3)

5.2.1 Test record shall be properly maintained with traceability to lot / samples tested, which may be verified by inspecting officials.

5.2.2 Manufacturer shall maintain proper accountal of LEDs, switches and all electronic components 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.

5.3 **Acceptance test:**

Acceptance test as per following would be carried out by Railway inspecting officials while carrying out normal inspection:-

(a) Verify sample plan:

Lot size	*Sample size*
Up to 20 Nos	3 Nos.
Between 21-50 Nos.	5 Nos.
Between 51 –100 Nos.	8 Nos.

Between 101-150 Nos.	12 Nos.
More than 151	15 Nos.

(b) Following shall constitute acceptance test:

i) Visual inspection (as per clause 2.3 as feasible through visual inspection)
ii) Colour coordinates (as per clause 2.1)
iii) Performance parameters (as per clause 2.2.1)
iv) Ambient temperature Severities test (as per clause 3.1)
v) Visibility test (as per clause 2.2.3)
vi) Low Battery Indication Test (as per clause 2.3.14, 2.3.15)
vii) Insulation test (as per clause 2.3.7)
viii) Burning-in test (as per clause 4.3)
ix) Drop test on one sample – performance test to ensure proper functioning after the drop test (as per clause 4.4)
(In case lamp develops cracks but passes the test, vendor shall replace the respective unit for supply.)
x) Reverse polarity protection test (as per clause 2.3.10)
xi) Current drain & design parameters' test (as per clause 5.1.12)
xii) Weight test (as per clause 2.3.13)
xiii) Life test for switch (as per clause 4.5)
xiv) Verification of marking//embossing (as per clause 2.3.12)
xv) Any other test considered necessary by the inspecting agency

6.0 SCOPE OF SUPPLY

Lamps may be procured either with 4 number of alkaline LR- 20 cells or without cells as per purchaser's requirement which should be clearly mentioned while calling offers for procurement. If lamps are procured with LR-20 cells, cells should not be older than three months from the month of manufacture at the time of supply.

7.0 DOCUMENTATION

Following details shall be supplied along with every unit-

(i) Colour co-ordinates, specified operating parameters as per the specification and minimum guaranteed values achieved by the manufacturer, technical and other particulars.
(ii) Schematic block diagram showing mounting arrangement of various modules & their details
(iii) Mechanical drawings of every part and complete unit.
(iv) Indications communicated through pilot amber LED.
(v) Any other information as deemed fit from user's point of view.

8.0 PACKING

8.1 Each lamp shall be individually wrapped in bubble sheet and packed in individual card board boxes. Cells in their original packing shall be kept separately in the box. The empty spaces shall be filled with suitable filling material. Alternatively, these may be packed in thermocol 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. Final packing cases shall not contain more than 100 lamps, each individually packed.

8.2 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 signage to indicate the correct position and precaution "Handle with Care'' with necessary instructions.

8.3 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.

9.0 WARRANTEE

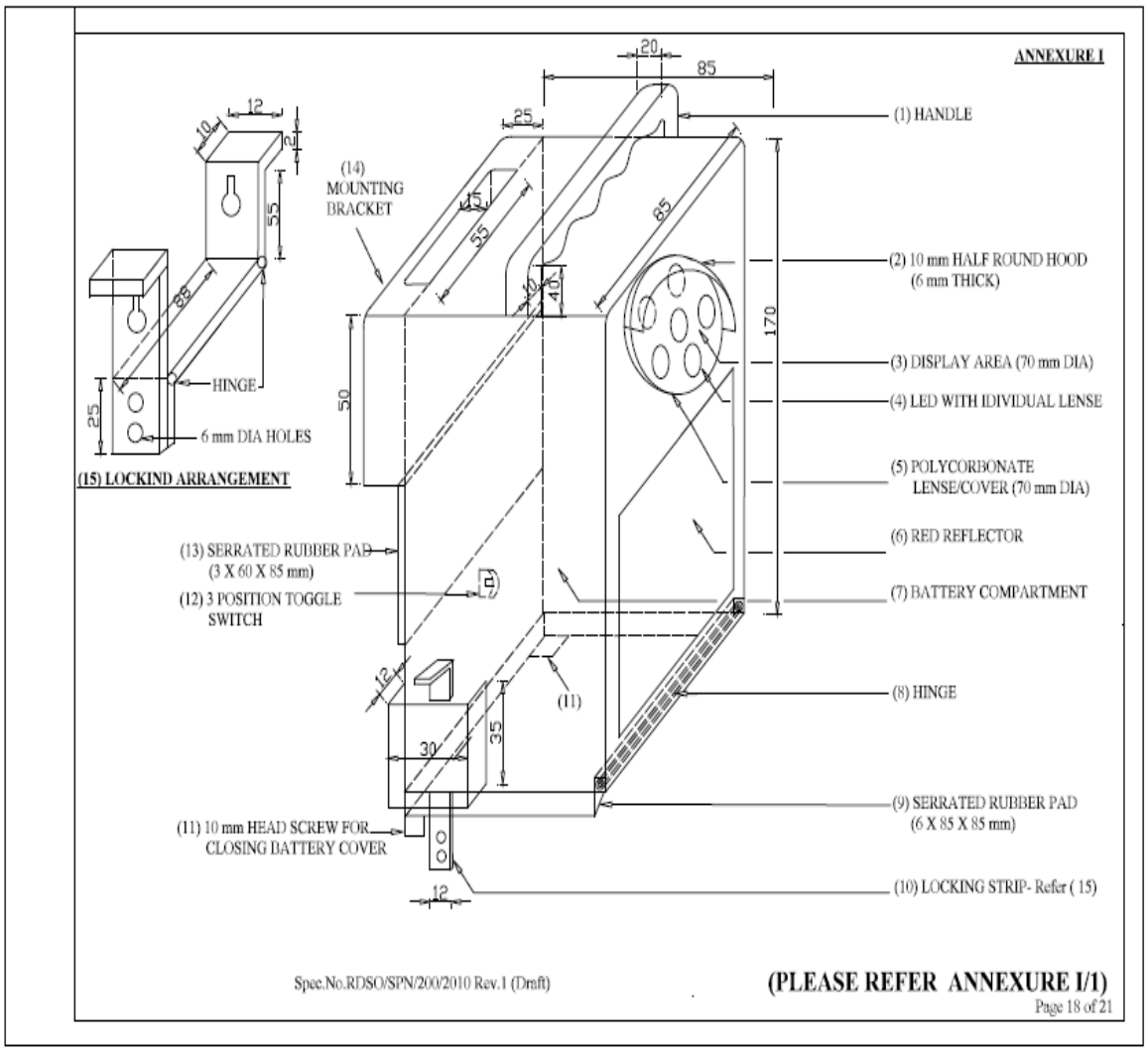
The vendor shall give a warrantee of 24 months for Tail lamp excluding cells.

10.0 INFRINGEMENT OF PATENT RIGHTS:

Indian Railway 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 Battery operated LED based flashing Tail lamp and any other factors which may cause such dispute.

------x------x----------

ANNEXURE-I


ANNEXURE I
(1) HANDLE
(2) 10 mm HALF ROUND HOOD (6 mm THICK)
(3) DISPLAY AREA (70 mm DIA)
(4) LED WITH IDIVIDUAL LENSE
(5) POLYCORBONATE LENSE/COVER (70 mm DIA)
(6) RED REFLECTOR
(7) BATTERY COMPARTMENT
(8) HINGE
(9) SERRATED RUBBER PAD (6 X 85 X 85 mm)
(10) LOCKING STRIP- Refer (15)
(11) 10 mm HEAD SCREW FOR CLOSING BATTERY COVER
(12) 3 POSITION TOGGLE SWITCH
(13) SERRATED RUBBER PAD (3 X 60 X 85 mm)
(14) MOUNTING BRACKET
(15) LOCKIND ARRANGEMENT
HINGE
6 mm DIA HOLES
Spec.No.RDSO/SPN/200/2010 Rev.1 (Draft)
(PLEASE REFER ANNEXURE I/1)
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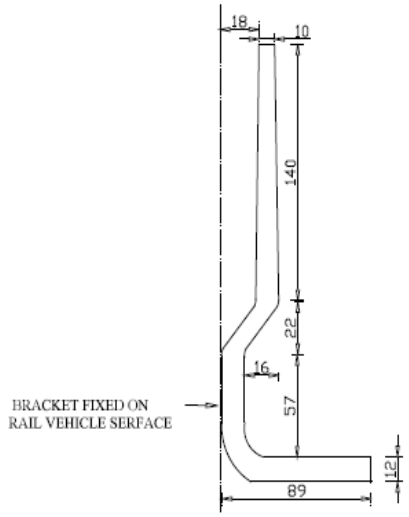
ANNEXURE-I/1

ANNEXURE I/1



TAIL LAMP BRACKET
RDSO DRG. NO. C/BF 1113

PART DRAWING NO.	DESCRIPTION	NO. REQD.
15	LOCKING ARRANGEMENT	1
14	MOUNTING BRACKET	1
13	SERRATED RUBBER PAD (3X 60 X 85)	1
12	3 POSITION TOGGLE SWITCH	1
11	10 mm HEAD SCREW FOR CLOSING BATTERY COVER	1
10	LOCKING STRIP	1
9	SERRATED RUBBER PAD (6 X 85 X 85)	1
8	HINGE	1
7	BATTERY COMPARTMENT	1
6	RED REFLECTOR	1
5	POLYCORBONATE LENSE/COVER (70 mm DIA)	1
4	LED WITH INDIVIDUAL LENSE	1
3	DISPLAY AREA (70 mm DIA)	1
2	10 mm HALF ROUND HOOD (6 mm THICK)	1
1	HANDLE	1

Note-

1. All dimension are in millimetres. Sketch is not to scale.
2. Sketch is tentative. Design may require some changes after development and evaluation of prototype sample.
3. Battery operated LED based flashing tail lamp is to be mounted on tail lamp bracket as per RDSO drawing no.C/BF1113(shown above). This bracket is fixed on rear surface of rail vehicle.
4. Metallic inserts to be reinforced in the moulding to improve strength of brackets for mounting & locking arrangement.
5. Nuts of stainless steel to be moulded in the body of tail lamp for head screws of battery compartment cover.

SPEC. & MATL.	BODY: INDUSTRIAL GRADE PLASTIC (LIKE ABS) RUBBER: INDUSTRIAL GR. LOCKING ARRANGEMENT: STAINLESS STEEL

R. D. S. O.

BATTERY OPERATED
LED BASED FLASHING TAIL LAMP

Spec.No.
RDSO/SPN/200/2010 Rev.1 (Draft)

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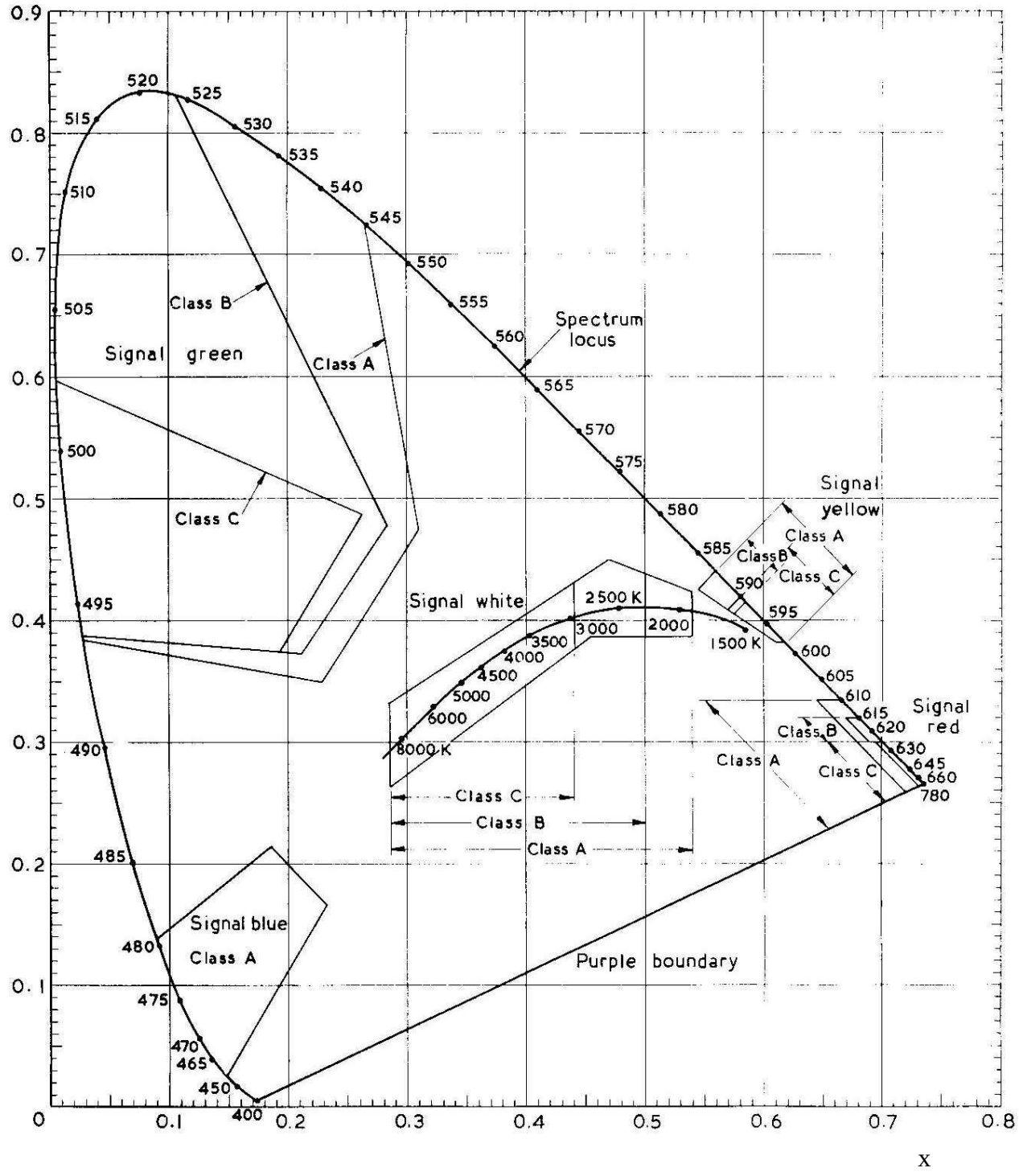
ANNEXURE-II

BS 1376 : 1974

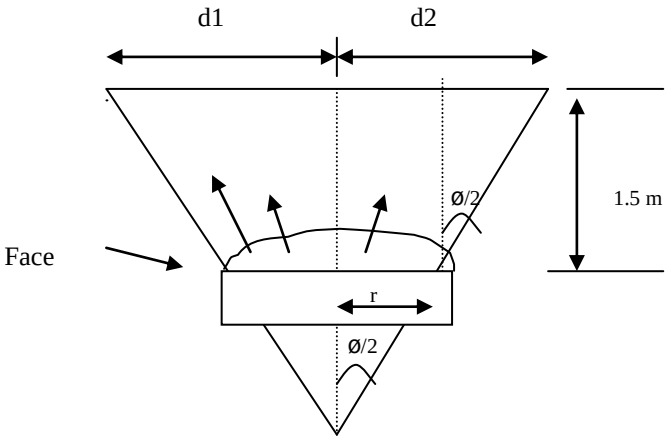


Chromaticity limits for signal colours

ANNEXURE-III

Measurement procedure for Dispersion Angle

1. Light up the lamp at the nominal voltage 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 Tail lamp in axial direction on both the sides and taking average of the distances, d_1 & d_2 in metres
   ($d = (d_1 + d_2) / 2$)
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
   $\tan^{-1} \frac{d - r}{1.5} = Ø/2$
4. 'r' is the distance from centre of the lamp to the outer most LED provided in the unit.



5. **Dispersion Angle = Ø**

-------x--------x---------