

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS



SPECIFICATION  
FOR  
LED BASED FLASHER LIGHT UNIT  
FOR  
ELECTRIC, DIESEL ELECTRIC,  
DIESEL HYDRAULIC LOCOMOTIVE,  
EMUs & DMUs.

SPECIFICATION No ELRS/SPEC/LFL/0017 (REV-1 Sep -2004)

RESEARCH DESIGNS & STANDARD ORGANISATION  
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## CHAPTER 1- GENERAL

### 1.0 OBJECTIVE & SCOPE:

- 1.0.1 The purpose of the locomotive flasher light (flasher) unit is to attract the attention of driver of approaching train and cause him to stop the train in the event of any unsafe track conditions. It is necessary that the flasher light becomes clearly visible on straight track at a distance of at least 2 Kms both during day and night.
- 1.0.2 This specification is meant for specifying technical requirements of LED based flasher light (Flasher) unit for provision on Railway rolling stock. The specification has been finalised incorporating type of LEDs to be used with their parameters, LED operating current with associated current regulators and modification of providing hood on lamp unit to improve visibility of flasher light unit. It also specifies test methods and acceptance tests to ensure consistency of quality of equipment.
- 1.0.3 This revision is done to standardise the lamp and control unit to facilitate interchangeability and ensure vendor compatibility.
- 1.0.4 This specification supercedes earlier Specification No. RDSO/PE/SPEC/Flasher light/0017 (Rev 0) on the subject.

### 1.1 DEFINITIONS:

RDSO	- Research Designs & Standards Organisation
Tenderer	- Firm/companies participating in the tender
Supplier	- The qualified tenderer for supply of the equipment
Railways	- Indian Railways Administration
CLW	- Chittaranjan Locomotive Works

### 1.2 REFERENCE TO VARIOUS SPECIFICATIONS:

- 1. IS: 616 Safety requirements for mains operated electronics.
- 2. IEC-60571(1998-02) General requirements and tests for electronic equipment used on Rail vehicles. (Second Edition)
- 3. IEC- 77 Environmental testing
- 4. IEC-61000 EMC
- 5. RDSO spec no ELRS/SPEC/SI/0015 (Latest) for "Reliability of Electronics used in Rolling stock application"

### 1.3. SUPPLIER'S RESPONSIBILITY:

The supplier's responsibility will extend to the following.

- 1.3.1 Supply of detailed instructions for installation of the equipment on the locomotive. Supplier shall also depute his representative for ensuring correct installation of first two equipments in the locomotive at each location (shed / CLW).
- 1.3.2 Supplier shall arrange Commissioning, testing & field trials of the prototype equipment in service jointly with RDSO and will depute team of engineers to Railway field units for this purpose.
- 1.3.3 The flasher light unit is required to service a life of 10 years. The supplier shall quote for spares, which may be required for satisfactory maintenance of the unit for a period of 3 years after completion of warranty period.
- 1.3.4 The supplier will be required to enter into a contract with the user railway for repair of electronic cards employed (if any) and shall indicate repair charges for the cards. The repaired card will have warranty of one year.
- 1.3.5 The design shall be developed as per requirement given in the specification. The detailed design shall be submitted to RDSO for scrutiny and approval of the design features before commencing of the manufacturing. The suppliers shall, however, be responsible for performance of complete system.
- 1.3.6 **Warranty:** The supplier shall be responsible for any damage to equipment provided in the locomotive due to defective design, materials, workmanship upto a period of 18 months after commissioning on the locomotive or 24 months from the date of supply, whichever is earlier. The supplier shall replace within one month, such equipment during the warranty period at his cost. The period of warranty will be extendable in case of recurring problems attributable to defective design, material or manufacturing. The supplier's liability in this respect of any complaints, defects and/or claim shall be limited to the furnishing and installation of replacement parts free of any charge.
- 1.3.7 The supplier shall be responsible for carrying out all the modifications at his cost on any part of the equipment during the period of warranty required for satisfactory operation of the equipment as per technical specification. For any technical decision the final authority from the purchaser's side is RDSO.
- 1.3.8 **Training:** The supplier shall arrange for training to IR personnel in maintenance and trouble shooting of the system supplied. One day training for three persons per location is to be arranged by the supplier in the field of maintenance and troubleshooting. The supplier shall furnish the syllabus and schedule of training programme to RDSO as part of design proposal. Training will be arranged free of cost. Suitable training material will be supplied to the participants.



- 1.3.9 The supplier shall supply the write up and the elaborate manual for maintenance and trouble shooting free of cost to IR for easy maintenance. Two set of manuals will be supplied each shed/shop or one set per 10 nos. of equipment supplied.

**1.4 RAILWAYS' RESPONSIBILITY:**

Railway will be responsible for following

- 1.4.1 Labour, consumables and electrical energy required for erection, testing & commissioning of the equipment
- 1.4.2 The wages and allowances as well as the cost of the passage to and from the place of training for railway personnel only
- 1.4.3 The installation of flasher light units on locomotives and connections of lamp units and flasher control units. Interconnecting cables shall be supplied by railways

**1.5 DOCUMENTATION:**

- 1.5.1 Documents to be submitted with offer: The tenderer shall submit the following information with the offer in printed form and digital format and compiled in a booklet. Offer with incomplete information may not be considered

- (a) System design. Salient features and advantages of the offered system. Schematic Circuit, Functional Description, Protection scheme. A summary sheet of important data required is placed at Annexure-B.
- (b) Man-machine interface: Details of switches, indications and fault diagnostic feature
- (c) BOM (Bill Of Material), Data sheets for components/devices and other equipment proposed for use
- (d) Mechanical interface diagram (Outline General Arrangement), assembly drawings of complete unit, mounting arrangement and weight
- (e) Clause by clause compliance
- (f) Details of technical support and training offered
- (g) Supply experience, Logistics proposed for warranty support
- (h) Recommended list of spares with cost for 3 years maintenance after warranty
- (i) List of special tools, jigs and fixtures needed for assembly, testing, commissioning, maintenance and repair
- (j) QAM (Quality Assurance Manual), QAP (Quality Assurance Plan)
- (k) Test protocol with procedure of testing
- (l) ISO 9000 certification
- (m) Details of infrastructure, manufacturing and testing activities in line with guidelines issued vide RDSO spec no. - ELRS/SPEC/SI/0015 (Latest)

- 1.5.2 The successful tenderer shall submit Following documents after award of contract

- (a) Technical documentation explaining the complete scheme characteristics, diagnostics, protection and control etc.
- (b) Detailed drawings of each system/sub-system with interface details in CAD format.
- (c) Vendor list for subsystems
- (d) Operation and Maintenance manual
- (e) Spares catalogue

**1.5.3 DOCUMENTS FOR FUTURE REFERENCE.** The tenderer shall submit 4 set of final design, BOM (Bill Of Material), mechanical drawing, approved test procedure etc. to RDSO, incorporating corrections, if any, during the design approval process. One set duly approved will be returned to the tenderer. These documents will require to be shown to the inspecting authorities/ railway representative on demand.

## **1.6 PROTOTYPE APPROVAL AND PERMISSION FOR BULK MANUFACTURING**

- 1.6.1** The successful tenderer shall submit a prototype sample for inspection/testing and approval by RDSO before undertaking the bulk manufacture. A copy of internal test results should accompany the inspection call.
- 1.6.2** The supplier shall undertake bulk manufacturing incorporating modifications/improvements as may be considered necessary in course of service trials and as directed by RDSO within the framework of the specification. In case of major change, the unit shall be type tested again.
- 1.7** Any deviations to this specification considered necessary to improve performance, reliability of the unit or for any other reason, should be furnished by tenderer with details and full particulars for consideration of purchaser. Unless such deviations are accepted in final contract, the provision of this specification will be binding on the contractor.

## **1.8 INFRINGEMENT OF PATENT RIGHTS:**

Indian Railway shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, components used in design, development and manufacturing equipment and any other factor, which may cause such dispute. The responsibility to settle any issue lies with the supplier.

## **1.9 FIELD TRIALS:**

After successful completion of type tests, the equipments shall be subjected to field service trials for a minimum period of six months. The number of trial equipments and venue shall be as agreed between the purchaser and the supplier. The installation and commissioning of the equipments for field trials shall be carried out by the supplier.



## CHAPTER 2- TECHNICAL REQUIREMENT

- 2.0 Each locomotive will be provided with two flasher units, consisting of lamp unit and flasher control unit one at each end. The flasher light unit must have the highest reliability under severe environmental conditions of operation of locomotives i.e. dust, humidity, high ambient temperature, shocks and vibrations, electrical switching surges, Electro Static Discharge variations in supply voltage etc.
- 2.1 The flasher light unit shall comprise of following
- Lamp Unit: Consisting of high intensity LED lamp assembly with its current regulator, provided in suitable water proof enclosure (IP65), window toughened front glass and hood protection against glare.
  - Flasher Control Unit: Consisting of electronic hardware for two independent circuits to drive the above LED lamp unit. It will be provided in suitable enclosure with adequate protections, ON/OFF switch, selector switch for main and standby circuit, audio visual indications and terminals.

## 2.2 TYPE OF SYSTEMS IN RAILWAYS

- 2.2.1 The supply voltage on Electric, Diesel-Electric and Diesel-Hydraulic locomotives are different. Therefore, this specification cover three types of systems

- System type E - For electric locomotives and EMUs
- System type D - For Diesel-electric locomotives and DMUs.
- System type DH - For Diesel-Hydraulic locomotives

- 2.2.2 The main difference and features of three types of systems, "E", "D" and "DH" are with regards to its enclosure and mounting arrangement, which may be seen from drawing Nos. CLW/ES/L-21-A, SKDL3626, SKDL 3627 and SKDL 3673. Power supply voltage and voltage variation for three types is given as below:

SYSTEM VOLTAGE - DC

	Type E	Type D	Type DH
Maximum	136	90	30
Nominal	110	72	24
Minimum	70	45	16

- 2.2.3 The flasher unit should work satisfactorily for the voltage range indicated in clause 2.2.2 above. However, proportionate change in the duration in "OFF" and "ON" period below the supply voltage of 70V for type E, 45V for type D and 16V for type DH will be acceptable. There should not be any damage to the equipment at voltages less than the minimum specified value for an indefinite period.

### 2.3 LAMP UNIT:

2.3.1 Flasher lamp unit shall be cluster of 120 high intensity Amber LEDs used in equally distributed cluster in rounded profile. LEDs giving min 7° view angle, arranged in series and parallel circuits to ensure average forward current and peak forward current through LED's limited to 20mA and 30 mA respectively. The manufacturer will submit design details to prove that current through LED's does not exceed the limits. The current regulation shall be better than 5% for the full working voltage range as per clause no. 2.2.2 checked at lamp terminal unit. It should work at nominal loco control voltage i.e. 110V for E type, 72V for D type and 24V for DH type locos.

2.3.2 The LEDs used in lamp unit shall be of type HLMP – ELXX-XXXX of Agilent Technologies or equivalent with following parameters at an ambient temperature of 25° C.

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
$V_f$	Forward Voltage	$I_f = 20 \text{ mA}$	1.7	2.25	2.6	V
$V_R$	Reverse voltage	$I_R = 100 \text{ }\mu\text{A}$	--	5	--	V
$I_R$	Reverse Current	$V_R = 5 \text{ V}$	--	--	100	$\mu\text{A}$
$\lambda_P$	Dominant Wavelength	$I_f = 20 \text{ mA}$	589.5	590	595	nm
	Junction Temp	-	--	130	-	°C
$I_v$	Luminous intensity	$I_f = 20 \text{ mA}$	5.5	7.2	9.3	cd
$I_f$	Forward current	--	--	20	50	mA

Each LED shall have an electrical shunt resistance across it. All the LEDs shall be configured in series parallel combinations in such a way that failure of any LED shall not affect the working of the unit. LED of each circuit will preferably be intermixed so that radiated area is not affected in case of failure of LEDs.

2.3.3 Amber yellow LED with dominant wave length of 590 to 595 nano meters shall be used. Radiating area (Where the LEDs are mounted) shall not be more than 50 sq. cm. The lux measured in axial direction shall not be less than 500 lux at 1 meter and 55 lux at 3 meters.

2.3.4 The display area (formed by the cover glass) of the lamp unit shall have a diameter of  $140 \pm 5 \text{ mm}$ . The mechanical body of the lamp unit should be water proof sealed housing of minimum 2 mm thick ABS sheet however, the hood should be made of 1.6 mm thick MS sheet.

### 2.4 CONTROL UNIT

2.4.1 The flasher control unit shall be designed such that it works with input voltage as per clause no. 2.2.2 giving regulated output for lamp unit working as follows.

Type E	Type D	Type DH
110 V DC	72V DC	24V DC

The PCBs used in flasher control unit shall be wave soldered to insure the consistency in the quality of product

2.4.2 Each control unit should have two separate PCBs for Main and Stand by circuit to ensure the reliability

2.4.3 Two LEDs (two dual colour Red/Green) indication shall be provided on control unit to indicate working of main/stand by PCB

2.4.3.1 The indication of above LEDs should be as under

Main selection Indication LED-1	Main O/P Indication LED-1	Stand by selection indication LED-2	Stand by O/P indication LED-2
Green glow	Red flashing	Green glow	Red flashing

2.4.4 A single pole main control switch shall be provided on the flasher control unit to switch "ON" or "OFF" the equipment. A double throw switch shall be provided to select main/standby circuits in the control unit. The switches shall be of standard make and their quality shall confirm to relevant BIS specification. Endurance test of 1 lacks operations should be ensured by the firm

2.4.5 The ON-OFF period of flasher unit shall be of equal period with  $40 \pm 5$  flashes per minute. This shall be maintained for full voltage range as per clause no 2.2.2

2.4.6 Facility for monitoring whether flasher light is lit or not shall be provided in the form of repeater LED indication (Red colour) and audio sound in the driver cabs on the control unit. The indication shall switch off if more than 20% of the lamp array fails.

2.5 **VISIBILITY:** The clear visibility of flasher light shall not be less than 2 kms. in clear daylight and will not be affected by sunlight glare.

## 2.6 CONSTRUCTION:

2.6.1 The LED lamp unit and flasher control unit shall be housed in two totally enclosed separate housings. The control unit shall have suitable opening for audio output



2.6.2 The lamp unit shall be housed in a suitable enclosure as per Annexure .... and the enclosure shall be to protect against ingress of water under heavy rain and storm conditions. It should conform to IP65 protection.

2.6.3 The arrangement as shown in drawing No. RDSO.SKDL 3626, SKDL-3628 and SKDL-3673 should be treated as tentative for prototype unit. After test and trials, the final dimensional drawing may be made for series production.

2.6.4 The maximum envelop size of the equipment should normally be as per table-2 and is to be fitted in the both the cabs.

Table-2

	H (mm)	W (mm)	L (mm)
Flasher Control unit	75	100	175
Lamp Hood	285	260	215
Lamp unit	210	210	130

2.6.5 The sheet steel used for the enclosures shall have thickness of at least 1.6 mm. The fabricated enclosures shall be thoroughly cleaned and given two coats of primer and two coats of paint of approved IS 5 gray shade code - 631 colour.

2.6.6 The exact profile of the lower frame of the enclosure will depend on the type of locomotive and details should be ascertained and verified by inspection of the locomotive cabs by the supplier before taking up the manufacture of enclosures.

#### 2.6.7 MARKING:

The following shall be punched on each of the unit on the anodised aluminium plate on control unit and lamp unit

1. Manufacturer's Name
2. Serial Number
3. Year of built
4. Input/output voltage & current on control unit
5. Input voltage & current on lamp unit
6. LED type/make on lamp unit

#### 2.7 GENERAL DESIGN FEATURES:

2.7.1 The flasher unit should use only solid-state devices of industrial grade.

2.7.2 All PCB should be wave soldered.

2.7.3 The electronics should be suitable for rolling stock application in heavily EMI polluted environment.

2.7.3 The unit shall be designed with switching mode operation to keep the heat sink size to minimum and avoid losses in any resistor in power circuit.

2.7.4 The wires/cables used for internal construction of the unit shall be of PTFE insulation and multi-strand copper conductors. Cables used for connecting control unit with lamp units shall be 2.5 mm<sup>2</sup> to RDSO Specification No. E-14/01 (Rev 2) 1993.

2.7.5 In view of limited space available in the locomotive, the equipment shall be design as compact as possible.

## 2.8 INTERFACING WITH OTHER EQUIPMENTS:

Flasher light shall also have provision for interfacing with others microprocessor based systems in the locomotive. Two (02) numbers volt free contact to work with as per clause no. 2.2.2 dc will be provided to communicate activation and failure of flasher light.

## 2.9 PROTECTION:

2.9.1 The flasher light unit should be so designed that it is capable to withstand the direct short circuit current at the output terminals without any damage to the equipment. The short circuit current shall be limited to a minimum possible value. The equipment shall function normal after the short circuit at output terminals is removed. The lamp and control unit will be independently checked for the protection.

2.9.2 Suitable back up fuse protection for both main/standby circuits shall be provided as protection against component failures. The fuse shall not blow with output terminals shorted.

2.9.3 The current regulator provided in lamp unit shall have over current protection. The lamp shall have built-in reverse polarity protection and input fuse protection.

2.10 The flasher unit (control unit and lamp unit) will have high efficiency, i.e. losses in circuit will be minimum and total power consumption of unit will be declared under Appendix - B and will be tested during type test.

### CHAPTER 3- CLIMATIC & ENVIRONMENTAL CONDITION

- 3.1 The Flasher light Control Unit will be fitted in locomotive cab where the temperature will be
- |                                   |           |
|-----------------------------------|-----------|
| a) Maximum temperature            |           |
| } Stabled Locomotive under sun    | 70 deg. C |
| } On board Working loco under sun | 55 deg. C |
| b) Minimum temperature            | 0 deg. C  |
| c) Average temperature            | 47 deg. C |
- 3.2 **Humidity:** Up to 100% during rainy season
- 3.3 **Altitude:** Up to 1200 m above mean sea level
- 3.4 **Rainfall:** Very heavy in certain areas. The loco equipment shall be designed suitably
- 3.5 **Environment:** Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/cm<sup>3</sup>. In many iron ore and coalmine areas, the dust concentration is very high affecting the filter and air ventilation system.
- 3.6 **Coastal area:** The equipment shall be designed to work in coastal area in humidity and salt laden and corrosive atmosphere. The maximum values of the condition will be as follows
- |                                   |                       |
|-----------------------------------|-----------------------|
| a) Maximum pH value               | 8.5                   |
| b) Sulphate                       | 7 mg per litre        |
| c) Max. concentration of chlorine | 6 mg per litre        |
| d) Maximum conductivity           | 130 micro siemens /cm |
- 3.7 **Vibration:** The equipment shall be designed to withstand the vibrations and shock encountered in service satisfactorily as specified in IEC 77 and 60571 (1998 - 02) (second edition) publication for the FLASHER LIGHT and electronic equipments respectively and relevant IECs as applicable to other equipment.
- 3.8 **Electromagnetic and Radio Frequency Interference Pollution** – High degree of electromagnetic pollution is anticipated in locomotive cab through high voltage contactor operation and RFI produced through wakie takie hand set of the driver's, where the equipment will be mounted. Necessary precaution should be taken in this regard.



## CHAPTER 4 - SCOPE OF SUPPLY

- 4.1 The scope of supply covers design, development and commissioning of complete set of Flasher light Unit for 25 kV ac locomotive as per technical requirement laid down in Chapter-2 of this specification.
- 4.1.1 One loco set of flasher light unit consist of the following items
  - a) Control unit 2 nos
  - b) Lamp unit 2 nos
  - c) Mounting Hoods (with all accessories) 2 nos
- 4.2 Detailed operation and maintenance manual and Spare Catalogue
- 4.3 Installation Drawings
- 4.4 List of spares for 3 years maintenance (Optional)
  - 4.4.1 Spares required by railways
    - a) Control unit
    - b) Lamp unit
- 4.5 Repair charges for the PCBs (Optional)
- 4.6 Testing jigs for troubleshooting at card level (Optional)

## CHAPTER 5 - INSPECTION

- 5.1 The whole of the material or fittings used in the construction of the equipment shall be subjected to inspection by the Inspecting officer and shall be to his entire satisfaction.
- 5.2 The inspecting officer shall have the power to
  - 5.2.1 Adopt any means he may consider necessary to satisfy himself that all the materials or fittings specified are actually used throughout the construction.
  - 5.2.2 Visit at any reasonable time and without previous notice either contractors works or his sub-contractor's works to inspect the manufacturers and the quality of the work at any stage.
  - 5.2.3 To reject any materials or fittings that do not conform to the relevant standard specifications or have not been manufactured in accordance with the approved practices. The rejected materials or fittings shall be marked in a distinguishable manner and shall be disposed off in such manner as the Inspecting Officer may direct to avoid its inadvertent use in the product order as per this specification.
- 5.3 Testing of equipment and fittings shall, as far as possible be carried out at the works of the manufacturers. Testing of bought out components may also be carried out at sub-contractor's premises, if so required. The contractor shall provide free of charge, such materials or fittings as may be required for testing whether at his own or his subcontractor's premises. The test for which facilities are not available may be carried out at RDSO or any other approved laboratory for which the testing charges shall be payable by the supplier.
- 5.4 The Inspecting Officer shall select all the equipments and the fittings required for test and the tests shall be carried out in his presence.
- 5.5 No material shall be packed or dispatched until the Inspecting Officer has passed it. The contractor's responsibility for its efficiency in every way shall remain the same as if the work had been manufactured and tested by him.
- 5.6 Should any part require alteration or any defect appear during the test or trial the contractor shall be without any extra charges make such alteration or rectify the defects to the satisfaction of the Inspecting Officer.
- 5.7 Copies of Maker's test certificate, guarantee the performance of the equipment shall be supplied in duplicated along with the delivery of each set of equipment.

## CHAPTER 6 -TEST

## 6.1 CATEGORIES OF TEST

6.1.1 **TYPE TEST:** Type test shall normally be carried out on equipment of the approved design. If there is any change in design or source of supply of any components/sub-components/assembly, units made to the changed design or from new source shall be treated as new item for the purpose of conducting type tests.

6.1.2 The type tests shall be repeated once in three years by RDSO. Type test will also be repeated in the following cases.

- Modification of equipment, which is likely to affect its function.
- Failure or variations established during type or routine test.
- Resumption of production after an interruption of more than two years.
- After supply of 200 units.

6.1.3 **ROUTINE TEST:** Routine test shall be carried out in every equipment of each order.

6.1.4 **ACCEPTENCE TEST:** Acceptance Test shall be carried on 10% of batch quantity subject to minimum of 5 nos. as per table given below.

6.2 Following tests will be carried out on the prototype unit as per relevant IEC specification or mutually agreed test program. Manufacturer will bear the expenses of the tests.

SL NO	TEST	CLAUSE	TYPE	ROUT-INE	Accep-tance Test
1	Visual inspection	IEC 60571.1 clause 10.2.1	✓	✓	✓
2	Tolerance & Dimension		✓	✓	✓
3	Cooling	IEC 60571 clause 10.2.3	✓		
4	Insulation Resistance	IEC 60571 clause 10.2.9	✓	✓	✓
5	DI Electric	As per clause 6.3.6 (b)	✓	✓	✓
6	Vibration and shock	IEC 60571 clause 10.2.11	✓		
7	Performance test	IEC 60571 clause 10.2.2	✓	✓	✓
8	Lux test	As per clause no. 6.9.2.2 (b)	✓	✓	✓
9	Voltage Surge	IEC 60571 clause 10.2.6.2	✓		
10	Electrostatic Discharge test	IEC 60571 clause 10.2.6.4	✓		
11	Transient burst susceptibility test	IEC 60571 clause 10.2.7	✓		
12	Radio interference test	IEC 60571 clause 10.2.8	✓		
13	Salt mist test	IEC 60571 clause 10.2.10	✓		
14	Damp heat	IEC 60571 clause 10.2.5	✓		
15	Dry heat	IEC 60571 clause 10.2.4	✓		



16.	Burn - in	As per Burn-in cycle attached as Annexure-2	✓		
17.	Water Ingress test	as per IP65 for lamp unit	✓		✓
18.	Over voltage Test	As per clause no. 6.10.2	✓		
19.	Short circuit test	As per clause no. 6.9.1.3	✓		✓
20.	Reverse polarity test	As per clause no. 6.10.3	✓	✓	✓
21.	Power consumption test	As per clause no. 6.10.4	✓		
24.	Endurance Test	As per clause 6.11	✓		✓
25.	Visibility Test	As per clause 6.8	✓		✓
26.	Measurement of luminous intensity	As per clause no. 6.9.2.2 (d)	✓		
27.	Measurement of dominant wave length	As per clause no. 6.9.2.2 (c)	✓		

The following clarifications are issued on the above tests.

### 6.3 VISUAL INSPECTION:

- 6.3.1 Check for general workmanship fitting, finish and mounting arrangement as per approved drawing of purchaser.
- 6.3.2 Check for proper water tight fitting of LED lamp unit.
- 6.3.3 Check that main components i.e. switches, transistors, capacitors and devices are as per check list supplied by the manufacturers and approved by purchaser.
- 6.3.4 Check terminals, switches, indications, type number etc. as per approved drawing.
- 6.3.5 The requirement listed in the latest reliability specification (ELRS/SPEC/SI/0015) for quality of PCB and other hard ware will be checked and confirmed clause by clause.
- 6.3.6 Check from supplier record that the unit has been subjected to "burn in" procedure and there was no failure of any component. In case there was a failure of any component, check that the card has been again subjected to "burn in" test.
- 6.3.7 **Visual inspection and Tolerance & Dimension** -The object of visual inspection is to check that the equipment is free from defects and the equipment are as per approved drawing. All the important dimensions will be measured and should be in permissible tolerance. Bill of materials will be submitted. The make, rating of equipments, subassemblies will be checked with the details as per approved design. If a change is needed in make or rating of important equipments, sub-assemblies, it should be intimated and should have approval of RDSO. Flasher light equipment with modified subassemblies will be given separate revision number.
- 6.4 **Insulation resistance** -- The insulation resistance with 500 V megger shall be more than 50 M ohms at 70 % RH for all the circuits. The period of the test should not less than 60 sec.

The following minimum requirements at the highly humid condition is to be ensured as per given below.

- 110 V circuit and earth : 20 M Ohms
- Control electronics and earth : 10 M Ohms
- Screen to earth : 10 M Ohms
- Lamp unit to earth : 10 M Ohms

## 6.5 Dielectric test

The voltage as per following table shall be applied for 1 minute between shorted connections and metallic supporting frame the test shall be considered as unsatisfactory if either a disruption discharge or flash over occur or dielectric equipment trips before 1 minute during the test.

	Type E/EU	Type D	Type DH
50 Hz, Ac rms Voltage	1500	1000	500

## 6.6 Burn in test:

The cards used on the equipment will be subjected to burn-in for 75 hours as per the temperature cycle in Annexure-2. The cards will be kept functional during the test. This will be part of internal test by manufacturer, whose results will be submitted during routine testing.

## 6.7 Documents to be submitted at the time of renewal of prototype.

- Changes in bill of material
- Changes in MCP after the test approval
- Warranty failures and compliances
- Quantity supplied to different consignee and status.

## 6.8 VISIBILITY TEST: The equipment will be checked to verify that it meets the visibility requirement laid in clause 2.5.

## 6.9 PERFORMANCE TEST:

### 6.9.1 CONTROL UNIT:

#### 6.9.1.1 The unit shall be operated for 8 (Eight) hours continuously at specified voltage. The number of "ON" and "OFF" cycle of the flasher per minute shall be recorded. The frequency rate shall not be less than $40 \pm 5$ fpm for the above said voltage variations

#### 6.9.1.2 Voltage variation test At the input voltage variation as per clause no. 2.2.2. Output voltage should be constant as per clause no. 2.4.1



**6.9.1.3 Short circuit test:** The output terminal should be shorted and the unit switched on with maximum input voltage specified in the specification. The unit shall be kept "ON" under such condition for 10 minutes. The unit shall be tested for item 6.9.1.1 & 6.9.1.2 after this test and there should not be any change in performance or any damage to the unit.

**6.9.1.4** A test shall be done to verify that when the flasher light is switched "ON" there is a clear audio visual indication in the working cab to attract the attention of the driver.

## **6.9.2 LAMP UNIT:**

Following tests to be carried out to ensure the quality of the LEDs.

**6.9.2.1** The LED current shall be as per clause 2.3.2 of the specification.

- a) **Glow Sensitivity test:** LEDs are highly sensitive to the applied voltage and will glow as soon as the voltage across the diodes exceeds the rated forward voltage of the P-N junction.
- b) **Gasket:** The rubber gasket shall be of adequate thickness, and shall not be loose in the body.
- c) **LED:** LED used in module shall have an absolute maximum forward current rating of at least 40% in excess of the rated operating current.
- d) **PIV Test:** The protection provided for peak inverse voltage across the LEDs to remain within permissible limit will be verified.

**6.9.2.2** Following test shall be done on complete lamp unit

- a) **WATER TIGHTNESS TEST** - The test shall be carried out as per IEC-60571, clause 10.2.12 as agreed between user and manufacturers, the lamp unit is to be tested for shower test to ensure water tightness of the unit.
- b) **LUX TEST-** Lux shall be measured in axial direction with the lamp unit ON at the voltage as per clause no. 2.2.2. It shall not be less than 500 lux at 1 meter & 55 lux at 3 meter under specified conditions. For conducting lux test, the frequency of flasher unit shall be  $40 \pm 5$  cycles/min. and average forward current through LEDs shall not be more than 20 mA.
- c) **MEASUREMENT OF DOMINANT WAVE LENGTH** - The dominant wavelength of LEDs shall conform to Para-2.3.3. The dominant wavelength shall lie between 590 to 595 nm.
- d) **Luminous Intensity Test:** High intensity Industrial grade LEDs shall be used for light intensity, as per clause no. 2.3.2 will be verified.



**6.10 COMPLETE UNIT TEST:**

**6.10.1 VIBRATION SHOCK AND BUMP TEST:** - The test shall be carried out as per IEC-60571, clause 10.2.11 with the equipment mounted and energised as in service.

**6.10.2 OVER VOLTAGE TEST:** 1.8 times the nominal system voltage shall be applied to the unit for two minutes and the unit shall work satisfactorily after the test.

**6.10.3 REVERSE POLRITY TEST :** The flasher light control unit and lamp unit should withstand the built-in reverse polarity protection. The equipment shall function normal after the reverse polarity at input terminals is removed

**6.10.4 POWER CONSUMPTION TEST :** Power consumption will be measured under rated condition and will not exceed the declared value as per design.

**6.10.5 DRY HEAT TEST:**

The temperature of the equipment is to be raised to 75°C at the rate of 1° c at 1.5 minute and to be kept at that temperature for 6 hours. In this test equipment should be in energised condition and check the working of the system. Cool it to the room temperature (recovery period 3 hrs) and carried out insulation test, Dielectric test at 85% voltage of the previous test and performance test.

**6.10.6 DAMP HEAT:**

Damp heat test shall be done keeping the equipment in deenergised condition. It is to be ensured that the RH of the oven should be between 80 to 100% during the above test. The temperature of the equipment is to be raised from ambient to 55°C in 2 hours and kept at that temperature for 6 hours. The temperature of the equipment 55°C should be brought down to ambient (recovery period) in 3 hours. The cycle is to be repeated at least two times and carried out insulation test, Dielectric test at 85% voltage of the previous test and performance test.

**6.10.7 COOLING:**

Bring down the temperature of the equipment to 0° ± 2 and keep it at the temperature for 2 hours and the carried out insulation test, Dielectric test at 85% voltage of the previous test and performance test after the recovery period of 3 hrs.

**6.11 ENDURANCE TEST (Only for switches): --**

The mechanical parts which need frequent operations are to be subjected to endurance test for 1,00,000 cycles of operation. At the end of the above cycles, these mechanical parts will be inspected for physical wear and tear. The contact resistance should not increase more than 10% of the initial value. The springs used, if any, should regain atleast 50% of the operational height when released at the end of the endurance test cycles of 1,00,000 operations. Finally the device will be checked for its satisfactory performance. In lieu of actual test, the supplier may furnish a certification of such a type test from the original manufacturer of the control switch..

**6.12 SURGE TEST:**

The test shall be conducted as per IEC-60571, clause 10.2.6.2. The surge pulse shall be 1.8 kV, 1.2/50 micro Sec

**6.13 TRANSIENT BURST SUSCEPTIBILITY TEST:**

This test shall be conducted as per IEC 1000 – 4 – 4 The complete system in simulated installed condition shall be put for the test as specified in IEC. The recommended test severity level is level 4 with Direct Coupling for Power Lines & with Capacitive Coupling for Communication & Signal Lines. The EFT of defined severity shall be applied on Communication line, Analog and digital input lines as follows:

Severity for Level 4		
	Power Lines	signal Lines
Repetition rate	2.5 kHz	5 kHz
Applied voltage	4 KV	2 KV
Rise time	5 ns +/- 30%	5 ns +/- 30%
Impulse duration	50 ns +/- 30%	50 ns +/- 30%
Burst duration	15 ms +/- 20%	15 ms +/- 20%
Burst Period	300 ms +/- 20%	300 ms +/- 20%
Connections / period	Direct Coupling both positive & negative side for 60 seconds each sides	Capacitive Coupling both positive & negative side for 60 seconds each sides

During test the equipment shall be watched for malfunctioning or any erratic behaviour. Data recorded in the memory of the system during test shall also be downloaded & evaluated through Evaluation Software for the performance of the system as well as Data Recording & Downloading system.

No degradation of the system & malfunctioning should be allowed during or after the test. For more details refer IEC 1000 – 4 – 4

**6.14 RADIO INTERFERENCE TEST:****6.14.1 RFI RADIATED/RADIATED SUSCEPTIBILITY:**

This test shall be conducted as per IEC 1000 – 4 – 3. The complete system in simulated installed condition shall be put in to the Radiation Chamber & desired Radiation as defined below shall be applied.

**Freq. Range:** 80 to 1000 MHz

**Field Strength:** 10V/m

**Amplitude Modulation:** 80% at 1kHz Sinusoidal

During test the equipment shall be watched for malfunctioning or any erratic behaviour. Data recorded in the memory of the system during test shall also be downloaded & evaluated through Evaluation Software for the performance of the system as well as Data Recording & Downloading system.



No degradation of the system & malfunctioning should be allowed during or after the test. For more details refer IEC 1000 – 4 – 3.

#### 6.14.2 INDUCED RF FIELD CONDUCTED/ CONDUCTED RF SUSCEPTIBILITY:

This test shall be conducted as per IEC 1000 – 4 – 6. The complete system in simulated installed condition shall be put for the test specified in IEC. The desired Radiation as defined below shall be applied on DC power in lines of Recorder cum Indicator & analog and digital input lines of equipment

**Freq. Range:** 0.15 to 80 MHz

**Amplitude:** 10V/rms

**Modulation:** 80% Amplitude Modulation

During test the equipment shall be watched for malfunctioning or any erratic behaviour. Data recorded in the memory of the system during test shall also be downloaded & evaluated through Evaluation Software for the performance of the system as well as Data Recording & Downloading system.

No degradation of the system & malfunctioning should be allowed during or after the test. For more details refer IEC 1000 – 4 – 6.

## APPENDIX "A"

### "BURN IN PROCEDURE FOR ELECTRONIC UNIT"

1. Each flasher unit containing semi-conductor devices, resistor, capacitor etc. must be "Burn In" to eliminate infant mortality in components. The components are stressed thermally by connecting to power supply bus and running at an elevated ambient of 75°C. Burn in is to be completed before final testing of the unit.
2. BURN IN PROCEDURE
  - 2.1 The unit shall be connected as per relevant circuit diagram and power supply. Due care should be taken for connection, recording serial number of card, unit, failed component if replaced.
  - 2.2 Power Supply - Based on type of equipment i.e., type "E", "D" or "DH", the voltage should be set corresponding to the rated voltage with tolerance of +10%. The supply bus must be protected by fuse. The use of fast acting fuse is recommended.
  - 2.3 Temperature - The ambient temperature inside the burn in chamber is to be 75°C ± 5%.
  - 2.4 Duration - Each card/unit is to be given a burn in for a period not less than 72 hours.
  - 2.5 Replacement of Component/Components - During panel testing or after the burn in test, if it is found necessary to replace any component, the device/component failure must be recorded. On completion of the electronic tests on such cards, the card must be treated as "New" and as such must be given a "Burn In" again and retested before releasing the unit. Proper record of failures, if any, must be kept and a certificate must be issued along with the unit giving particulars, i.e., card number, unit number, date of burn in conducted, duration, tested by, passed by, etc.

## APPENDIX "B"

### INFORMATION TO BE SUPPLIED BY THE MANUFACTURER ALONGWITH THE OFFER

1. Type/Make .....
2. Input Voltage range .....
3. LED lamp current regulation .....
4. Lux measured at 1 meter  
at 3 meters .....Lux  
.....Lux
5. Colour of light beam .....
6. Number of arrays .....
7. Number of LEDs in each array .....
8. Flasher Frequency .....Flashes/Min.  
On time .....  
Off time .....
9. Dielectric strength .....
10. Short circuit current at lamp  
terminals and unit capacity to  
withstand this fault current. ....
11. Insulation resistance .....M ohms
12. Operating temperature range .....
13. Power consumption .....
14. Voltage output of control unit .....
15. Component ratings

S.No.	Symbol as per circuit diagram	Ratings	Loading under worst conditions	Safety factor	Make and Type No



16. Circuit diagram
17. Dimensional drawing
18. Other particulars. The manufacturer may like to furnish details such as:  
Units already manufactured and supplied to impart type test, service performance  
if already in service etc.
19. Test results in case the manufacturer has already tested the unit.

Annexure-2

# BURN-IN TEST

