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No. of Pages : 12**SPECIFICATION FOR ENERGY EFFICIENT LED TUBE FOR
RETRO FITMENT IN PASSENGER COACHES.**Issued By**Integral Coach Factory, Chennai - 38**

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INTEGRAL COACH FACTORY, CHENNAI: 38	ICF/ELEC/960 Date: 04.12.17 REV.00
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0.0 FORWARD

At present, Fluorescent Tubes (FL) / Compact Fluorescent Tubes (CFL) / Incandescent lamps (IC) are being provided in the luminaires inside the passenger coaches of Indian Railways. Now that the energy efficient LEDs, which are environmental friendly, maintenance free and having very long working life are commercially available, it is planned to provide LED tubes as retro-fitment in place of FL/CFL/ Incandescent lamps in the existing light fittings in passenger coaches of Indian Railways.

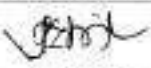

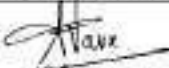
1.0 SCOPE

- 1.1 The scope includes design, development, manufacturing, testing and supply of LED tubes with minimum IP-20 protection as per IEC-60529 to be fitted in the existing holders provided for various types of Fluorescent tube (FL) / Compact Fluorescent tube (CFL) / Incandescent lamps being used as a light source in all types of Self-generating AC and NON-AC coaches, EOG LHB AC and Non-AC coaches, conventional/3 Phase EMU & DEMU and Kolkata Metro coaches of Indian Railways. The driver can be in-built with tube or separate unit design (similar to electronic ballast in existing FL/CFL fittings).
- 1.2 The following types of LED tubes are covered in this specification:

Sl. No.	Type of tube	Description of tube and usage
1	Type –A	9 W (max) (2 feet) LED tubular tubes to be used in the existing holder in place of 18 W FL in TL & AC, conventional EMU/MEMU and DEMU coaches.
2	Type –B	18 W (max) (4 feet) LED tubular tubes to be used in existing holder in place of 36 W (4 feet) FL being used in Conventional/3 phase EMU, DEMU & Kolkata Metro coaches
3	Type –C	5 W (max) tubular LED tubes to be used in the existing holder in place of 11/13 W CFL (4pin) in TL & AC coaches
4	Type –D	Since exact retro-fitment is not possible due to space limitation, suitable fitting to be developed with same OGA including mounting with 2 W LED lamp/chip. As such retro-fit fitting is envisaged and not the lamp, for this type.

- 1.3 Input to the tubes will be fed through battery bank of 110V DC in parallel with alternator, rectifier cum regulator in conventional passenger coaches and from battery charger through 750/415/110V transformer in LHB coaches. In case of conventional/3 phase EMU/MEMU, the input to the tube will be fed through 141 V AC auxiliary winding of traction transformer or auxiliary converter respectively.

The LED tube shall be suitable for operating voltage range available as input i.e. 90V to 170V AC/DC with 15% ripple content. There may be surges in input supply with peak value of approximately 350V. However, it is advisable that the firm measures the harmonic distortion and surges in the coach before designing the LED tube. The over voltage trip shall be set between 200V to 205V AC (RMS)/DC. As soon as the voltage comes below 200 V AC(RMS)/DC, the tube should switch on automatically.

		
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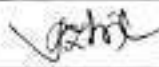


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2.0 INFRINGEMENT OF PATENT RIGHTS

Indian Railways shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of the components, used in design, development and manufacturing of these light fittings and any other factor which may cause such dispute. The responsibility to settle any issue rises with the manufacturer.

3.0 REFERRED STANDARDS: The latest following standards shall be referred to

IEC 62504	General lighting – Light emitting diode (LED) products and related equipment – Terms and definitions
IEC 62560	Self-ballasted LED tubes for general lighting services Part-1-Safety requirements
IEC 62612 / IS 16102 (Pt-2)	Self-ballasted LED tubes for general lighting services Part-2 Performance requirements
IEC 60598-1	Luminaires- General requirements and tests
IEC 62707-1	LED Binning-Part 1 General requirements and white grid
IEC 62717/IS 16103(Pt-2)	LED modules for general lighting-performance requirements
IEC 61347-2-13	Particular requirements for DC or AC supplied control gear for LED modules
IEC 62384/ IS 16104	DC or AC supplied electronic control gear for LED modules- performance requirements
IEC 62031/IS16103(Pt-1)	LED modules for general lighting – Safety specifications
IEC 61347-1	Tube control gear – General and safety requirements
IS 16107 (Part-1)	LED luminaires for general lighting purposes Part 1 safety requirements
IEC 62471/ IS 16108	Photo Biological safety of Tubes and Tube system (certificate to be produced).
IEC 60529	Classification of degree of protections provided by enclosures.
IEC 60571	Electronic equipment used on Railway vehicles.
ELRS/SPEC/S1/0015-OCT, 2001 (Rev 0)	Specification of Electronics used in Rolling Stock Application.
IEC 61373	Shock and Vibration Tests for rolling stock application
IEC 61000	Electromagnetic compatibility (EMC)
IS16106	Electrical and photometric measurement of solid state lighting (LED) products
LM-80 / IS16105	Method of measurement of lumen maintenance of solid state lighting (LED) sources
TM-21-11	Projecting long term lumen maintenance of LED light.
UIC-555	Electric lighting in passenger rolling stock.
IEC 60081	Double capped Fluorescent tubes

		
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4.0 SERVICE CONDITIONS

The LED tube with respective light fitting (IR scope item) shall be suitable for working on coaches of Indian Railways under the following environmental and operational conditions encountered during service.

4.1 Environmental conditions

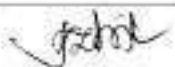

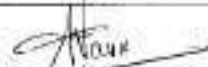
Maximum ambient air temperature	: 55° C
Minimum ambient air temperature	: -5° C
Max. Relative humidity	: 98 %
Atmosphere	: Extremely dusty and desert weather and desert terrain in certain areas. The dust contents in air may reach as high values as 1.6 mg/m ³
Coastal area	: The equipment shall be designed to work in coastal area in humid, salt laden and corrosive atmosphere.

The maximum value of the condition in the coastal area will be as follows:

Max. pH value	: 8.5
Sulphate	: 7 mg/litre
Max. concentration of chlorine	: 6 mg/ litre
Max. Conductivity	: 130 micro sec/cm
Annual rainfall	: Ranging between 1750 to 6250 mm with thunder storm
Altitudes	: Not exceeding 1200 m above sea level

4.2 Working Conditions

Train Speed(maximum)	200 km/h
Supply voltage(Nominal)	<ul style="list-style-type: none"> • 110 V AC/DC (conventional/LHB / 3-phase EMU, DEMU/ Kolkata Metro coaches) • 127V AC (Conventional EMU/MEMU coaches)
Voltage range	<ul style="list-style-type: none"> • 90 V-140 V AC/ DC(conventional/LHB/3-phase EMU, DEMU/ Kolkata Metro coaches) • 90 V-170 V AC (Conventional EMU/MEMU coaches)
Vibration and shocks	Maximum vertical acceleration 3.0 g Maximum lateral acceleration 3.0 g Maximum longitudinal acceleration 3.0 g ('g' being the value of acceleration due to gravity)
Frequency & Amplitude	Sinusoidal form of vibration, the frequency 'f' lies between 1 Hz and 100 Hz. The amplitude 'a' expressed in mm is given as a function of 'f' by the equation $a = 25 / f$ for value of 'f' between 1 Hz and 10 Hz $a = 250 / f^2$ for value of 'f' between 10 Hz and 100Hz

		
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4.3 The manufacturer shall provide "in the field service support" during guarantee period.

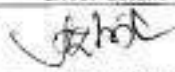

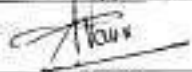
5.0 CONSTRUCTION

- a) LED array shall be used in the tube to get uniform light output throughout length of the tube without any dark/white patches. The performance requirement of the LED tube shall have uniformity level of at least 1:1.3 as per norm of IIC 555.
- b) Diffuser of sufficient strength shall be provided over the LED array to ensure glare free light and to protect the LEDs. Diffuser material used in the tube shall be fire retardant conforming to UL94-V0 grade. The fire retardant property of diffuser material shall not get affected by heat generation from Driver and LED assembly for which suitable thermal management shall be adopted. The polycarbonate material shall be with glossy finish. Proof of procurement of diffuser material from renowned/proven sources and conformity with UL 94-V0 shall be submitted at the time of prototype testing. Approving authority however reserves the right to verify this by testing in NABL accredited lab on the tube sample as per applicable test procedure.
- c) If external driver is used, the same should be minimum IP 65 protected. Also a colour band to be provided on the tube for identification with the approval of approving authority.
- d) The caps attached to the tubes shall be strong enough to withstand torsion test as specified below both initially and at the end of the life test.

Mechanical strength: The tube shall withstand torsion test carried out in accordance with IS:2418 (Part I) with the torsion moment of 1.2 Nm applied gradually.

6.0 TECHNICAL REQUIREMENTS

- 6.1 The design of the LED tube shall ensure quality, reliability and safety and for a lifetime burning hours of 40,000 hrs for which industrial grade components suitable for service conditions prescribed vide clause 4.0 shall be used.
- 6.2 LED of NICHIA/OSRAM/LUMILEDS/CREE/BROADCOM make shall be used for the purpose. The manufacturer shall submit the proof of procurement of LEDs from above OEMs at the time of testing.
- 6.3 Total harmonic distortion (THD) shall less than 10% at full load at nominal voltage.
- 6.4 The power factor of the tube shall be more than 0.9.
- 6.5 LED controller (Driver), internal to the LED tube or external, shall be EMI/EMC compliant.
- 6.6 The output voltage of the driver for 9W to 18W shall be 24V±5% DC and for less than 9W, the output voltage shall be 6/12V±5% at constant current for entire input voltage range. This aspect will be verified in case of external driver whereas in case of inbuilt driver details of driver be submitted by supplier for evaluation and approval.

		
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- 6.7** High lumen and energy efficient LEDs with the following features shall be used:
- The working life of the LED tube at LED junction temperature of 85°C shall not be less than 40,000 hours of cumulative operation and shall be suitable for continuous operation of 24 hours per day. These features shall be supported by datasheet.
 - Colour temperature of the white colour LED used in the tube shall be in the range of 5700 K-6500 K for cool day white.
 - The LEDs used shall have white point stability less than 5 step (Macadam ellipse) or as per LM80. The manufacturer shall submit the compliance from OEM.
 - The LEDs shall be LM80 certified for white LED along with TM21 projection for minimum 50,000 hours.
 - The LEDs used shall be UL certified with UL number.
 - The LED driving current shall not be more than 80% of absolute maximum forward current.
 - The LED beam/view angle (typical) shall be 120° or more.
- 6.8** Adequate heat sink with proper thermal management shall be provided.
- 6.9** The tube shall be maintenance free.
- 6.10** The design of the LED tube should be such that no white spots/dark patches are visible and the glare from individual LED is restricted and shall appear as a single source of light along with diffuser used in the luminaire as in the case for lighted globe and it shall not cause inconvenience to the passengers.
- 6.11** **Illumination Level:** The tube shall be so designed that the illumination level shall be evenly distributed and shall be free from glare. Illumination level of different types of tube shall be as given below:

Sl. No.	Type of tube	Vertical Distance (Mtrs) from the floor level (light fitting)	Vertical Distance (Mtrs) from the floor level (Lux meter)	Average Illumination Level of tube (Lux)	Colour of illumination
1.	Type -A	2.3 mts	0.84	90	Cool day white
2.	Type -B	2.3 mts	0.84	130	Cool day white
3.	Type -C	1.8 mts	0.84	90	Cool day white

Note:

- Variation in illumination level shall not reduce by more than 2% for input voltage range from 90V to 170 V AC/DC.
- The illumination shall not have infra-red and ultra-violet emission. The test certificate from the NABL approved laboratory shall be submitted.

		
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6.12 Lumen Maintenance @ 6000hrs shall be > 80% , After 40,000 burning hours of tube, the intensity of light shall be at least 70% with degree of uniformity of at least 1:1.3 as per UIC 555.

7.0 TESTS:

Tests are classified as:-

- Type test
- Acceptance test
- Routine test.

7.1 Type Test

Type tests shall be carried out to prove confirmation with the requirement of specification and general quality/design features of the unit. The results of the type tests shall be valid for a maximum period of 3 years. In case of any change in Bill of Material (BOM) or design of tube, complete type test shall be repeated.

If any sample fails in any of the type tests, two fresh samples shall be taken and tested. If any sample again fails in that test, the whole lot shall be rejected.

7.2 Acceptance Tests:

These tests are carried out by an inspecting authority at the manufacturer's premises on sample taken from a lot for the purpose of acceptance of a lot. Acceptance tests shall not be carried out from particular tube from the lot on which type tests have already been conducted. Recommended sampling plan is given below.

7.2.1 Sample size and criteria for conformity

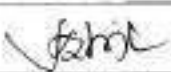

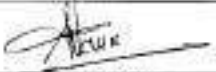
The tube shall be selected from the lot at random. In order to ensure randomness of selection, procedures given in IS 4905-1968 (Reaffirmed 2001) may be followed.

7.3 Routine Tests:

These tests shall be performed by the manufacturer on each tube of the same type and the results shall be submitted to the inspecting agency, prior to offering the lot for acceptance test.

7.4 Test Scheme:

Sl. No.	Description of test	Clause no.	Type Test	Acceptance Test	Routine Test
1.	Visual and Dimensional check	8 (i)	Y	Y	Y
2.	Insulation resistance test	8 (ii)	Y	Y	Y
3.	HV test	8 (iii)	Y	Y	-

		
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4.	Over voltage protection	8 (iv)	Y	Y	-
5.	Wattage measurement	8 (v)	Y	Y	Y
6.	Surge protection	8 (vi)	Y	-	-
7.	Reverse polarity	8 (vii)	Y	Y	Y
8.	Temperature rise Test	8 (viii)	Y	-	-
9.	Ra (Colour Rendering Index) measurement test	8 (ix)	Y	-	-
10.	Lux measurement	8 (x)	Y	Y	Y
11.	Fire retardant Test	8 (xi)	Y	-	-
12.	Vibration and Shock test	8 (xii)	Y	-	-
13.	Environmental tests	8 (xiii)	Y	-	-
14.	Life test	8 (xiv)	Y	-	-
15.	EM/EMC Test	8 (xv)	Y	-	-
16.	Endurance Test	8 (xvi)	Y	-	-
17.	Resistance to humidity	8 (xvii)	Y	-	-
18.	Safety	8 (xviii)	Y	-	-
19.	Power factor	8 (xix)	Y	-	-
20.	Total harmonics Distortion	8 (xx)	Y	-	-

Note: Test report from NABL accredited lab will be acceptable for prototype tests if facilities are not available with the manufacturer.

8.0 Method of Testing

i) Visual and Dimensional Check:

The tube shall be checked visually for dimensions as per approved design and shall be suitable for fitment in the existing luminaire.

ii) Insulation resistance test

The insulation resistance of the tube between earth and pins shorted together shall not be less than 5M Ω when measured with 500V megger before and after HV test.

iii) HV test

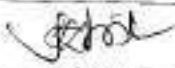
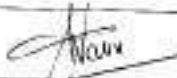
Immediately after insulation resistance test, an AC voltage of 1.72 KV rms (1500 + 2 x rated voltage) of sine wave form of 50 Hz shall be applied for one minute. There shall not be any kind of break down, flashover or tripping of supply.

iv) Over voltage protection

The Luminaire shall withstand at 250V DC/AC for two minutes.

v) Wattage measurement

The wattage of tube for respective type of LED tubes considered as maximum rated power at 110 volts DC/AC.

		
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vi) **Surge protection**

It shall withstand a surge of 2.5kV \pm 5% as per the procedure given in IEC-60571 at the input terminals.

vii) **Reverse polarity**

The tube shall withstand polarity reversal. It shall be operated with reverse voltage for 5 minutes at maximum value of voltage range. At the end of this period, the supply shall be made in correct polarity and the tube shall operate in a normal way.

viii) **Temperature rise Test:**

Temperature rise test shall be conducted at 90 V DC with full rated power. The temperature rise shall be recorded by temperature detector mounted on the body of the tube.

The tube shall also be subjected for short time rating after continuous loading to ensure the temperature rise within the permissible limit. The maximum temperature rise of the body of the tube shall not be more than 20°C.

ix) **Ra (Colour Rendering Index) measurement test**

The lumen is the unit of luminous flux, which is equal to the flux emitted in a solid angle of one Steradian by a uniform point source of one candela.

The initial reading of the chromaticity co-ordinates x & y shall be within 5 SDCM (Standards Deviation for Colour matching) from the standardised rated value as per Annexure - D of IEC 60081. The Colour Rendering Index shall be minimum 80.

The initial reading of the general colour-rendering index (Ra) shall not be less than the rated value decreased by 3.

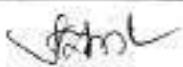
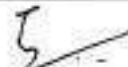
Test certificate based on relevant standards to this measurement shall be submitted

x) **Lux measurement**

Lux measurement with the help of Lux meter shall be carried out at a distance as shown in clause no. 6.11 above. Value obtained shall not be less than the Lux specified in clause no. 6.11 of the specification.

xi) **Fire retardant Test**

Fire Retardant test shall be conducted as per UL-94 V0 for the diffuser material used in the tube. The test certificate from approved NABL or Govt. labs is acceptable. Tube if tested shall be as per applicable test method on specimen.

		
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xii) Vibration and Shock Test

The tube with existing fitting from railways on loan basis or separate fixture (made by the supplier) shall be subjected to the vibration and shock testing (for Category-1, Class A) as per latest IEC 61373.

xiii) Environmental tests

- The Tube shall meet the following tests as prescribed in IEC – 60571:
 - a) Dry heat test.
 - b) Damp heat test
 - c) Test in corrosive atmosphere
 - d) Burn-in test on PCB controller card only as per RDSO specification no. ELRS/SPEC/S1/0015-OCT, 2001 (Rev.0) for 45 hours.
- In routine tests, 100% tubes shall be kept 'ON' for 48 hours at $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$, electrical parameters before and after tests shall be recorded and shall be in range before and after dry heat test. All parameters shall remain in the limit.
- In acceptance tests, 5 tubes shall be kept 'ON' for 2 hours at $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and $-10^{\circ}\text{C} \pm 3^{\circ}\text{C}$. No tubes shall fail in this test.

xiv) Life Test

- The lumen maintenance & life test shall be as per LM80/S 16105 and TM-21 respectively.
- The lumen maintenance of the tube shall not be less than 80-90% of the initial lumens after 6000 burning hours at condition of case temperature (or solder point temperature) of 105°C and ensure testing is done at minimum 80% of its absolute maximum forward current (I). The initial lumens will be taken after 100 hours aging. Certificate from OEM of LED manufacturer shall be submitted.

xv) EMI/EMC Test

EMI/EMC tests shall be conducted on tube unit as per IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4 and IEC 61000-4-6.

xvi) Endurance Test

The Tube shall be kept "ON" with input voltage of 170 V AC/DC for 200 hours. After this, the TUBE is subjected to 20,000 cycles of "ON" and "OFF", each cycle consisting of 3 seconds "ON" and 10 seconds "OFF" period. Tube should pass this test. Then, the test is to be continued beyond 20,000 cycles up to one lakh cycles, followed by performance test.

		
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xvii) Resistance to Humidity test:

This is carried out by suspending the painted panels in corrosion chamber maintained at 98% RH and temperature cycle of 42-48 deg. C. for 7 days and examining it for any sign of deterioration and corrosion of metal surface.

xviii) Safety

The LED tube shall comply with the safety requirements as per IEC 62471 for Risk Group-2. Test certificate from OEM / NABL or Govt approved labs is acceptable.

xix) Power factor

The power factor of the tube shall be more than 0.9 in working voltage range 90-170V AC.

xx) Total harmonics Distortion

Total harmonic distortion (THD) shall less than 10% at full load at nominal voltage.

9.0 MARKING:

9.1 The following information shall be distinctly and indelibly marked on the tubes for retrofitment:

- a) Indian Railways Insignia
- b) Year of manufacture/Serial Number
- c) Name of Manufacturer
- d) Rated watt and voltage
- e) Polarity on pins(if required)

10.0 ISO CERTIFICATION:

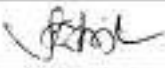


Firm shall possess the ISO certification for design, development, manufacturing and supply of the tube.

11.0 GUARANTEE

The tube shall have replacement guarantee for satisfactory performance and manufacturing defects for a period of 60 months from date of commissioning or 66 months from date of supply, whichever is earlier.

12.0 APPROVAL

12.1 While seeking approval, the firm shall submit a sample to the Vendor approving authority along with test results, circuit diagrams and dimensional drawing of the Tube. The prototype testing shall be carried out at manufacturer's work.

		
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SPECIFICATION FOR ENERGY EFFICIENT LED TUBE FOR RETROFITMENT IN PASSENGER COACHES	Page 11 of 12

12.2 The manufacturer shall also submit details like make, type, reliability grade, rating and loading of various electronic components used in the circuit. The temperature rise of the various components under the most adverse conditions shall also be declared.

12.3 Final approval for appearance in vendor directory is subject to field trials for a period of three months for performance/lumen measurement of the tube as compared to test results during prototype.

12.4 WITHDRAWAL OF APPROVAL

Approval granted to the manufacturer is liable to be withdrawn in the event of noticing any change at a later date in the design or change from the bill of material as approved earlier without seeking the prototype approving authority's approval or using components of inferior specification/quality compromising with the reliability.

13.0 SCHEDULE OF TECHNICAL REQUIREMENTS:

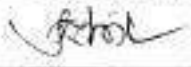

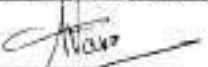
13.1 General

- a) The manufacturer shall have minimum 3 years of experience in design, manufacturing, installation and commissioning of different types of LED luminaries. In order to establish proven record for the same, it is the prerogative of approving authority to ask for certificates from customers.
- b) The supplier shall submit Quality Assurance Plan (QAP) for the LED tube.
- c) The manufacturer shall have all the requisite testing facilities for the tests mentioned above at their works. However, special tests such as IP protection, environmental, surge, vibration and shock tests etc. may be carried out in any NABL approved labs and test results shall be submitted to Vendor approving authority.

13.2 DETAILS OF ESSENTIAL INFRASTRUCTURE

- Dust free environment with ESD protection for the assembly of LEDs/PCB.
- Testing jigs for the testing of assembled LEDs/PCB.
- Component lead forming machines for through hole devices.
- Temperature controlled automatic wave-soldering machine with auto-fluxing facilities for through hole devices.
- Automatic Temperature controlled re-flow-soldering machine for surface mounted devices.
- Stencil and solder paste application machine for surface mounted devices.
- Automatic Device insertion (Pick and place) machine for surface mounted devices with in-circuit testing facility.
- Assembly facilities for LED tubes.

All the above facilities are considered essential and shall be verified by Vendor approving authority. However, the firm may outsource only LEDs/PCB assembly and

		
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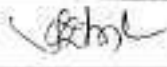

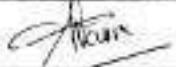
soldering with the sub-vendor at the developmental stage, which shall have the all above facilities. Railways officials may visit the premises of sub-vendor engaged by the firm for LEDs/PCB assembly. The firm shall arrange the visit to the sub-vendor's premises.

13.3 ESSENTIAL MEASURING INSTRUMENTS FOR TESTING

The following instruments with up-to-date calibration are considered essential for testing purpose: -

- Variable regulated DC supply at least up to 300 Volts.
- Heat chamber/oven having minimum range of 0-150°C with alternate arrangement of standby power supply for carrying out endurance tests.
- H.V. Tester.
- Adequate number of meters for measurement of different electrical parameters.
- Megger (500Volt)
- Measuring Gauges such as Vernier caliper, micrometers, dial gauge.
- Non-contact digital thermometer, contact less thermometer and room thermometer.
- Digital multimeter.
- Digital Weighing machine.
- Complete test bench for measuring the different parameters as mentioned in the specification.
- Milli-ohm/Micro-ohm meter
- Lux meter.
- Power analyzer
- Chromameter
- 8-channel Digital temperature scanner
- Spectrophotometer for single LED checking.
- Computerized test bench for PCB testing
- Computerised test setup for electrical parameter of Light testing
- Dark room

All the above facilities are considered essential at the developmental stage itself and shall be verified by Vendor approving authority before considering the firm as a developmental source.

		
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SPECIFICATION FOR ENERGY EFFICIENT LED TUBE FOR RETROFITMENT IN PASSENGER COACHES	Date: 19-12-2018 Page 1 of 1

CORRECTION SLIP NO-1 to ICF SPECIFICATION No. ICF/ELEC/960 REV. 00

Clause 7.2.1 shall be Read as follows

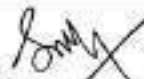
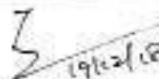

7.2.1 Sample size and criteria for conformity

7.2.1.1 The number of electronic tube to be selected from each lot, shall depend upon the size of the lot and shall be in accordance with column 1 and 2 of table given below:

TABLE SIZE SAMPLING AND ACCEPTANCE NUMBER		
LOT SIZE	ACCEPTANCE TESTS	
	SAMPLE SIZE	ACCEPTANCE NUMBER
Column 1	Column 2	Column 3
UP TO 50	8	0
51 TO 100	13	0
100 TO 300	20	1
301 TO 500	32	2
501 AND ABOVE	50	3

7.2.1.2 These tubes shall be selected from the lot at random. In order to ensure the randomness of selection, procedure given in IS: 4905-1968 (Reaffirmed 2001) may be followed.

7.2.1.3 The tube, selected according to column 1 and 2 of above table, shall be subjected to acceptance tests. A tube failing to satisfy any of these requirements shall be termed as defective. The lot shall be considered as conforming to these requirements, if the number of defectives found in the sample is less than or equal to the corresponding acceptance number in column 3 of table given above, otherwise the lot shall be rejected.

		
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INTEGRAL COACH FACTORY, CHENNAI: 38	ICF/ELEC/960 REV.00 CS-2
SPECIFICATION FOR ENERGY EFFICIENT LED TUBE FOR RETROFITMENT IN PASSENGER COACHES.	Date: 24.05.19 Page 1 of 2

CORRECTION SLIP No. – 2 to ICF SPECIFICATION No, ICF/ELEC/960 REV.00

I. Clause 1.2 Sl.No. 4 shall be read as follows

Sl. No.	Type of tube	Description of tube and usage
4	Type –D	2 W (max) LED lamp to be used in the existing holder in place of incandescent bulb in TL & AC coaches

II. Clause 6.11 Sl.No. 4 is added

Sl. No.	Type of tube	Vertical Distance (Mtrs) from the floor level (light fitting)	Vertical Distance (Mtrs) from the floor level (Lux meter)	Average Illumination Level of tube (Lux)	Colour of illumination
4	Type –D	-	0.75 m (vertical distance from bottom of the lamp)	50	Cool day white

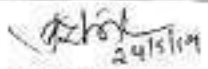

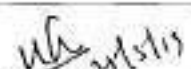
III. Clause 7.4 Sl.No. 13 shall be read as follows

Sl. No.	Description of test	Clause no.	Type Test	Acceptance Test	Routine Test
13	Environmental tests	8 (xiii)	Y	Y	Y

IV. Clause 8 Sl.No. xiii shall be read as follows

Environmental tests

- In Type tests, The Tube shall meet the following tests as prescribed in IEC – 60571:
 - a) Dry heat test.
 - b) Damp heat test
 - c) Test in corrosive atmosphere
 - d) Burn-in test on PCB controller card only as per RDSO specification no. ELRS/SPEC/S1/0015-OCT, 2001 (Rev.0) for 45 hours.
- In routine tests, 100% tubes shall be kept 'ON' for 48 hours at $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$, electrical parameters before and after tests shall be recorded and shall be in range before and after dry heat test. All parameters shall remain in the limit.
- In acceptance tests, 5 tubes shall be kept 'ON' for 2 hours at $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and $-10^{\circ}\text{C} \pm 3^{\circ}\text{C}$. No tubes shall fail in this test.

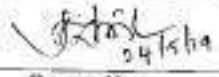
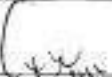
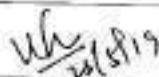
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INTEGRAL COACH FACTORY, CHENNAI: 38	ICF/ELEC/960 REV.00 CS-2
SPECIFICATION FOR ENERGY EFFICIENT LED TUBE FOR RETROFITMENT IN PASSENGER COACHES	Date: 24.05.19 Page 2 of 2

V. The general guideline for dimensions of LED tube shall be followed as per the annexures mentioned in table below:-

Sl No	Type of tube	Annexure to be followed
1	Type - A & B	ANNEXURE-1 OF ICF/ELEC-960
2	Type - C	ANNEXURE-2 OF ICF/ELEC-960
3	Type - D	ANNEXURE-3 OF ICF/ELEC-960

		
Prepared by AEE/D	Checked by DYCEE/D	Approved by CDE/ELEC

INTEGRAL COACH FACTORY, CHENNAI :38	ICF/ELEC/960 REVISION : 00 CS-03
SPECIFICATION FOR ENERGY EFFICIENT LED TUBE FOR RETROFITMENT IN PASSENGER COACHES	Date: 26-08-2019 Page 1 of 2

CORRECTION SLIP NO-03 to ICF SPECIFICATION No.ICF/ELEC/960 REV. 00

I. The following are added in clause no. 5.0

c) All types of LED lamps for retrofitment mentioned in this specification shall be manufactured with **Internal drivers** only.

f) Supply Terminals :

The supply terminal for retrofitment lamp shall be as follows.

- (i) **Type A & B** : Tube shall work on both AC & DC power supply. Supply terminals shall be provided at both ends. The two pins provided at each end shall be internally shorted. The LED tube shall work if the direction of the tube is reversed with respect to holder.
- (ii) **Type C** : Lamp shall work on both AC & DC power supply. Lamp shall fit on existing 4 pin holder and supply terminals shall be provided at end pins (i.e. first and fourth pin). It shall work even if the polarities are reversed.
- (iii) **Type D** : Lamp shall work on both AC & DC power supply. It shall be easily fitted by removing existing Edison bulb without any wiring/fitment change.

II. Clause 6.11 Note (1) shall be read as follows

“Variation in illumination level shall be $\pm 2\%$ for input voltage range from 90V to 170V AC/DC.”

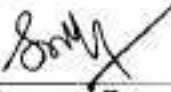
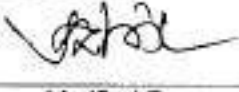
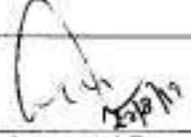
III. The following are added in Test scheme clause 7.4

Sl. No.	Description of test	Clause no.	Type Test	Acceptance Test	Routine Test
21	Supply Terminals	8(xxi)	Y	Y	Y
22	Marking	8(xxii)	Y	Y	Y

IV. The following are added in clause no. 8.0

(xxi) The arrangement of supply terminals shall be checked as per the requirement stated in clause 5.0 (f).

(xxi) The marking shall be checked as per clause 9.0. The marking information shall be distinctly and indelibly printed/engraved.

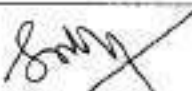
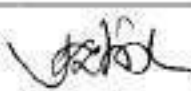
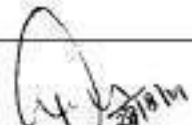
		
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INTEGRAL COACH FACTORY, CHENNAI :38	ICF/ELEC/960 REVISION : 00 CS-03
SPECIFICATION FOR ENERGY EFFICIENT LED TUBE FOR RETROFITMENT IN PASSENGER COACHES	Date: 26-08-2019 Page 2 of 2

- V. Clause no.V of Correction slip-02 for general guideline for dimensions of LED tube and drawings mentioned in this clause are deleted.
- VI. For new developments, the general guideline for dimensions of LED tube shall be followed as per the annexures mentioned in the table below and need not send dimensional drawings for approval to ICF

Sl. No.	Type of tube	Annexure to be followed
1	Type A&B	ANNEXURE-1 OF ICF/ELEC-960,CS-03
2	Type C	ANNEXURE-2 OF ICF/ELEC-960,CS-03
3	Type D	ANNEXURE-3 OF ICF/ELEC-960,CS-03

		
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TYPE-A



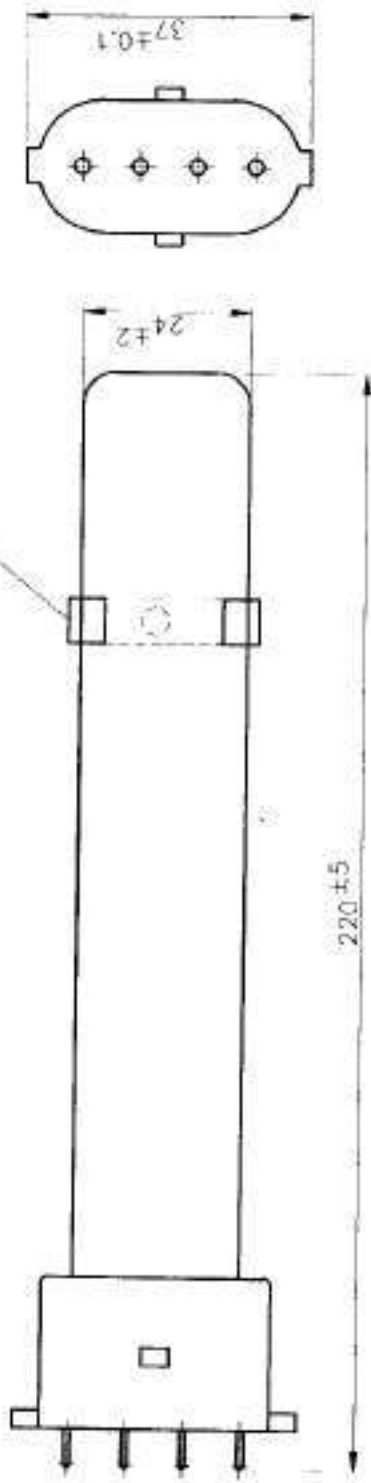
TYPE-B

NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. THIS DRAWING SHALL BE FOLLOWED AS A GENERAL GUIDELINE FOR DIMENSIONS ONLY OF LED TUBE TO BE USED IN PLACE OF FLUORESCENT LAMP.

26-08-2019	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	ANNEXURE - 1 OF ICF/ELEC-960, CS-03
DATE	SSE/D	SEE/D	DY.CEE/D	

SUITABLE SUPPORTING CLIP



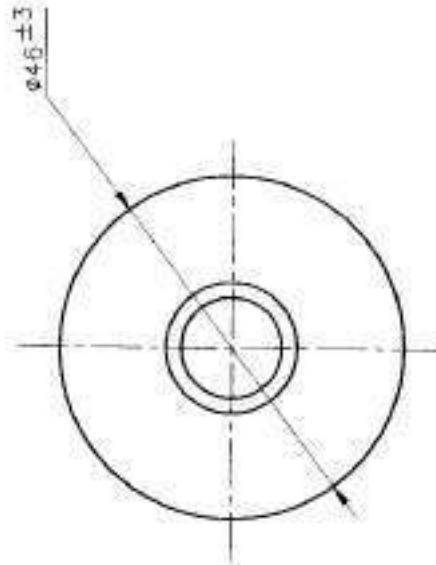
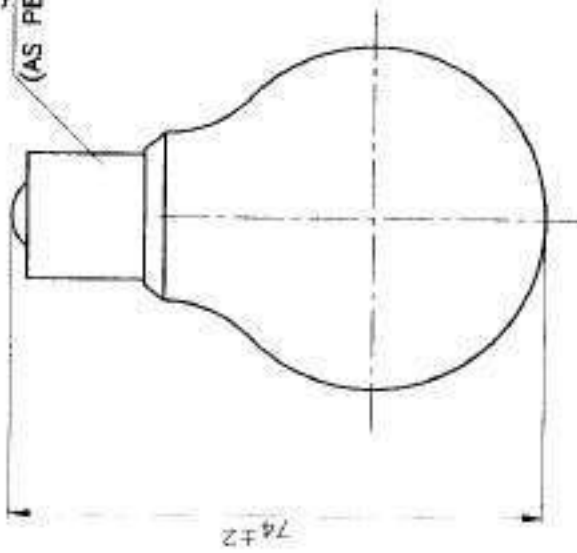
TYPE-C

NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. THIS DRAWING SHALL BE FOLLOWED AS A GENERAL GUIDELINE FOR DIMENSIONS ONLY OF LED LAMP.
3. THE LAMP CAP SHALL BE SUITABLE FOR 4PIN,2G7 TYPE HOLDER.

26-08-2019				ANNEXURE - 2 OF ICF/ELEC-960, CS-03
DATE	SSE/D	SEE/D	DY.CEE/D	

SCREW TYPE/BAYONET TYPE CAP
(AS PER THE REQUIREMENT OF USER RAILWAY)



NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. THIS DRAWING SHALL BE FOLLOWED AS A GENERAL GUIDELINE FOR DIMENSIONS ONLY OF 2W LED LAMP TO BE USED IN PLACE OF INCANDESCENT LAMP.

TYPE-D

ANNEXURE - 3 OF ICF/ELEC-960,CS-03

26-08-2019	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
DATE	SSE/D	SEE/D	DY.CEE/D