



भारत सरकार - रेल मंत्रालय
GOVERNMENT OF INDIA - MINISTRY OF RAILWAYS

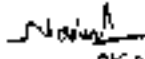
अनुसंधान अभिकल्प एवं मानक संगठन
RESEARCH DESIGNS AND STANDARDS ORGANISATION

TITLE :
SPECIFICATION FOR ENERGY EFFICIENT LED BASED LUMINAIRE
UNITS FOR PASSENGER COACHES


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SPECIFICATION No. RDSO/PE/SPEC/TL/0091-2016 (Rev "1")

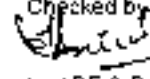
Sl.No	Date of Revision/amendment	Revision/ Amendment	No. of Pages	Remarks
1	05.07.2016	Rev.1	21	Incorporating all Amendments to Specification No. RDSO/PE/SPEC/TL/0091-2008 (Rev 0) and incorporation of light fittings for all types of Passenger coaches, including retro-fitment of LED lamps in the existing coaches.

अनुमोदित
APPROVED


05.07.16

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SPECIFICATION FOR ENERGY EFFICIENT LED BASED LUMINAIRE UNITS FOR PASSENGER COACHES

0.0 FORWARD

At present, conventional type luminaires are being provided inside the coaches of Indian Railways. With the introduction of white Light Emitting Diodes (LEDs) having the life not less than 50000 working hours, it, now, is possible to use these LED lamps in place of the existing fluorescent lamps /compact fluorescent lamps (FL/CFL) in the luminaire. These LEDs are almost maintenance free and the total saving in energy is expected to be more than 50%. Keeping in view the energy saving, the increased life of the fitting, vibration resistant features, ruggedness, no warm up period, excellent color rendering, controllable & recurring savings on account of maintenance and being environmental friendly, the use of energy efficient LED based luminaire is, now considered for provision in place of FL/CFL in the luminaire in passenger coaches of Indian Railways.

1.0 SCOPE

- 1.1 New Coaches:** The scope includes design, development, manufacturing, testing and supply of energy efficient luminaires suitable for operation on 110V AC/DC supply complete with all accessories, LED lamps compatible with suitable current control driver circuit including mounting arrangement for illumination in the all type of passenger coaches i.e. air conditioned coaches, non air conditioned (sleeper), chair car, conventional EMU/MEMU, DEMU, three phase EMU, Kolkata Metro, LHB and new coaches for all passenger trains including Rajdhani and Shatabdi Express trains as per the drawing numbers listed in Annexure-3. The luminaires shall be of rugged and robust design suitable for Railway rolling stock working on Indian Railways under the operational and environmental conditions encountered during service as specified in clause 4.0. Types of luminaire covered in this specification are shown in Table-1.

TABLE-1 (TYPE OF LUMINAIRE)

Sl.No.	Type of Luminaire	Maximum Wattage of complete Luminaire	Usage of Luminaire
General			
1.	Type -A	18 Watt	Passenger area (Cabin) for conventional AC coaches
2.	Type -B1	9 Watt	<ul style="list-style-type: none"> Corridor, Doorway & Gangway of all conventional coaches (except ICF built AC) and Non AC LHB Coaches. Passenger area (Cabin) of conventional Non-AC and LHB Non-AC coaches. Conventional Non AC Chair car (Day coach)
3.	Type -B2	9 Watt	Door way & Gangway for ICF built conventional AC coaches.
4.	Type -C	9 Watt	Cabin and corridor area of ICF built SCN coaches
5.	Type -D	9 Watt	Lavatory/Mirror
6.	Type -E	1 Watt	Night light luminaire cum berth indication for AC and non-AC coaches

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7	Type - F1	2 Watt	Berth reading light (Longitudinal) for LHB coaches
8	Type - F2	2 Watt	Berth reading light (upper berth) for LHB coaches
9	Type - F3	2 Watt	Berth reading light (transverse lower berth) RHS for LHB coaches
10	Type - F4	2 Watt	Berth reading light (transverse lower berth) LHS for LHB coaches
11	Type - F5	2 Watt	Berth reading light for Conventional coaches
12	Type - G	1 Watt	Emergency Exit Indication light
13	Type - H 1	1 Watt	Luminaire for Toilet indication for LHB AC coaches
14	Type - H2	1 Watt	Luminaire for Toilet indication for Conventional AC coaches
15	Type - I	3 Watt	Passenger alarm chain indication light
16	Type - J	9 Watt	Luminaire for SLR coaches
17	Type - K	9 Watt	Entrance doorway
For LHB AC Coaches			
18	Type - L	18 Watt	Passenger area (Cabin)
19	Type - M	9 Watt + 1 Watt	Corridor light with night light
20	Type - N	9 Watt	Doorway/ Gangway Area
For chair car/EMU/MEMU Coaches.			
21	Type - O	18 Watt	Passenger area for LHB AC coaches
22	Type - P	--	Dummy fitting for LHB AC Coaches
23	Type - Q1	2 Watt	Reading light for LHB AC chair car (2-Seater)
24	Type - Q2	2 Watt	Reading light for LHB AC chair car (3-Seater)
25	Type - R	18 Watt	LHB Non-AC chair car
26	Type - S	18 Watt	Conventional AC chair car, 3-Phase EMU
27	Type - T	18 Watt	Compartment area for MEMU coaches (DMC/TC)

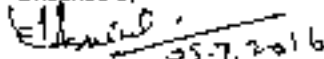
Note:

- The luminaires shall generally be in accordance with drawings mentioned in Annexure-3. Out of these, drawings for types - B2, C, E, F5, G, H2, K & S are tentative and for guidance purpose. However, the detailed drawings for these types shall be submitted by the manufacturer maintaining overall dimensions and mounting holes for approval before offering Prototype tests. For all other types the drawings mentioned in Annexure-3 are final and if any deviation is required to improve the luminaire, prior approval shall be obtained from the Vendor approving authority.
- Each type of luminaire shall be supplied with the associated driver circuit and required optics. Driver card as well as complete luminaire shall have validation by LED manufacturer for its compatibility. LED array shall be designed in MS/Aluminium enclosure (irrespective of materials given in the drawings) for thermal management and to maintain $T_j < 85^\circ\text{C}$.
- The output voltage of the driver for 9 W to 18 W luminaire shall be $24\text{V} \pm 5\%$ DC and for luminaire less than 9 W, the output voltage shall be $6/12\text{V} \pm 5\%$ at constant current for entire input voltage range.

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1.2 Retro-fitting of lamps in the existing/old coaches:

The scope includes design, development, manufacturing, testing and supply of LED lamps with inbuilt driver and with IP-65 protection as per IEC-60529 to be fitted in the existing holders provided for various types of fluorescent lamp (FL) / compact fluorescent lamp (CFL) / incandescent lamps being used as a light source in all types of Train Lighting, AC conventional EMU/MEMU, DEMU, 3 Phase EMU & DEMU and Kolkata Metro coaches of Indian Railways.

1.2.1 The following types of LED lamps to be operated in voltage range of 90V-140V AC/DC:

- 9 W tubular LED lamps to be used in the existing holder in place of 18 W FL in TL & AC coaches
- 5 W tubular LED lamps to be used in the existing holder in place of 11 W CFL in TL & AC coaches.
- 5 W LED lamp to be used in the existing bayonet cap type holder in place of 15/25 W incandescent lamp in TL & AC coaches.
- 5 W LED lamp to be used in the existing Edison screw type holder in place of 25 W incandescent lamp in TL & AC coaches.

1.2.2 The following types of LED lamps to be operated in voltage range of 90V to 170V AC:

- 9 W (2 feet length) LED tubular lamps to be used in same holder in place of 18 W (2 feet length) FL in conventional EMU/MEMU, DEMU coaches
- 18 W (4 feet length) LED tubular lamps to be used in same holder in place and 36 W (4 feet length) FL being used in 3 phase EMU, DEMU & Kolkata Metro coaches.

1.3 Input to the luminaire will be fed through battery bank of 110V DC in parallel with alternator, rectifier cum regulator in conventional coaches and from battery charger through 60/15/9KVA, 750/415/110V transformer in LHB coaches. The luminaire shall be suitable for operating voltage range available as input i.e. 90V to 140V DC with 15% ripple. There may be surges in input supply with peak value of approximately 350V. However, it is advised that the firm may measure the harmonic distortion and Surges in the Coach before designing the LED based luminaire. 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 luminaire should switch on automatically.

In case of conventional EMU/MEMU, the input to the luminaire will be fed through 141 V AC auxiliary winding of transformer (25 kV/862/266/141 V).

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

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IEC 62560	Self-ballasted LED lamps for general lighting services Part-1-Safety requirements
IEC 62612 / IS 16102 (Pt-2)	Self-ballasted LED lamps 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 62722 2-1	Luminaire performance Part-1: General requirements and Part-2 1: Particular requirements for LED luminaire
IEC 62031/IS16103(Pt-1)	LED modules for general lighting – Safety specifications
IEC 61347-1	Lamp 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 Lamps and Lamp system
IS 16107 (Part-2)	LED luminaires for general lighting Part 2 Performance requirements
IS: 513	Cold rolled low carbon steel sheets.
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 D)	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.

4.0 SERVICE CONDITIONS

Recess mounting type light unit complete with luminaire and mounting accessories shall be suitable for working on coaches of Indian Railways under the following environmental and operational conditions encountered during service.

4.1 Environmental conditions

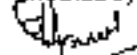
Maximum ambient air : 55° C
temperature
Minimum ambient air : -5° C
temperature
Max. Relative humidity : 98 %

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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	200 km/h
Supply voltage	<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

Track irregularities, level of shocks and vibrations to which the luminaires are exposed may be far more than actually given in IEC for on board (Ceiling) mounting arrangement. Measured data of vibration levels at critical locations of light fitting and its mounting arrangement of existing fittings, which can be used for design and in case of any doubt, the manufacturer must carry out instrumented trials on the existing stock for measurement of shocks and vibrations in consultation with the Vendor approving Authority at design stage itself. The fitting and its mounting arrangement shall be so designed that the performance is not adversely affected due to such high level of vibrations and shocks

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

5.0 CONSTRUCTION

- a) The RCF/ICF drawings of various types of luminaires mentioned in the specification are listed in Annexure 3. The performance requirement of the complete luminaire shall have uniformity level of at least 1:1.3 as per norm of IEC 555 in accordance with Annexure -1. The detailed calculation for lux level, uniformity in distribution as

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per clause no. 6.12 & 6.13 including the lux distribution curve/graph/spatial distribution shall be submitted. Deep drawn (not fabricated) housing of luminaire shall be made of 1.00 mm thick Steel sheet conforming to IS: 513 (Grade DD) unless otherwise mentioned in the respective drawings

- b) Diffuser of sufficient strength shall be provided under the LED chamber to ensure glare free light and to protect the luminaire. Diffuser material shall be Fire retardant conforming to UI 94-V0 grade made from "Lexan SP 24-492x" polycarbonate material (not less than 1.50 mm thick) of GE Plastic/Sabic make or any other equivalent make with the prior approval of Vendor approving authority. Selection of diffuser shall be such that the individual LEDs are not visible and appearance looks like a brightly lighted surface.
- c) All steel items excluding hardware shall be given surface treatment for anti-rust and anti-corrosion before finishing with powder coating. The thickness of powder coating shall not be less than 60 microns to white colour (Shade no 042 'IFB white' of M/s Berger or similar in M/s Asian / M/s Nerolac make paint) with glossy finish from inside and outside.
- d) Housing of the driver for the luminaire (if required) shall be made of Aluminium or fire retardant polycarbonate/fibre sheet having IP65 protection.
- e) Suitable number of LEDs shall be used in the luminaire. LED of NICHIA/OSRAM/SAMSUNG/LUMILEDS/CREE/AVAGO 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.
- f) Manufacturer shall be solely responsible for testing and performance of the luminaire after installation and shall also ensure the specified and uniform illumination and comfort level in the coach
- g) Suitable WAGO/Phoenix or equivalent other makes cage-clamp type connectors with the approval of Vendor approving authority shall be used between driver and LED array and between driver to input.
- h) Suitable grommets shall be provided for cable traversing.
- i) The weight of the luminaire shall be as low as feasible
- j) Total harmonic distortion (THD) shall be less than 15% for luminaires up to 4Watt and less than 10% for luminaires more than 4 Watt at full load at nominal voltage
- k) The power factor of the luminaire shall be more than 0.90 for the luminaire up to 4 Watt and more than 0.95 for the luminaire above 4Watt

5.1 High lumen and energy efficient LEDs with the following features shall be used:

- a) The working life of the lamp at junction temperature of 85°C for 350mA/ 175mA/80mA/85mA current shall not be less than 50000 hours of cumulative operation and shall be suitable for continuous operation of 24 hours per day. These features shall be supported by datasheet.
- b) Colour temperature of the white colour LED used in the luminaire shall be in the range of 6000 K-7000 K for cool day white.
- c) The output of LED (efficacy) shall not be less than 150 lumen per watt at minimal operating current and shall ensure guaranteed operation life of not less than 50000 burning hours with the controlled junction temperature of 85°C
- d) LED controller (Driver) shall be EMI/EMC compliant.

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- e) 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.
- f) The LEDs shall be LM80 certified for white LED along with TM21 projection for more than 50000 hours.
- g) The LEDs used shall be UL certified with UL number.
- h) The LED driving current shall not be more than 80% of absolute maximum forward current.
- i) The LED beam/view angle (typical) shall be 120° or more.

6.0 TECHNICAL REQUIREMENTS

6.1 The luminaire casing/housing shall be made as per the requirement in Clause 5.0(a).

6.2 The electronic components used shall be as follows. -

- a) All the electronic components used in the circuit shall be of industrial grade or above.
- b) Metallic film/Paper/Polyester Capacitor shall be rated for 105°C or above.
- d) The resistors shall be preferably made of metal film/chip resistor of adequate rating. The actual loading versus rating shall be 3.
- e) The junction temperature of the Switching devices such as transistors and MOSFETs etc. shall not exceed 125°C (allowing thermal margin of 25°C).
- g) The protective cum adhesive coating (fire retardant) used on PCBs shall be clear and transparent and shall not affect color code of electronic components or the product code of the company.
- h) The heavy components shall be properly fixed. The solder connection should be with good finish.
- i) The electronic circuits, PCB and components shall meet the requirement of RDSO Specification No. ELRS/SPEC/S1/0015-OCT, 2001 (Rev.0) for electronics used in Rolling Stock Application. The electronics covered for this equipment shall pass all the tests called for in the specification. The manufacturer shall indicate the deviation or compliance.
- j) The infrastructure for Quality Assurance facilities as called for in the specification shall be available with the manufacture for this product.

6.3 Low smoke, halogen free, fire retardant thin walled flexible a-beam/PTFE cable with multi-strand copper conductors suitable for continuous operation at 120°C shall be used inside the luminaire as connecting wires and fuse protection shall be provided at input side.

6.4 Adequate heat sink with proper thermal management shall be provided. Design should not consider heat dissipation through roof top as roof is provided with heat insulation material.

6.5 Care shall be taken in the design that there is no stagnation of water anywhere in the luminaire as well as driver. The entire housing shall be dust proof and water spray having IP-65 protection as per IEC 60529.

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- 6.6 The unit shall be maintenance free.
- 6.7 Temperature of diffuser's surface shall be lower than the fluorescent/compact fluorescent luminaire being used presently.
- 6.8 The control gear shall be designed in such a way that temperature of heat sink shall not be more than 45°C for air-conditioned coaches and 10°C above the ambient for non-air-conditioned coaches.
- 6.9 Diffusers used shall be such that the glare from individual LED is restricted and shall appear as a single source of light as in the case for lighted globe and it shall not cause inconvenience to the passengers.
- 6.10 The illumination of the luminaire provided in the coach shall not have multiple shadows under one Luminaire
- 6.11 All the material used in the luminaire shall be halogen free and fire retardant conforming to UL94-V0.
- 6.12 **Illumination Level:** The fitting shall be so designed that the illumination level shall be evenly distributed and shall be free from glare. Illumination level of different types of luminaire shall be as given below:

Sl. No.	Type of Luminaire	Vertical Distance (Mtrs) from the floor level	Average Illumination Level (Lux)	Colour of illumination
1	Type -A	0.84	120	Cool day white
2	Type -B1 & B2	0.84	80	Cool day white
3	Type -C	0.84	80	Cool day white
4	Type -D	0.50	100	Cool day white
5	Type -E	10.0*	Clear visible	Blue
6	Type - F1/F2/F3/F4/F5	0.75	100	Cool day white
7	Type -G	10.0*	Clear visible	Cool day white
8	Type -H1/H2	10.0*	Clear visible	Green - Vacant Red - Occupied
9	Type -I	400*	Clear visible	Red
10	Type -J	0.84	80	Cool day white
11	Type -K	0.84	80	Cool day white
12	Type -L	0.84	120	Cool day white
13	Type -M	0.84	80	Cool day white
14	Type -N	0.84	80	Cool day white
15	Type -O	0.84	120	Cool day white
16	Type -P			
17	Type -Q1/Q2	1.20	100	Cool day white
18	Type -R	0.84	120	Cool day white
19	Type -S	0.84	120	Cool day white
20	Type -T	0.84	120	Cool day white

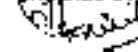
* Horizontal distances

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Note:

1. Variation in illumination level shall be $\pm 2\%$ for input voltage range from 90V to 140 V AC/DC (for TL&AC coaches, 3 phase EMU, DEMU & Kolkata Metro coaches) and 90 V AC to 170 V AC (For Conventional EMU / MEMU coaches).
2. The illumination shall not have infra-red and ultra-violet emission. The test certificate from the NABL approved laboratory shall be submitted

- 6.13** After 50,000 burning hours, the luminaire intensity shall be at least 70% with degree of uniformity of at least 1.1.3 as per UIC 555. Data sheet showing year wise deterioration in the LED shall also be submitted along with design.
- 6.14** Detailed design shall be furnished before manufacturing of prototype. However, information as per Annexure-2 shall be submitted by the manufacturers along with in-house test results while offering for witnessing the prototype testing at firm's premises.

7.0 TESTS:

Tests are classified as:-

- Prototype test
- Type test
- Acceptance test
- Routine test.

7.1 Prototype Test

Prototype test is conducted on the first unit developed by the firm as per the relevant specification.

7.2 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 unit, 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

7.3 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 luminaire from the lot on which type tests have already been conducted. Recommended sampling plan is given below.

7.3.1 Sample size and criteria for conformity

The luminaire 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.

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7.4 Routine Tests:

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

7.5 Test Scheme:

Sl. No.	Description of test	Clause no.	Prototype Test	Type Test	Acceptance Test	Routine Test
1.	Visual and Dimensional check	8 (i)	Y	Y	Y	Y
2.	Checking of Purchase documents of LED	8 (ii)	Y	Y	Y	Y
3.	Resistance to humidity	8 (iii)	Y	Y	-	-
4.	Insulation resistance test	8 (iv)	Y	Y	Y	Y
5.	HV test	8 (v)	Y	Y	Y	Y
6.	Over voltage protection	8 (vi)	Y	Y	Y	Y
7.	Wattage measurement	8 (vii)	Y	Y	Y	-
8.	Short circuit protection	8 (viii)	Y	Y	-	-
9.	Surge protection	8 (ix)	Y	Y	-	-
10.	Reverse polarity	8 (x)	Y	Y	Y	Y
11.	Temperature rise Test	8 (xi)	Y	Y	-	-
12.	Ra (Colour Rendering Index) measurement test	8 (xii)	Y	Y	Y	Y
13.	Lux measurement	8 (xiii)	Y	Y	Y	Y
14.	Fire retardant Test	8 (xiv)	Y	Y	-	-
15.	Test for IP65 protection	8 (xv)	Y	Y	-	-
16.	Vibration and Shock test	8 (xvi)	Y	-	-	-
17.	Environmental tests	8 (xvii)	Y	-	-	-
18.	Life test	8 (xviii)	Y	-	-	-
19.	EMI/EMC Test	8 (xix)	Y	-	-	-
20.	Endurance Test	8 (xx)	Y	Y	-	-
21.	Safety	8 (xxi)	Y	-	-	-

8.0 Method of Testing

i) Visual and Dimensional Check:

The unit shall be checked visually for all dimensions as per approved design and drawing. General workmanship should be good; all the components properly secured and sharp edges shall be rounded off. Check the marking and quality of the workmanship visually. Check the rating and make of electronic/electrical items. Documents shall also be verified as mentioned in the specification.

ii) Checking of Purchase documents of LED

Document of purchase of LED lamps from the approved sources viz. NICHIA/OSRAM/SAMSUNG/LUMILEDS/CREE/AVAGO with bill of entry and certificate of conformance from manufacturer along with validation of driver controller card and luminaire by the manufacturer of the LEDs to ascertain the life of the LEDs shall be checked.

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iii) 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 to 48°C for 7 days and examining it for any sign of deterioration and corrosion of metal surface.

iv) Insulation resistance test

The insulation resistance of the unit between earth and current carrying parts shorted together shall not be less than 100MΩ at 60% RH when measured with 500V megger before and after HV test.

v) 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 between the live parts and frame. There shall not be any kind of break down, flashover or tripping of supply.

vi) Over voltage protection

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

vii) Wattage measurement

The wattage of luminaire shall be measured at 90V, 110V and at 140V DC. In case of luminaire for conventional EMU/MEMU, DEMU, it shall be measured at 90V, 110V, 140 V and 170V AC

viii) Short circuit protection

The luminaire shall withstand Short circuit protection. The luminaire shall work normal after re-setting

ix) Surge protection

It shall withstand a surge of 3kV +5% as per the procedure given in IEC-60571 at the input terminals for all types of luminaire.

x) Reverse polarity

The Luminaire 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 Luminaire shall operate in a normal way.

xi) Temperature rise Test:

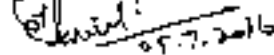
Temperature rise Test shall be conducted at 90 V DC with full load. The temperature rise shall be recorded by temperature detectors mounted at the specified reference points on the body of semiconductors, capacitors and other components as agreed between purchaser and manufacturer. The maximum-recorded temperature under worst conditions shall be corrected to 55°C and compared with maximum permissible

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temperature (for power devices at junction) The thermal margin available shall be compared with the safety margin declared by the manufacturer. Under loading conditions as specified above, the corrected temperature of the power devices shall have a safety margin of minimum 10°C .

Temperature at junction shall not exceed 125°C when corrected to 55°C . The Luminaire 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 electronic devices on the PCBs shall not be more than 20°C .

xiii) 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.

Certificate based on relevant standards to this measurement shall be obtained from the OEM.

xiii) Lux measurement

Lux measurement with the help of Lux meter shall be carried out at a distance as shown in clause no. 6.12 above. Value obtained shall not be less than the Lux specified in clause no. 6.12 of the specification.

xiv) Fire retardant Test

Fire Retardant test shall be conducted as per UL-94 V0 for the insulating material used in the luminaire.

xv) Test for IP protection

This test shall be conducted as per IEC 60529 except berth reading light.

xvi) Vibration and Shock Test

The complete unit cubicle together with its mounting arrangements (including shock-absorbing devices, if provided) shall be subjected to the vibration and shock testing (for Category-1, Class A) as per latest IEC 61373.

xvii) Environmental tests

- The Luminaire shall meet the following tests as prescribed in IEC – 60571:

- a) Dry heat test.
- b) Damp heat test
- c) Test in corrosive atmosphere

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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% luminaires 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 luminaires 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 luminaires shall fail in this test.

xviii) Life Test

- The lumen maintenance & life test shall be as per LM80/IS 16105 and TM-21 respectively.
- The lumen maintenance of the lamp shall not be less than 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.

xix) EMI/EMC Test

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

xx) Endurance Test

The Luminaire shall be kept "ON" with input voltage of 140 V DC (for luminaires for voltage range of 90-140 V DC/AC) and at 170 V AC (for luminaires for voltage range of 90-170 V AC) for 200 hours. After this, the Luminaire is subjected to 20,000 cycles of "ON" and "OFF", each cycle consisting of 3 seconds "ON" and 10 seconds "OFF" period. Luminaire should pass this test. Then, the test is to be continued beyond 20,000 cycles up to one lakh cycles, followed by performance test.

xxi) Safety:

The complete Luminaire unit, LED and driver shall comply with the safety requirements as per IEC mentioned in clause no. 3.0 above

9.0 MARKING:

9.1 The following information shall be distinctly and indelibly marked on the housing:

- Indian Railways Insignia
- Year of manufacture/Serial Number (MMYY/ABCD)
- Name of Manufacturer
- Rated watt and voltage (Input)
- Rated watt - Output

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9.2 The make, month and year of manufacture shall also be marked on driver and LED panel.

9.3 The following information shall be distinctly and indelibly marked on the lamps for retro filament:

- a) Indian Railways Insignia
- b) Year of manufacture/Serial Number
- c) Name of Manufacturer
- d) Rated watt and voltage

10.0 ISO CERTIFICATION:

Firm shall possess the ISO certification for design, development, manufacturing and supply of the complete Lighting Unit.

11.0 GUARANTEE

The complete Luminaire shall have replacement guarantee for satisfactory performance and manufacturing defects for a period of 60 months from the date of commissioning or 72 months from the 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 Luminaire. The prototype testing shall be carried out at manufacturer's work.

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 luminaire as compared to test results during prototype.


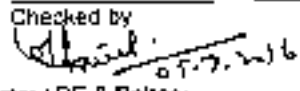
12.4 WITHDRAWAL OF APPROVAL

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 three years' experience in design, manufacturing, installation and commissioning of different types of LED based luminaire

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- b) The manufacturer should have technical collaboration/MoU with the LED manufacturer for supply of LEDs and know-how for adequate thermal management to ensure minimum guaranteed performance as given in the specification, the selection procedure for selecting right type of LEDs for such application.
- c) The MoU should also indicate the Quality Assurance Plan (QAP) for handling, storage and life cycle test of the LED proposed to be used.
- d) 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.

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 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.


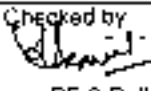
13.3 MOCK UP Facilities for uniformity and lux level

Actual of the coach compartment/cabin (similar to at least two cabins of 3-tier AC coach) and lavatory etc shall be arranged by the manufacturer for measurement of lux level and uniformity level. Achievement shall be submitted along with the test data of prototype sample being offered for witnessing the prototype tests.

13.4 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.

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- 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.
- Storage type Oscilloscope.
- Power analyzer
- Chroma meter
- 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
- Centre lathe, CNC milling machine, hydraulic press etc for manufacturing of luminaires (Optional)
- Dark room
- Powder coating plant (Optional)

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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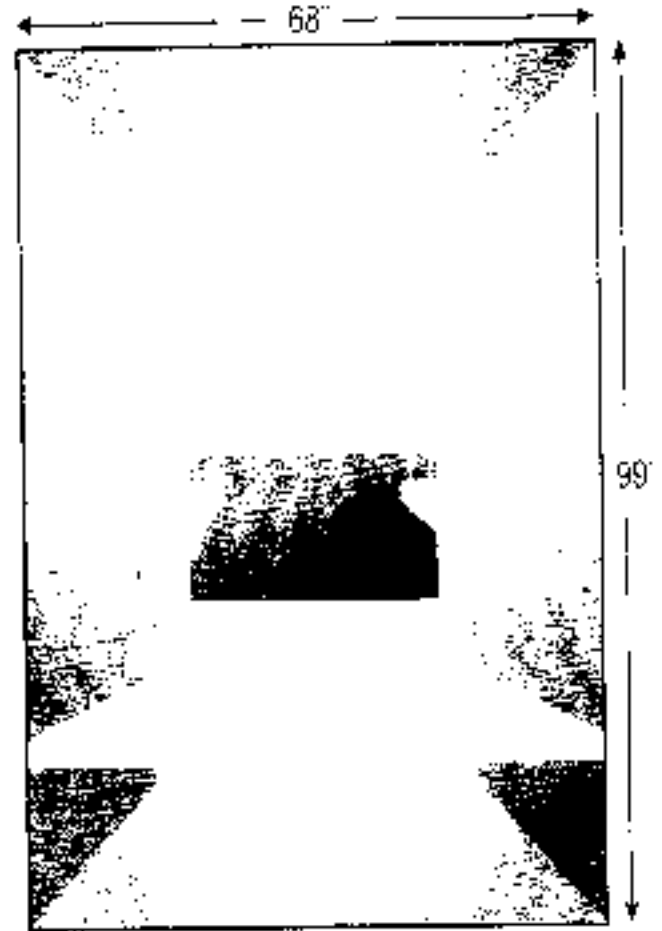
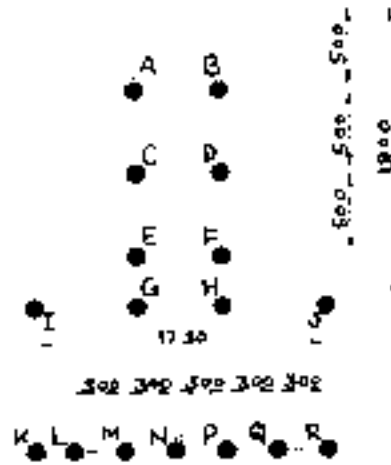

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Annexure -1

GENERAL LAYOUT OF COUPE (ACCN)



Measurement location	Lux measurement			
	Ground Level	Lower berth	Middle berth	Upper berth
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
P				
Q				
R				
Linearity				
Uniformity				

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Annexure-2

**LUMINAIRE WISE DATA TO BE FURNISHED BY THE MANUFACTURER
WHILE OFFERING FOR WITNESSING THE PROTOTYPE TESTS**

ILLUMINATION CHARACTERISTICS: $T_j = \dots^\circ\text{C}$, $I_f = \dots\text{mA}$

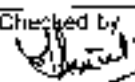
Sl No.	Parameter	Absolute Values		
		Min.	Typical	Max
1	Luminous Flux (lm) (Rank ---)			
2	Storage Temperature ($^\circ\text{C}$)			
3	Viewing Angle (Degree)			
4	Luminous Efficiency(lm/w)			
5	Dominant Wavelength (nm)			
6	Color temperature (K) (Rank ---)			
7	Forward Voltage(v) Rank (Rank ---)			
8	Colour Rendering Index (Rank ---)			
9	CIE Coordinates (Rank ---)			

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Annexure-3

Details of LED Light Fittings of LHB, Conventional & MEMU/EMU coaches

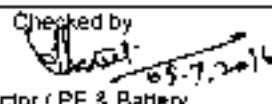
Sr. No.	Description	Type of fitting	Drawing No.	
			PU	NO.
1	LED Light Fitting for Passenger Area (Cabin) of conventional AC coaches	Type-A (18 W)	RCF	CC76452
2	LED Light Fitting for Corridor, Doorway & Gangway for all conventional Coaches (except ICF built AC Coaches) and Non AC LHB Coaches. Passenger area (Cabin) for conventional & LHB Non AC Coaches and Conventional Non AC Chair Car (Day Coach)	Type-B 1 (9 W)	RCF	CC76453
3	LED Light Fitting for Doorway & Gangway for ICF built conventional AC Coaches	Type-B 2 (9 W)	ICF	ICF/STD-7-6-050
4	LED light fitting for Cabin & Corridor Area of ICF Built SCN coaches	Type-C (9 W)	ICF	ICF/STD-7-6-046
5	LED Light Fitting for Lavatory/Mirror	Type-D (9 W)	RCF	LW76092
6	LED Light Fitting for Night Light with Berth Indication for AC & Non AC Coaches	Type-E (1 W)	ICF	ICF/STD-7-6-053 (2 Sheets)
7	LED Light Fitting for Berth Reading Light (Longitudinal) for LHB coaches	Type-F1 (2 W)	RCF	LW76093
8	LED Light Fitting for Berth Reading Light Upper Berth for LHB coaches.	Type-F2 (2 W)	RCF	LW76094
9	LED Light Fitting for Berth Reading Light Transverse Lower Berth RHS for LHB coaches.	Type-F3 (2 W)	RCF	LW76095
10	LED Light Fitting for Berth Reading Light Transverse Lower Berth LHS for LHB coaches.	Type-F4 (2 W)	RCF	LW76096
11	LED Light Fitting for Berth Reading Light for conventional AC coaches	Type-F-5 (2W)	ICF	ICF/STD-7-6-051
12	LED Light Fitting for Emergency Exit indication.	Type-G (1 W)	ICF	ICF/STD-7-6-049
13	LED Light Fitting for Toilet Indication in LHB AC Coaches	Type-H 1 (1 W)	RCF	LW76097
14	LED Light Fitting for Toilet Indication in Conventional AC Coaches	Type-H 2 (1 W)	ICF	ICF/STD-7-6-052
15	LED Light Fitting for Passenger Alarm Chain Indication	Type-I (3 W)	RCF	LW76098
16	LED Light Fitting for SLR Coaches	Type-J (9 W)	RCF	CC76457
17	LED Light Fitting for Entrance Doorway	Type-K (9 W)		ICF/STD-7-6-048
18	LED Light Fitting for Passenger area (Cabin) for LHB AC Coaches	Type-L (18 W)	RCF	LW76090
19	LED Light Fitting with Night light (Corridor Area) for LHB AC Coaches	Type-M (9W + 1W)	RCF	LW76091
20	LED Light Fitting for Doorway/Gangway area for LHB AC Coaches	Type-N (9 W)	RCF	LW76099
21	LED Light Fitting for LHB type AC Chair Car	Type-O (18 W)	RCF	LW76100
22	Dummy Fitting for LHB type AC Chair Car	Type-P	RCF	LW76101
23	LED Light Fitting for Reading Light for LHB AC Chair Car (2 seater)	Type-Q1 (2 W)	RCF	LW76102

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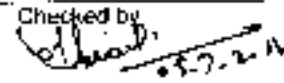
24	LED Light Fitting for Reading Light for LHB AC Chair Car (3 seater)	Type-Q2 (2 W)	RCF	LW76103
25	LED Light Fitting for LHB Non-AC Chair Car	Type-R (18 W)	RCF	LW76104 (3 Sheets)
26	LED Light Fitting for Conv. AC Chair Car, EMU & DEMU coaches	Type-S (18 W)	ICF	ICF/STD-7-6-047
27	LED Light Fitting for MEMU coaches (DMC/TC)	Type T (18 W)	RCF	CC76460 (9 sheets)
PART DRAWING				
28	Diffuser for LHB type Coaches		RCF	LW76105
29	Frame for LED light fitting for LHB type AC chair Car		RCF	LW76106
30	LED Module box with diffuser		RCF	LW76107
31	Diffuser for LED light fitting for LHB Non AC Chair Car		RCF	LW76108
32	Details for berth reading lights		RCF	LW76109
33	Front Cover		RCF	LW76110
34	Front cover		RCF	LW76111
35	Front cover for Transverse Lower Berth (RHS)		RCF	LW76112
36	Front cover for Transverse Lower Berth (LHS)		RCF	LW76113
37	FRP bracket Assembly		RCF	LW76114

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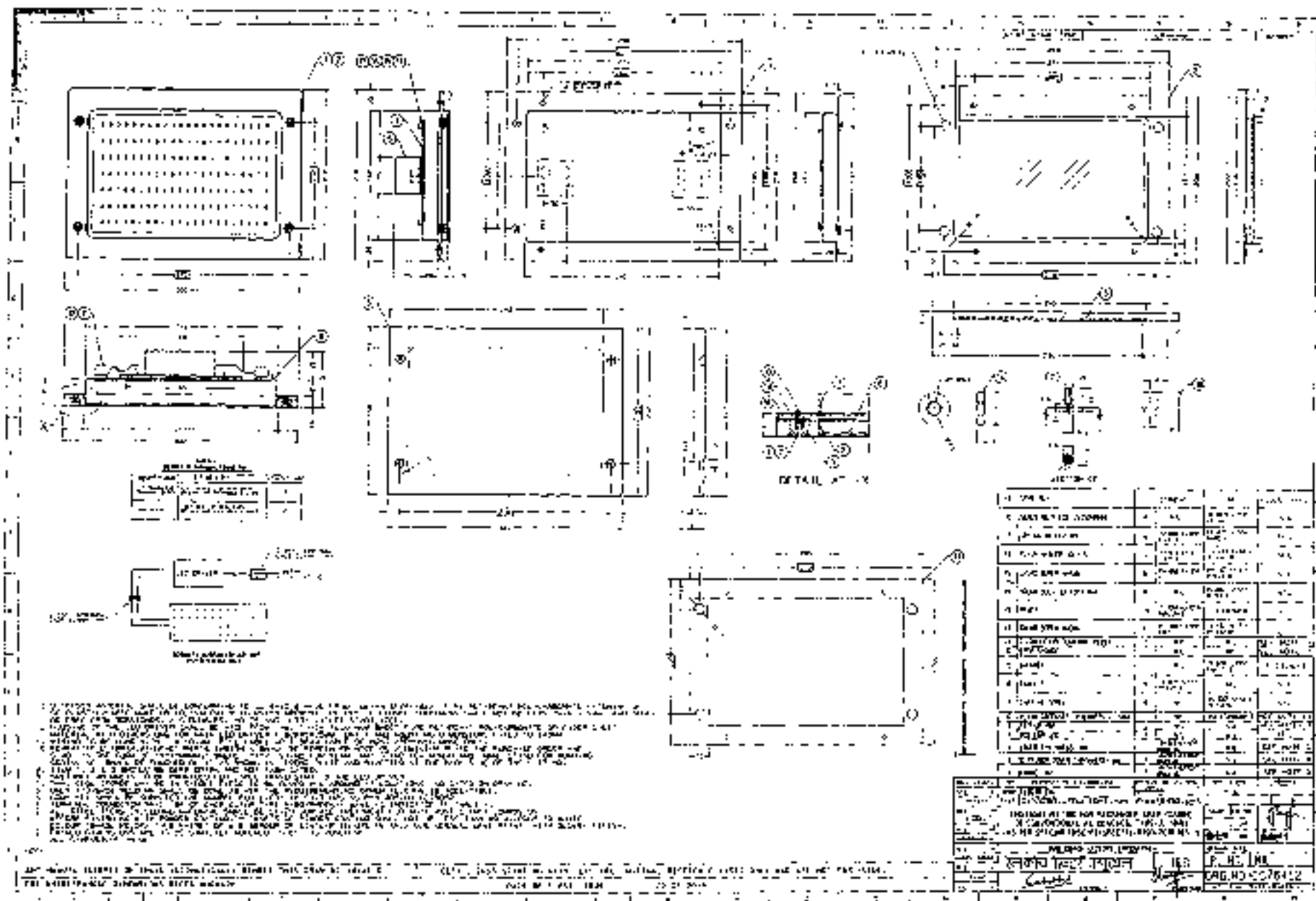


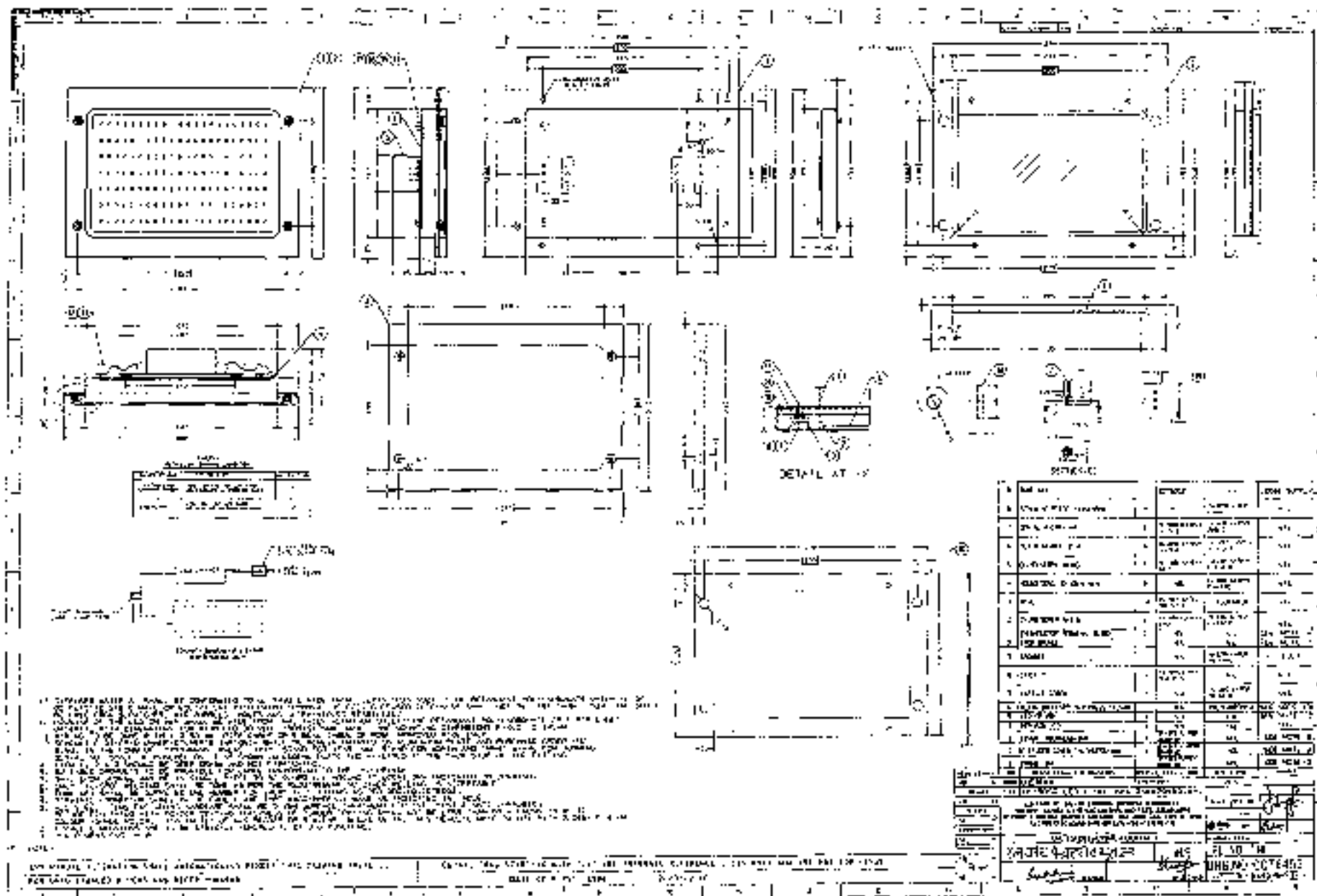
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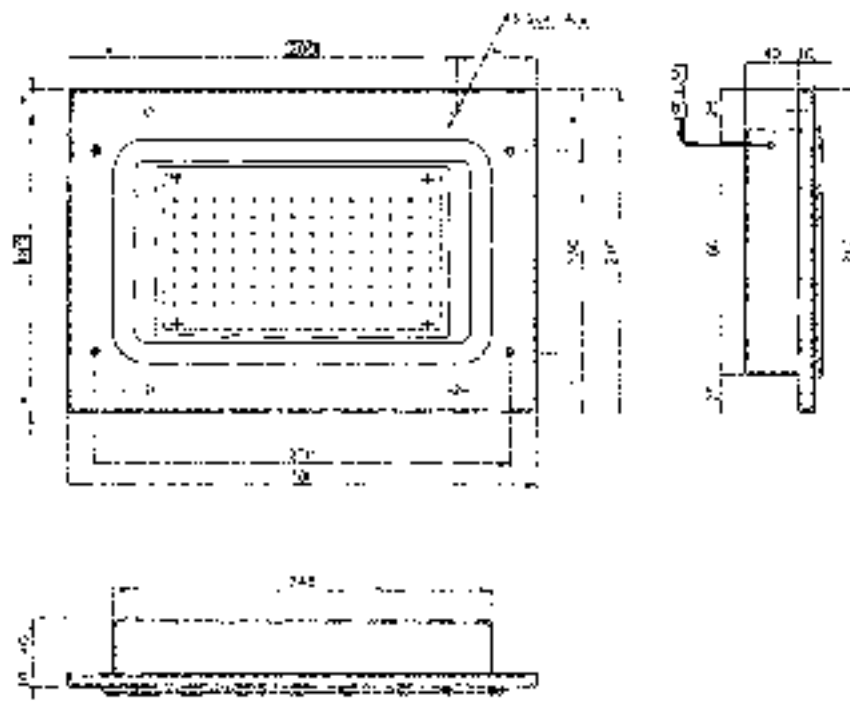


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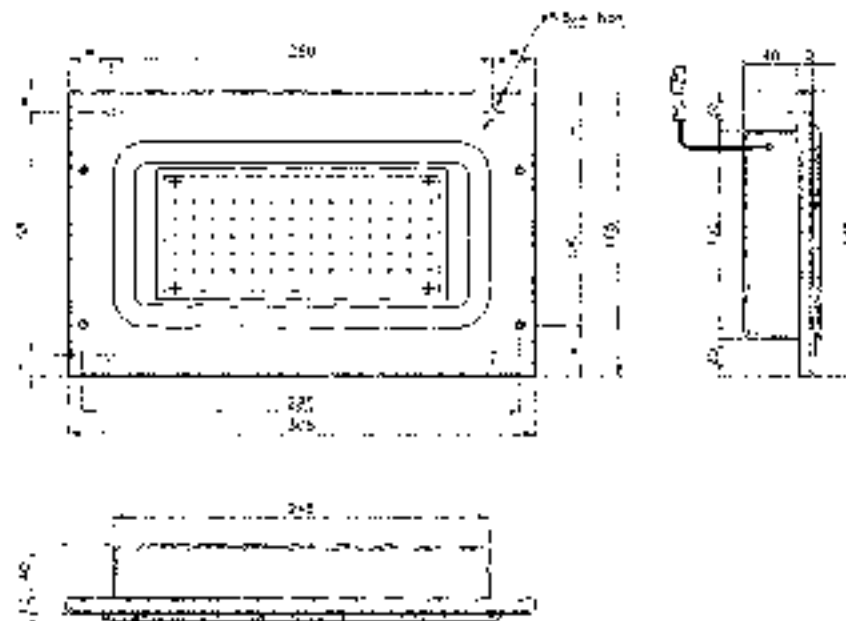


ICF/STD-7-6-050

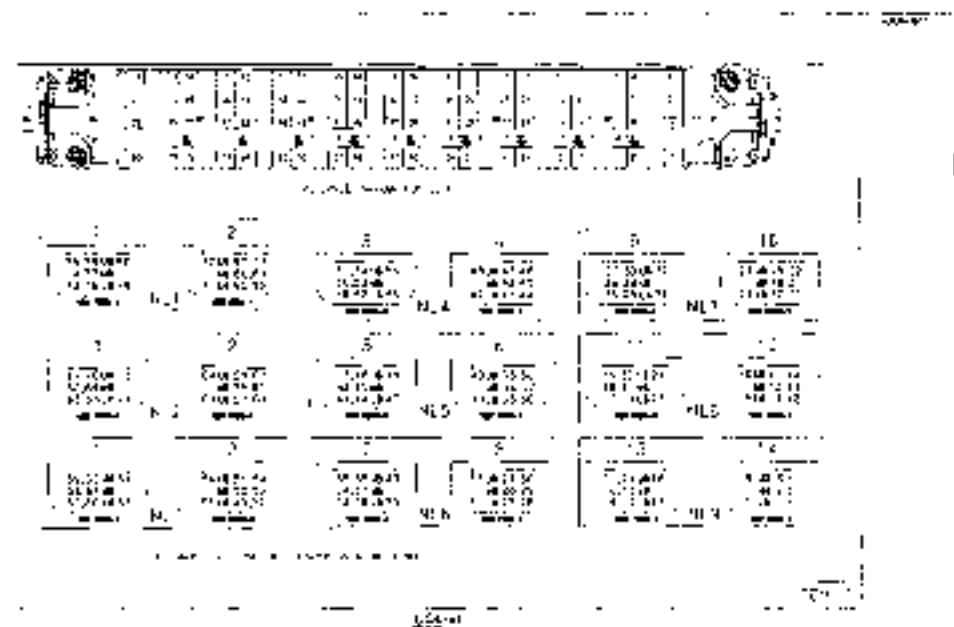
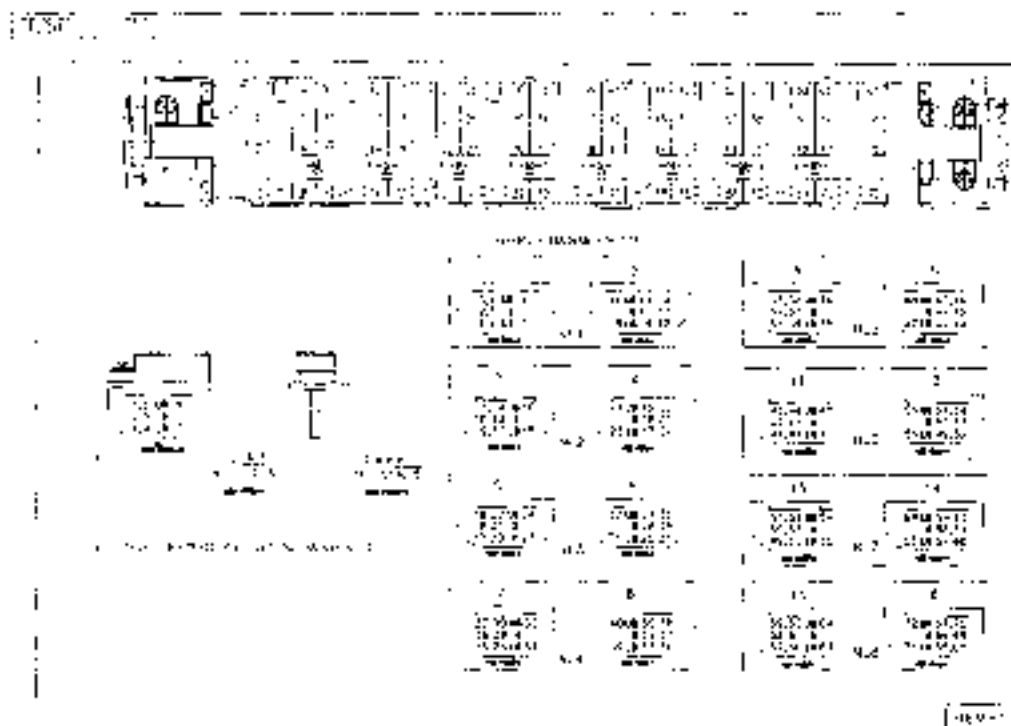


GROUP 7-6			SUPERSEDED BY	
LED LIGHT FITTING, TYPE-B2 (8W)			DATE	REV
GANGWAY AREA OF ICF BUILT CONV. AND COACHES			13A	1
(AS PER SPEC NO. RDS/STP/SPC/1/0091-2016, REV 1)			13A	1
CAD FILE ED-PAD/140 7-6 050---CONRAD			13A	1
INDIAN RAILWAY STANDARDS			13A	1
SHEET 1 OF 1			13A	1
ICF/STD-7-6-050			13A	1

ICF/STD-7-6-046

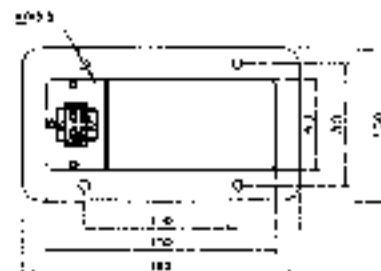
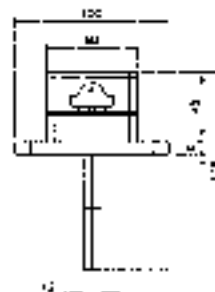


ASSEMBLY DRAWINGS			STD. FILE: CU-CAD/STD-7-6-046-1.DWG		SHEET 1 OF 1		SUPERSEDED BY: REVISIONS	
DATE	DATE OF LATEST REV.	DATE OF NEXT ISSUE	BY CEE/	DATA CODE NO. 140	INDIAN RAILWAY STANDARDS	DATE 20-08-2016 REV. 01 BY SANTOSH J.		
						INTERNAL CHECK FACILITY CREMAN 33		
						ICF/STD-7-6-046		

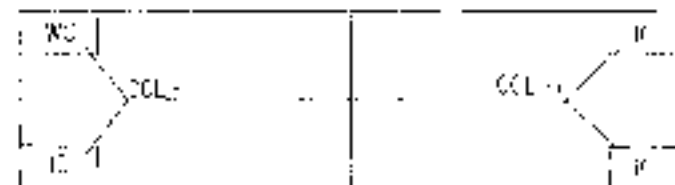


GENERAL INFORMATION		SPECIFICATIONS		TESTING		REVISIONS	
1	2	3	4	5	6	7	8
<p>1. DESCRIPTION: This is a schematic diagram of a control panel. It shows the electrical connections between various components, including switches, relays, and sensors.</p>				<p>2. SPECIFICATIONS: The diagram is drawn to scale. All dimensions are in inches. The components are labeled with their respective part numbers.</p>			
<p>3. TESTING: The diagram was tested using a standard electrical testing procedure. The results are as follows:</p>				<p>4. REVISIONS: The diagram was revised on 10/10/2023 to correct the wiring connections for components 1 and 2.</p>			
<p>5. NOTES: The diagram is a preliminary drawing. It is subject to change without notice.</p>				<p>6. APPROVALS: The diagram was approved by the design team on 10/10/2023.</p>			
<p>7. REFERENCES: The diagram is based on the following references:</p>				<p>8. CONTACT: For more information, please contact the design team.</p>			

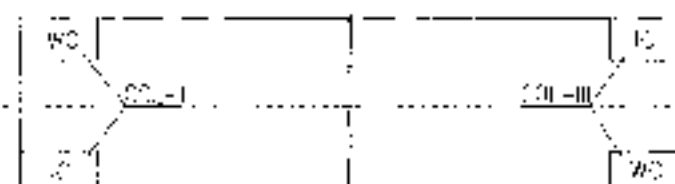
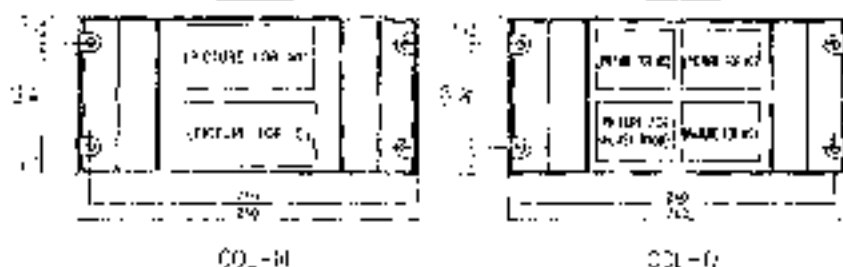
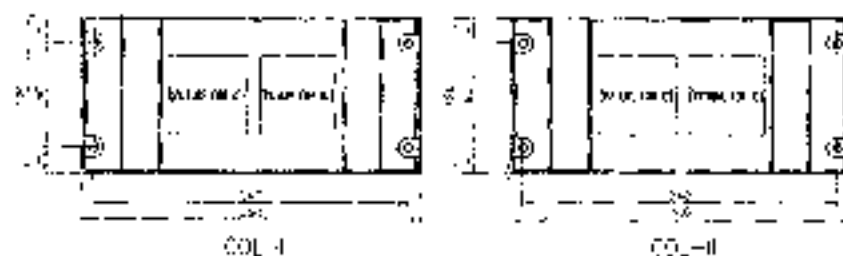
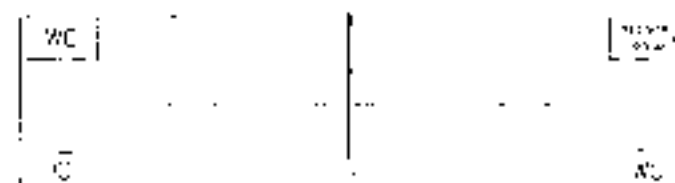
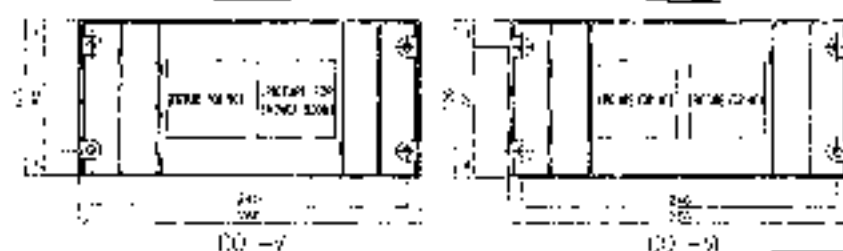
ICF/STD-7-6-049



				GROUP T-A				SUPERSEDED BY:			
				LED LIGHT FITTING, TYPE-G (1W)				SUPERSEDES:			
				FOR EMERGENCY EXIT INDICATION				SCALE 1:25		ISO 70	
				(45 PER SPEC NO. RSC/00/ISS/11/01/01-2016 (02/1))				ISO 70		ISO 70	
								INT. DIM.		RATINGS A	
				SPEC FILE: LD-EAD-140 T-A 045-000000				INT.		INTEGRAL CORP. FACTORY	
				DATA CODE NO 140				SHEET 1 OF 1		CHENNAI - 35	
				INDIAN RAILWAY STANDARDS				ICF/STD-7-6-049			



Ref: 1403800 020 3000000 0000 0000 0000 0000 0000 0000

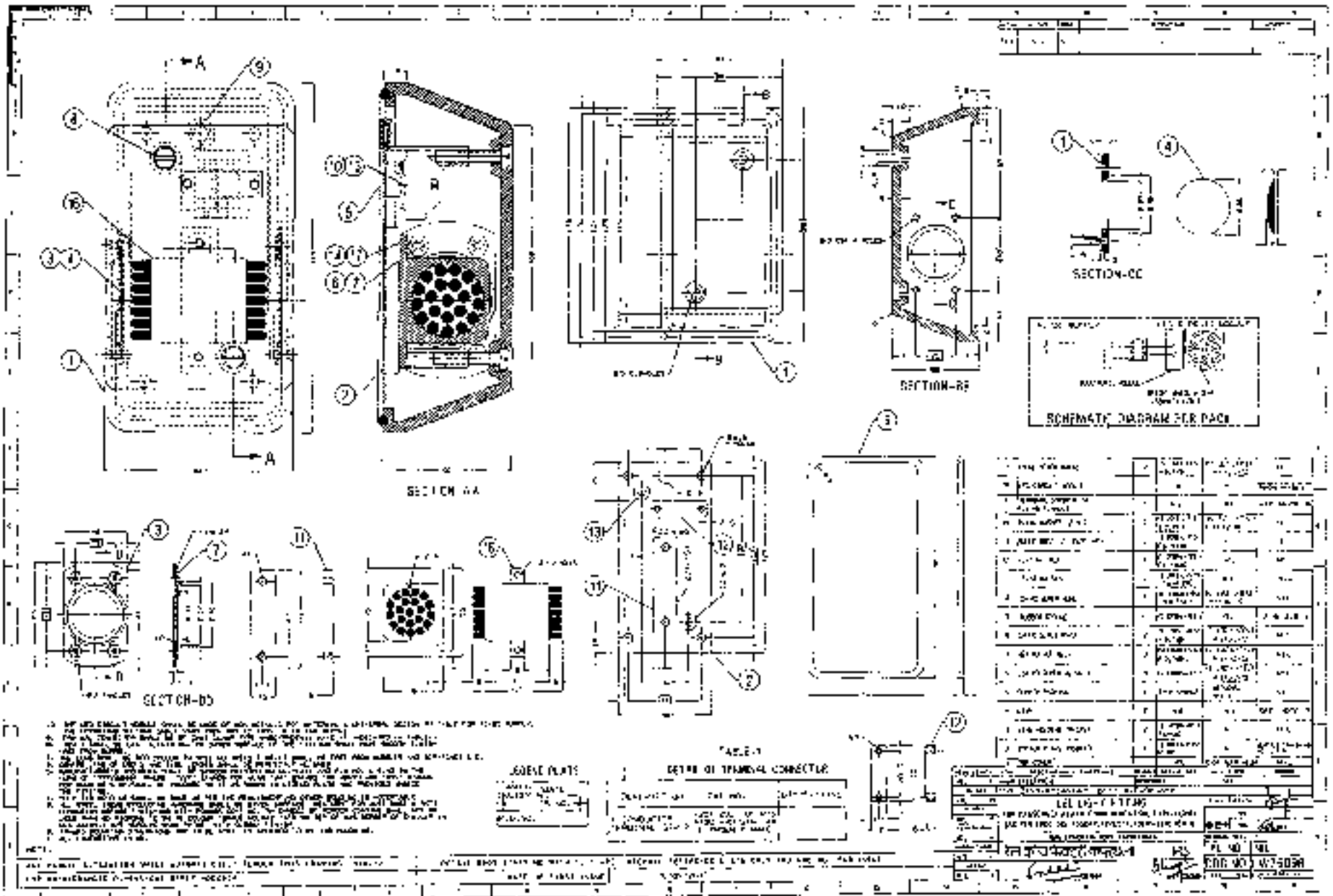
[illegible]

(6) $\exists x \in \mathbb{R}^2 \exists y \in \mathbb{R}^2 \exists z \in \mathbb{R}^2$

23-2

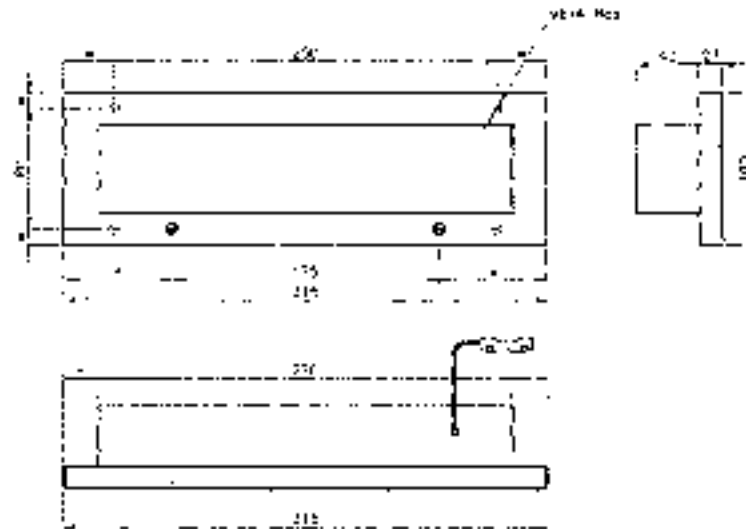
[illegible]

A-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
B-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
C-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
D-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
E-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
F-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
G-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
H-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
I-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>
J-1	<p>LED LIGHT FITTING, TYPE - H2 (1W) FOR TOILET VENTILATION AND COMB. AIR EXHAUST (AS PER SPEC. NO. RESOURCES PROJECT - 2015 - 2016)</p>	<p>QUANTITY: 10 UNIT: EACH TOTAL: 10</p>

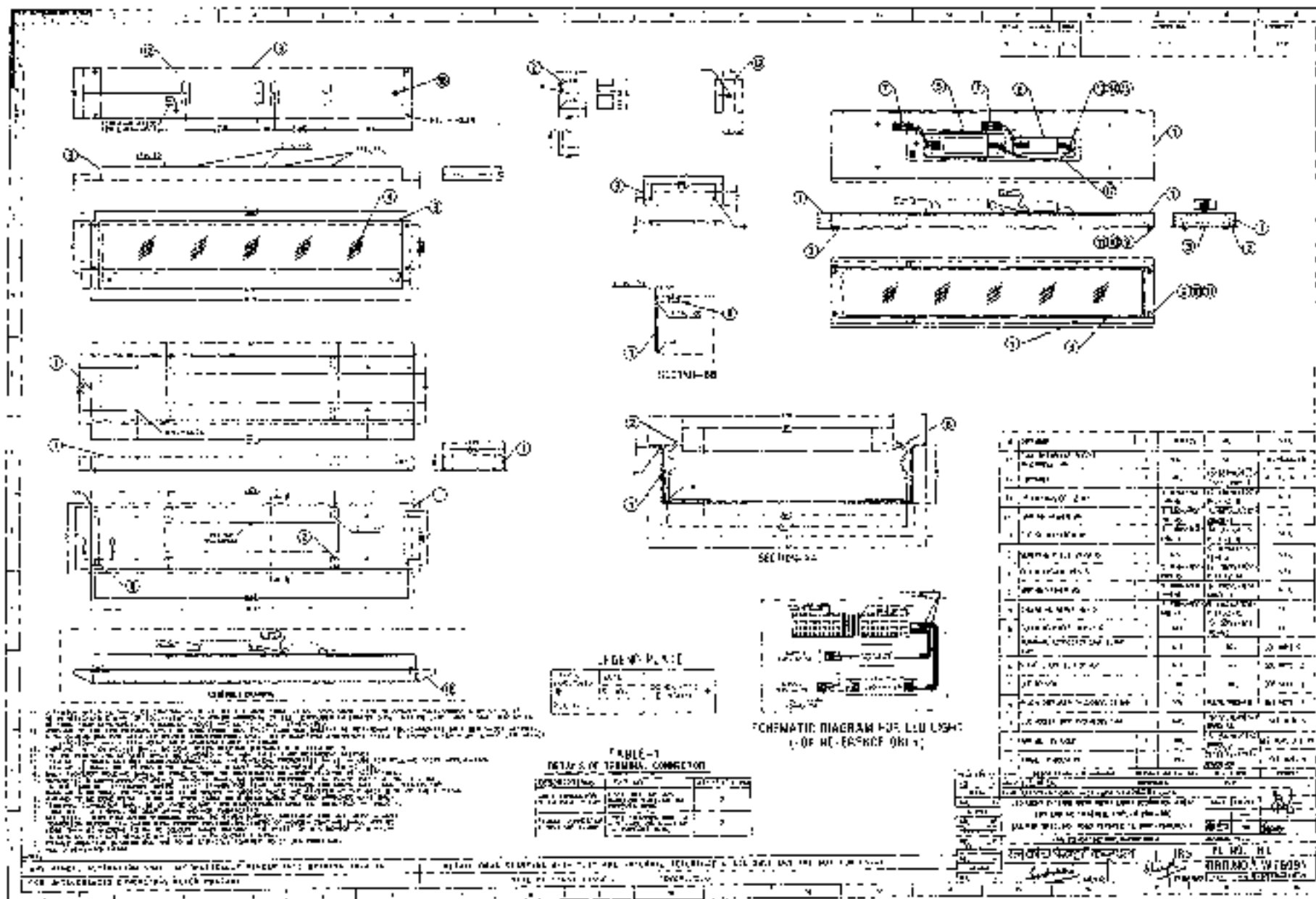


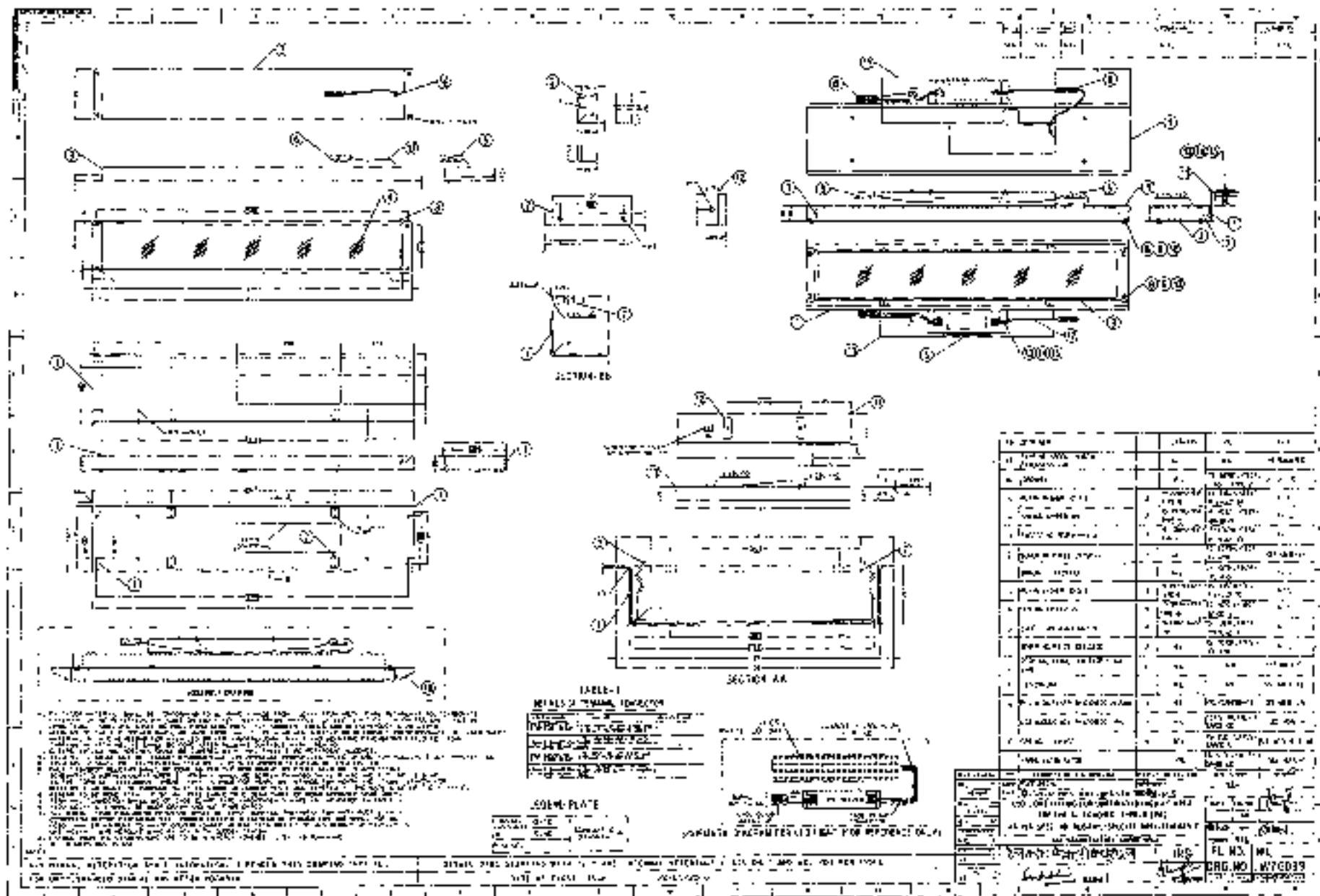
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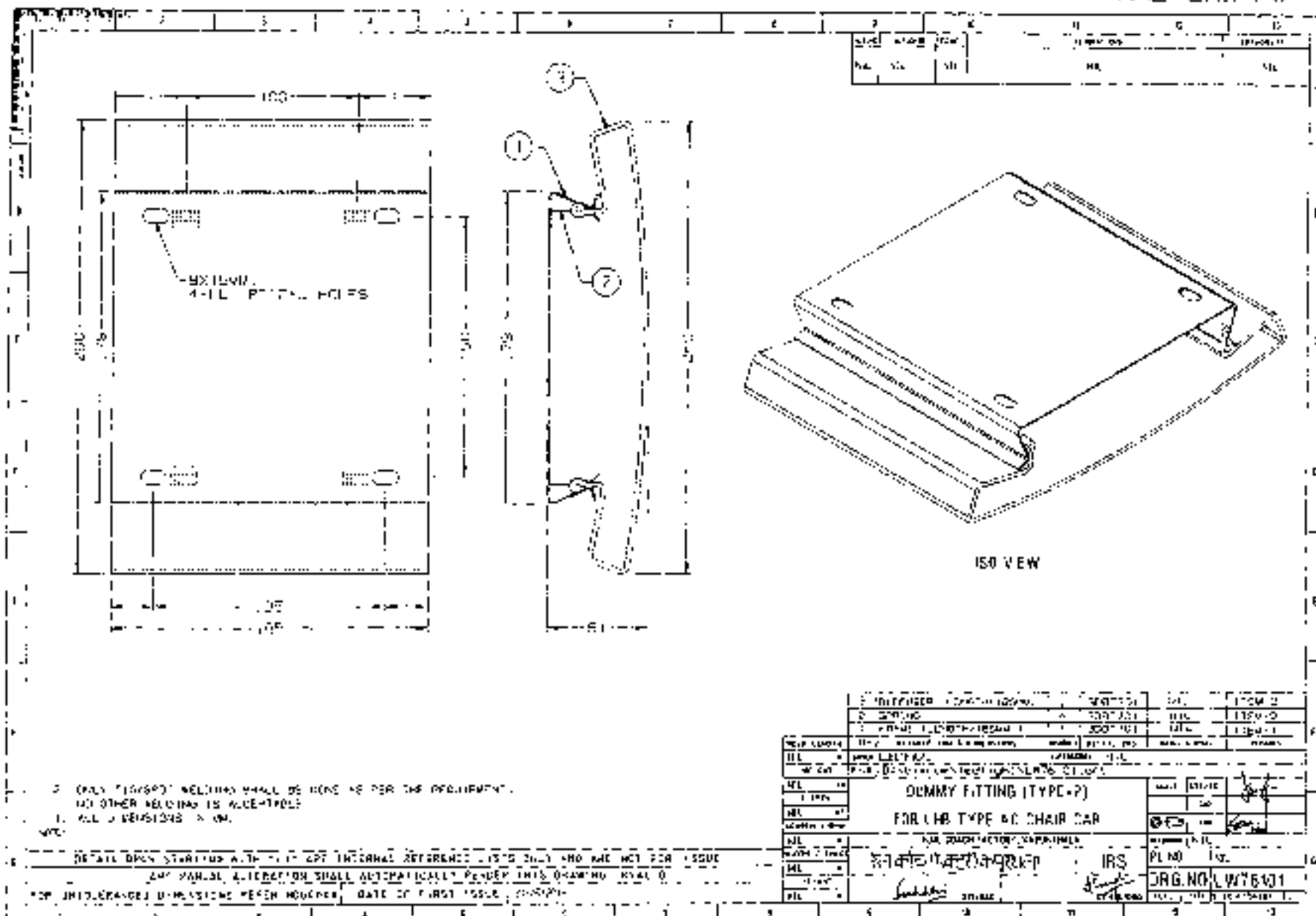
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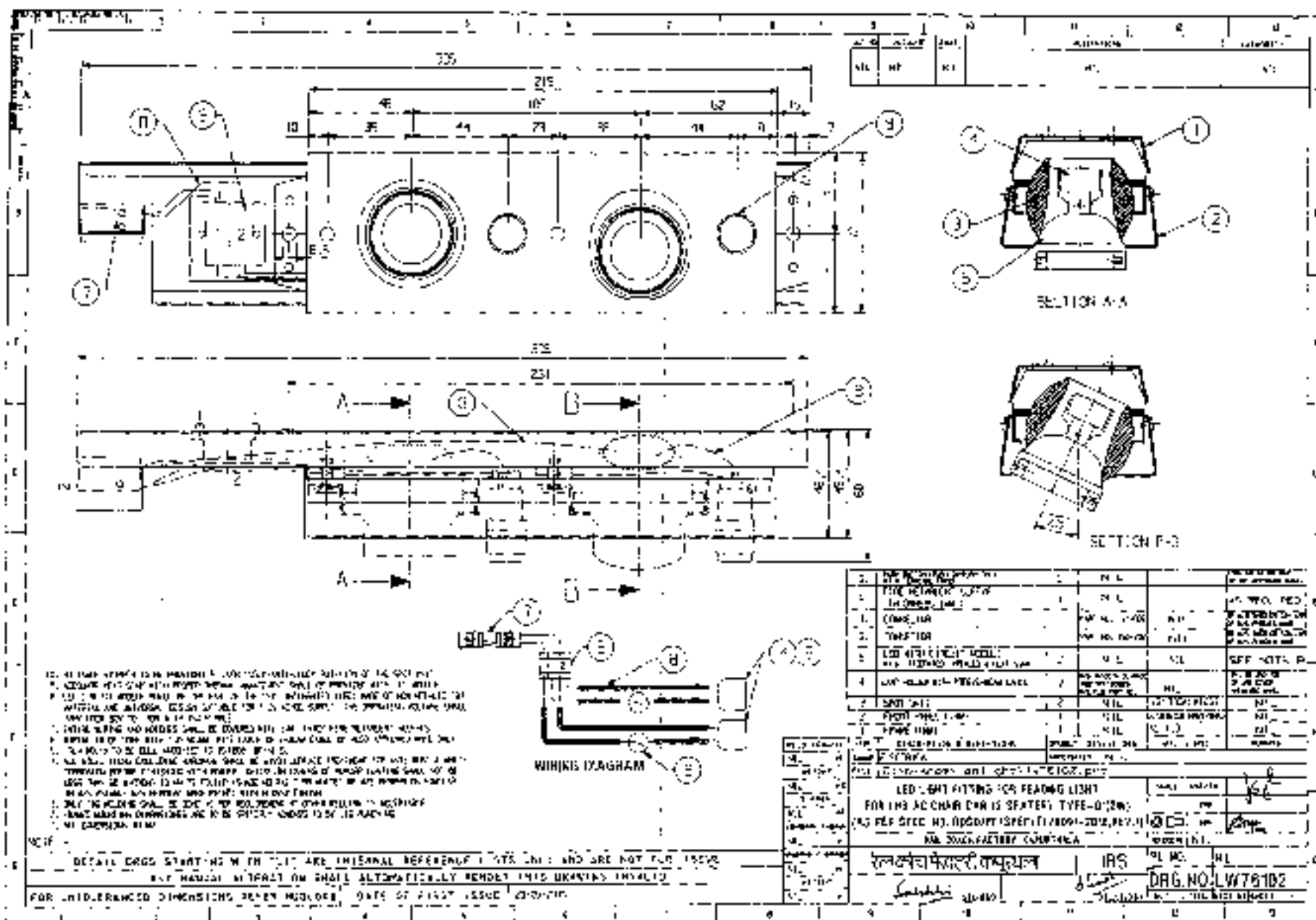


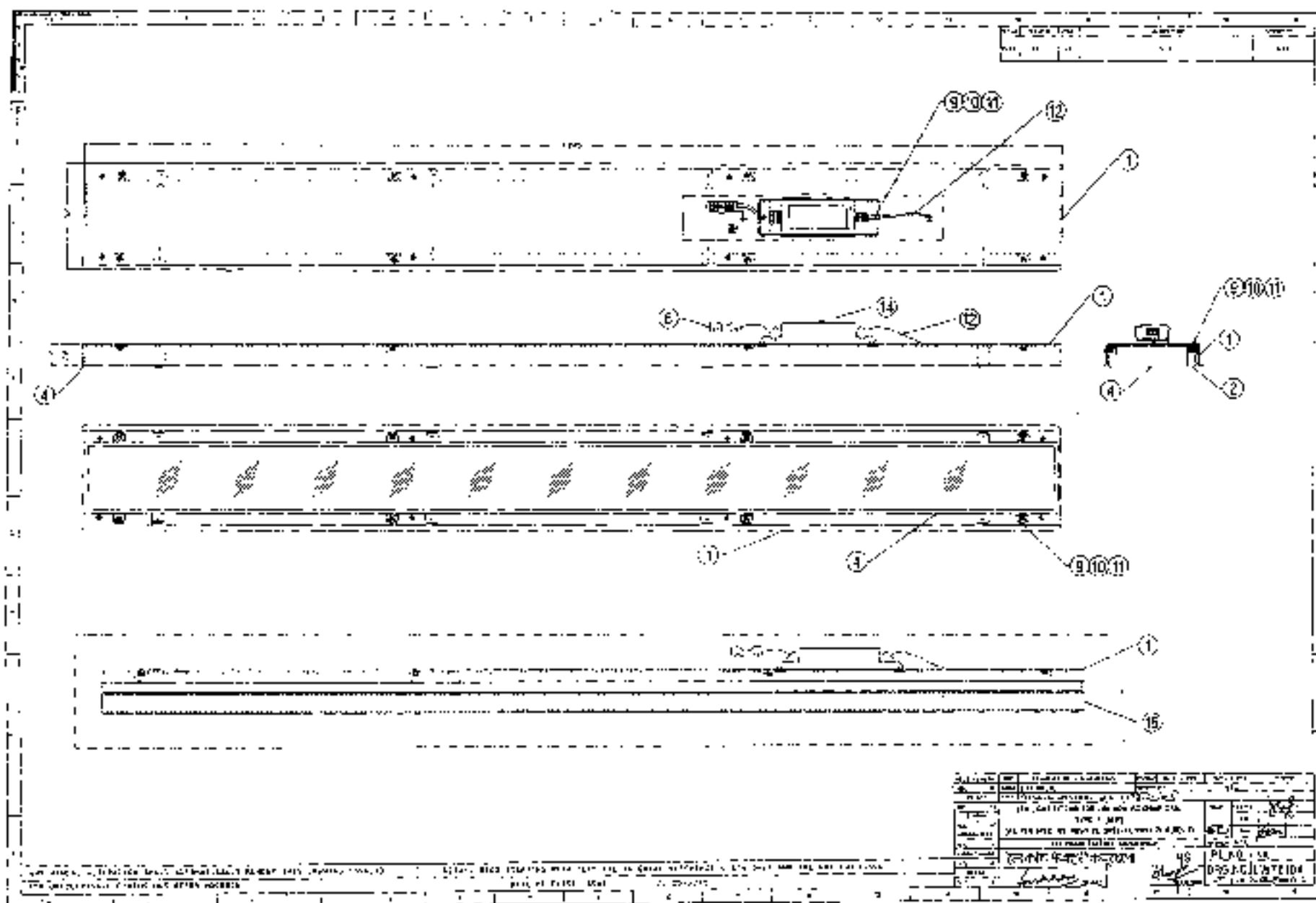
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FOR ENTRANCE DOORWAY AREA				1:2	01/01/2016
(AS PER SPEC NO. RDSO/RSPEC/100/1-2016, REV 11)				ACT	DATE
SHEET 1 OF 1				DATE	01/01/2016
INDIAN RAILWAY STANDARDS				INDIAN RAILWAY STANDARDS	
ICF/STD-7-6-048				ICF/STD-7-6-048	

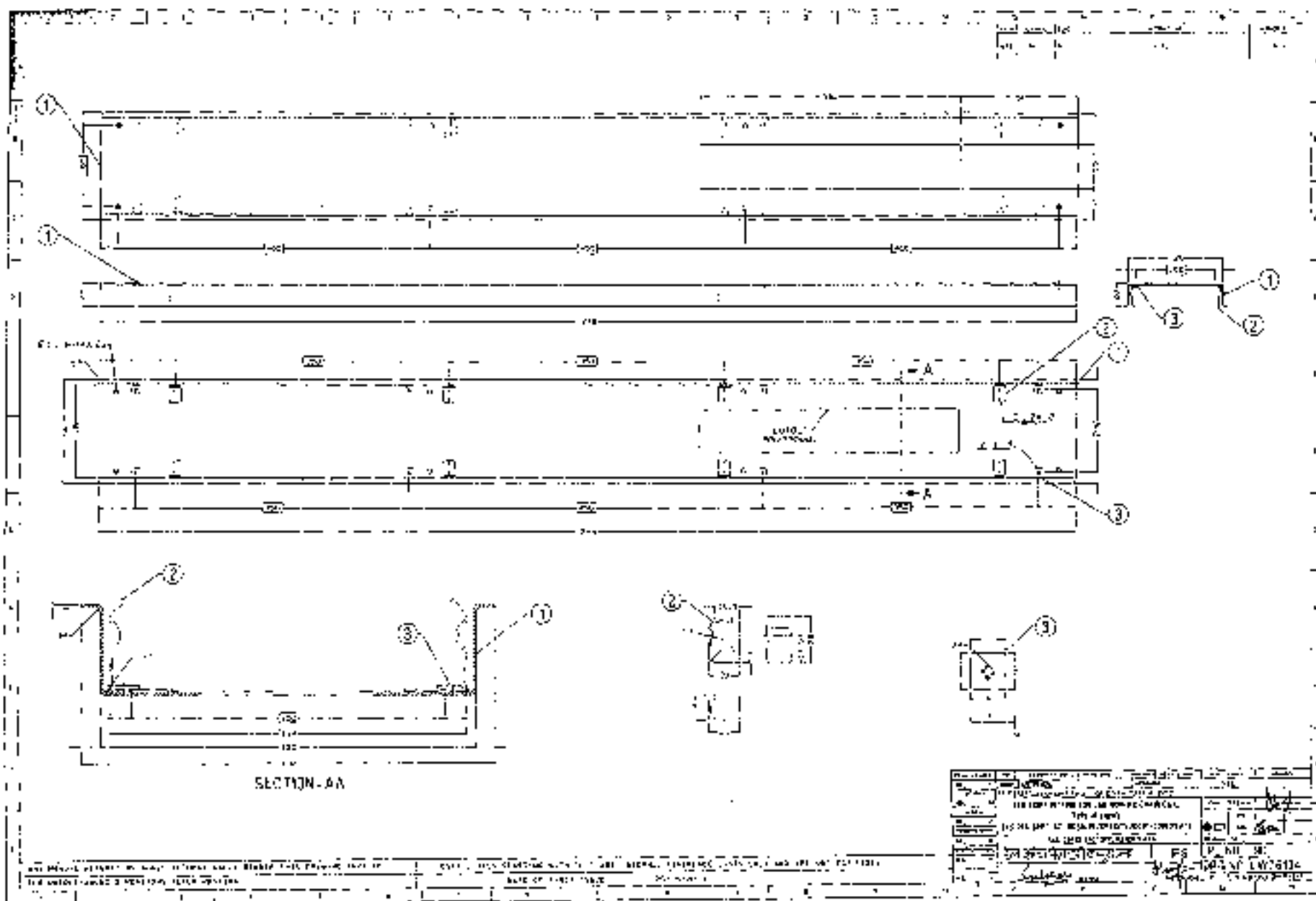




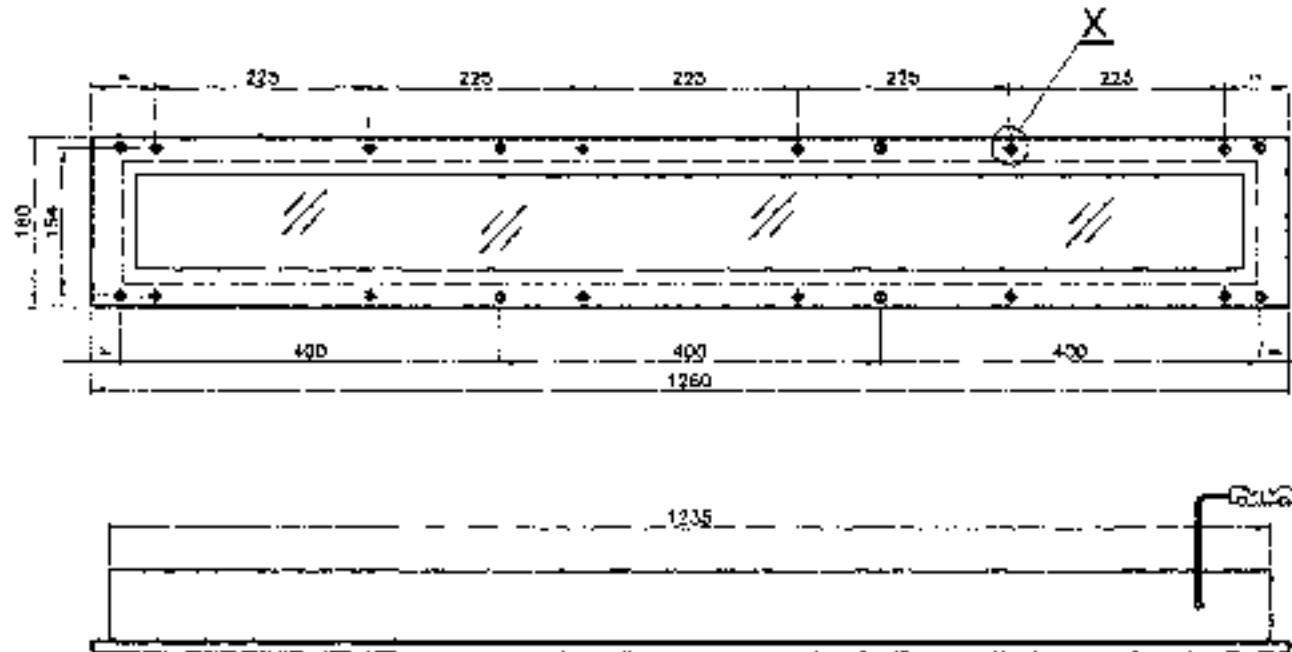




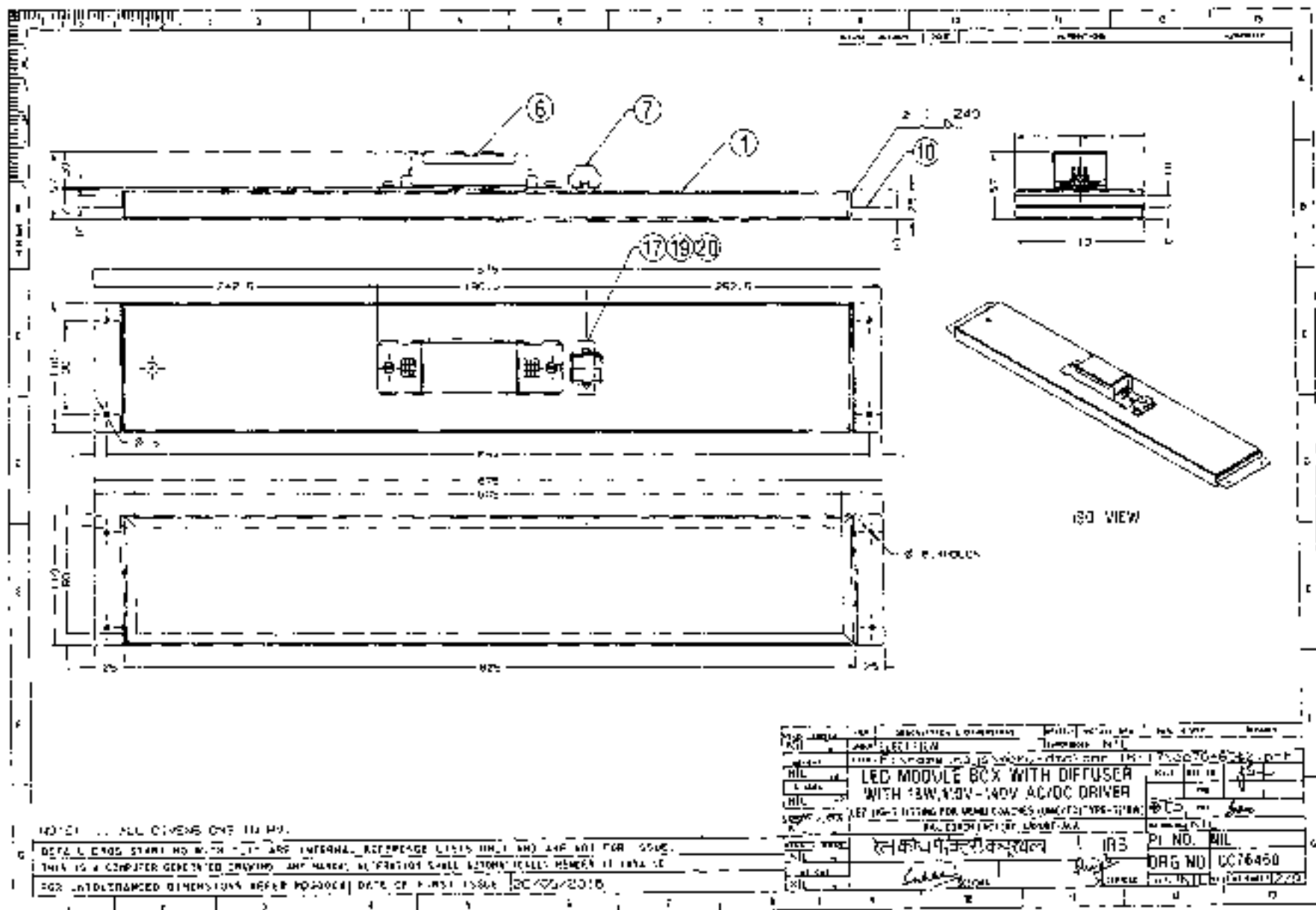


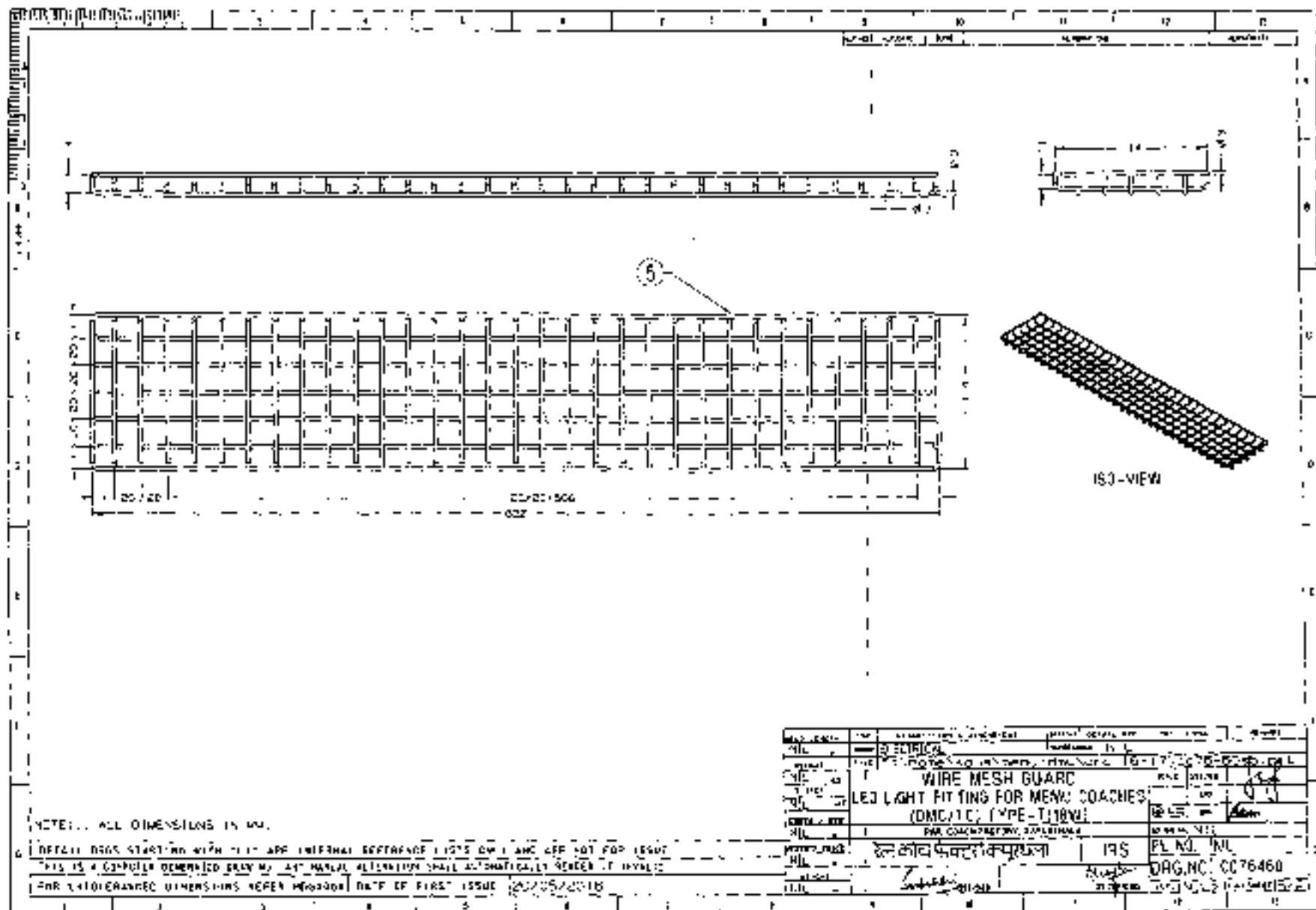


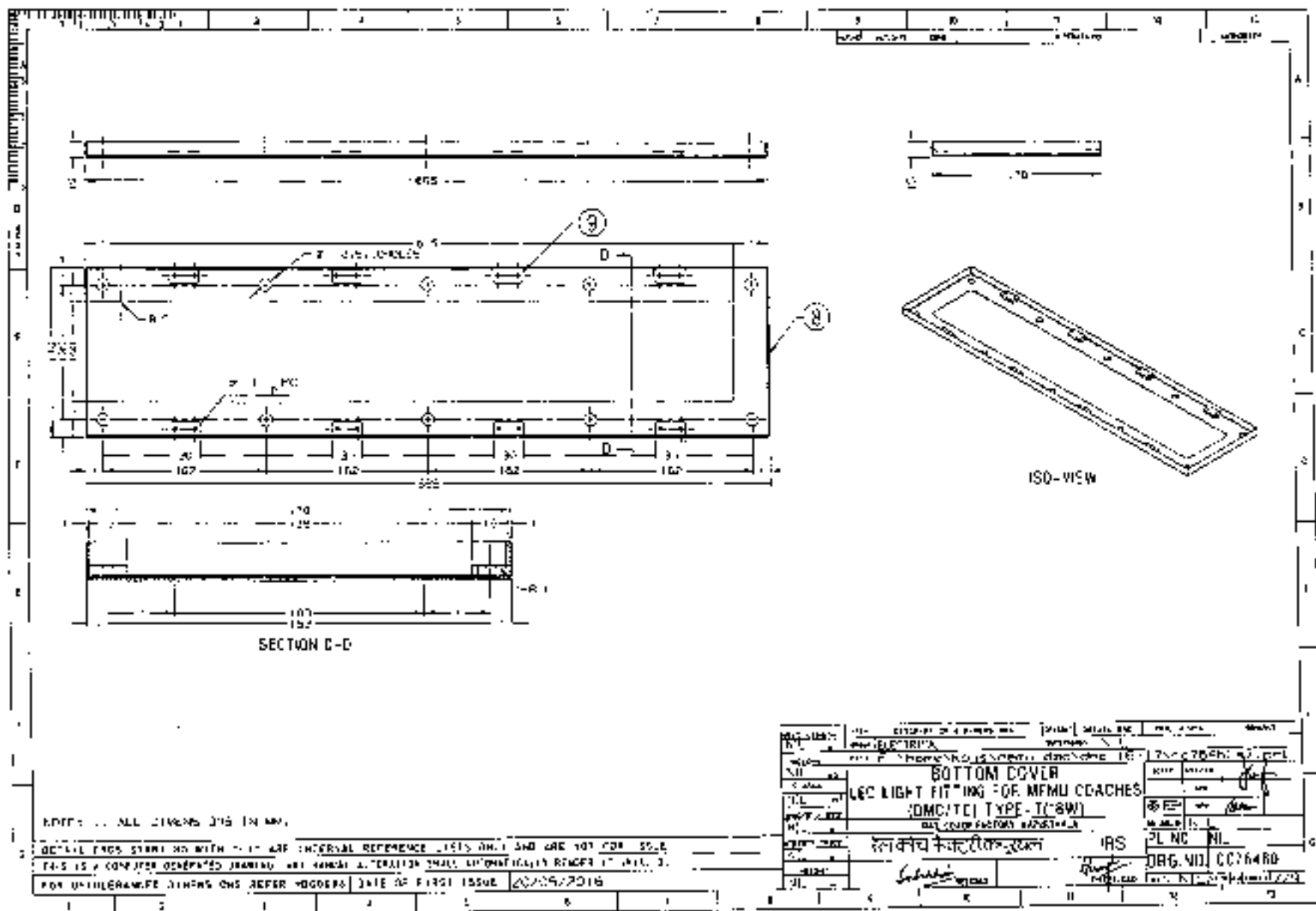
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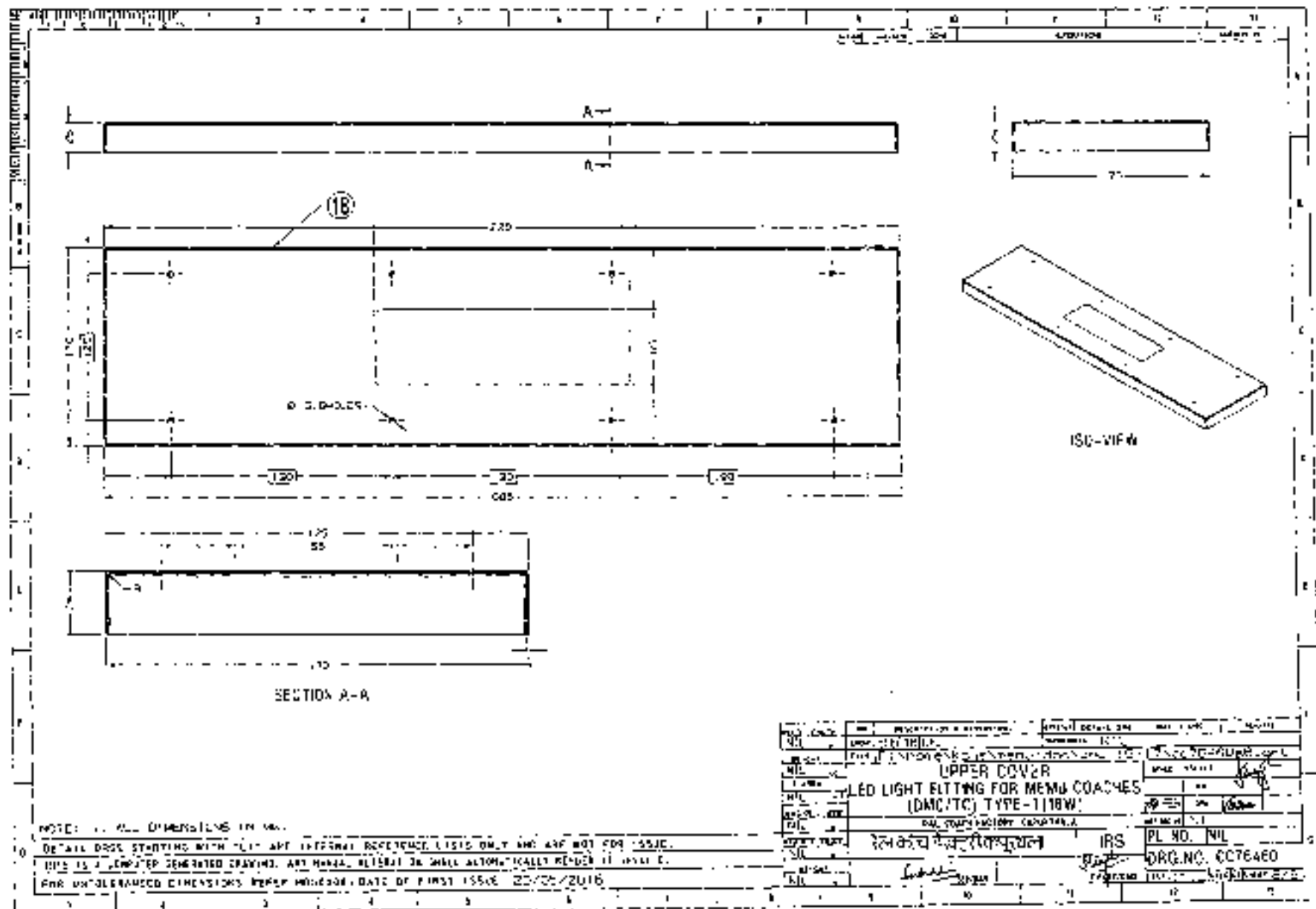


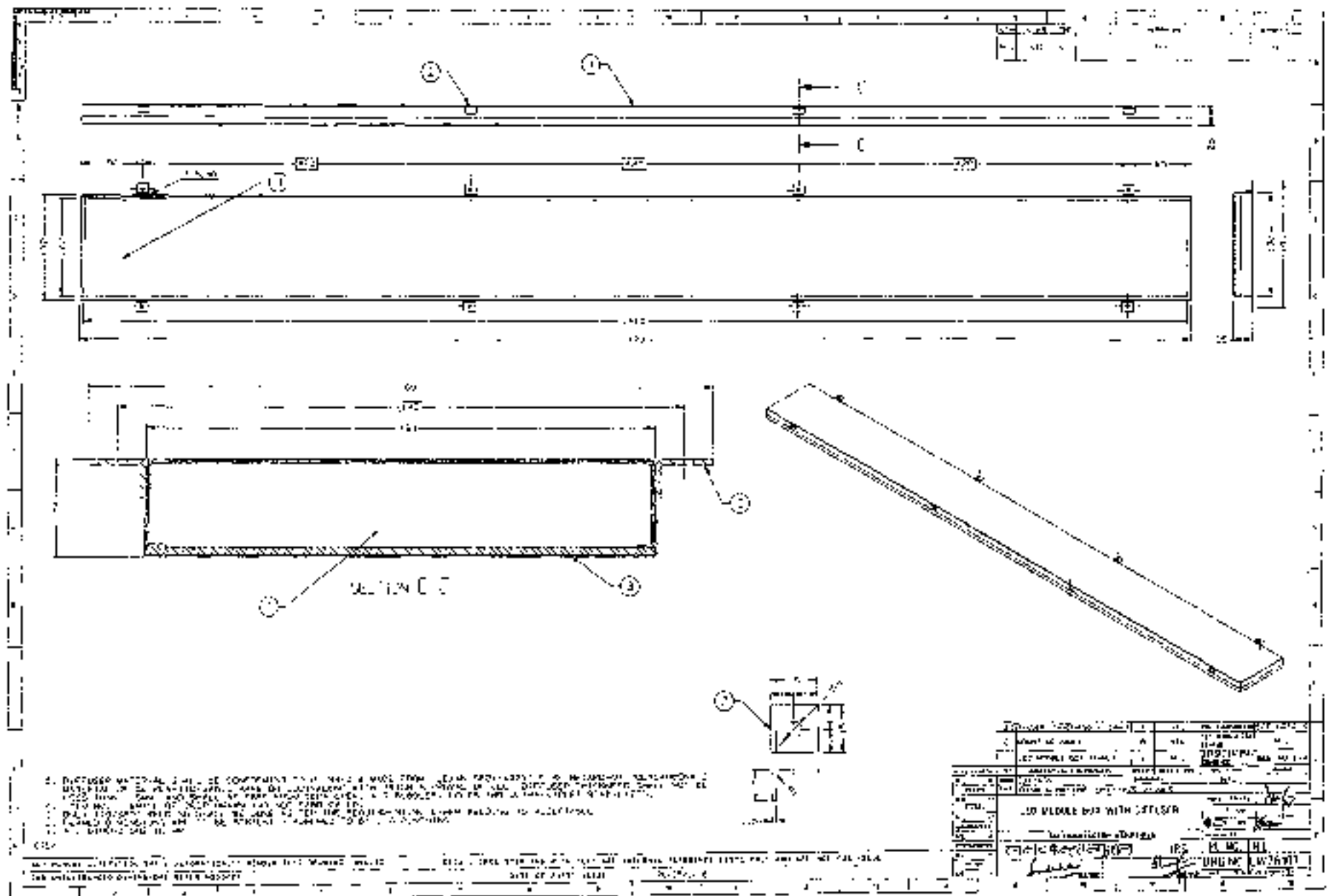
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(AS PER SPEC. NO. RDSO/PE/SPEC/TL/0091-2016, REV.1)		SSE/0	
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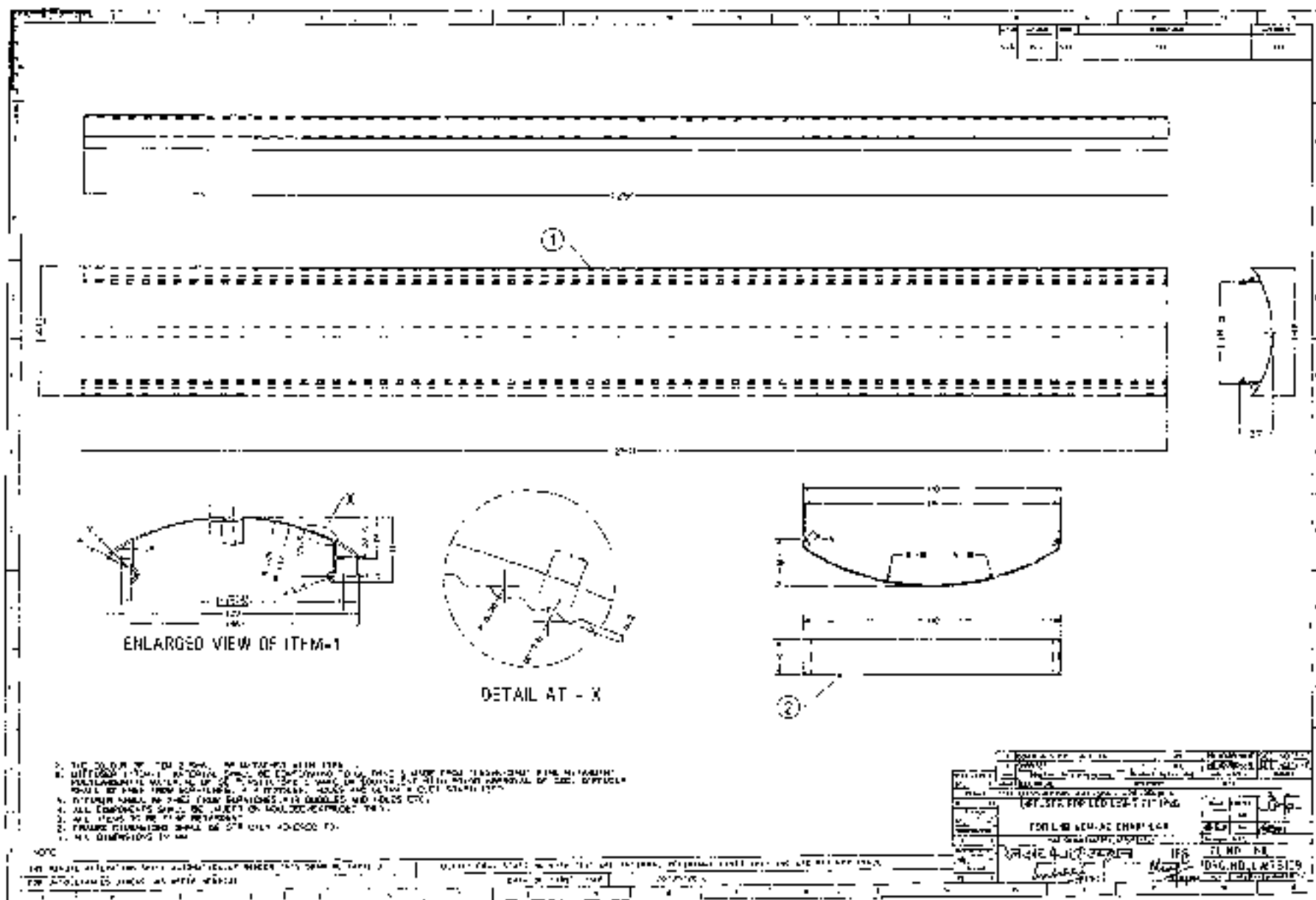


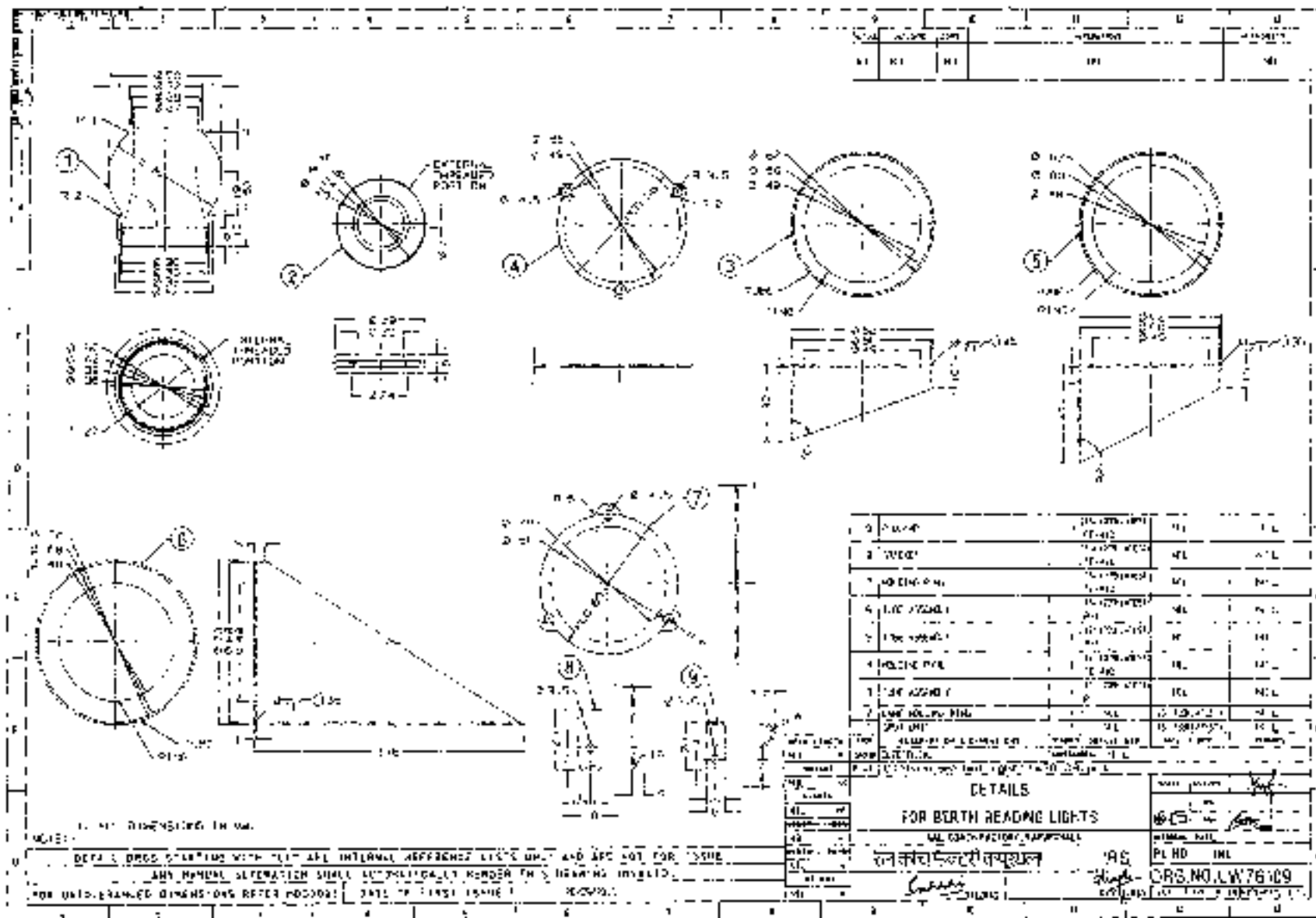


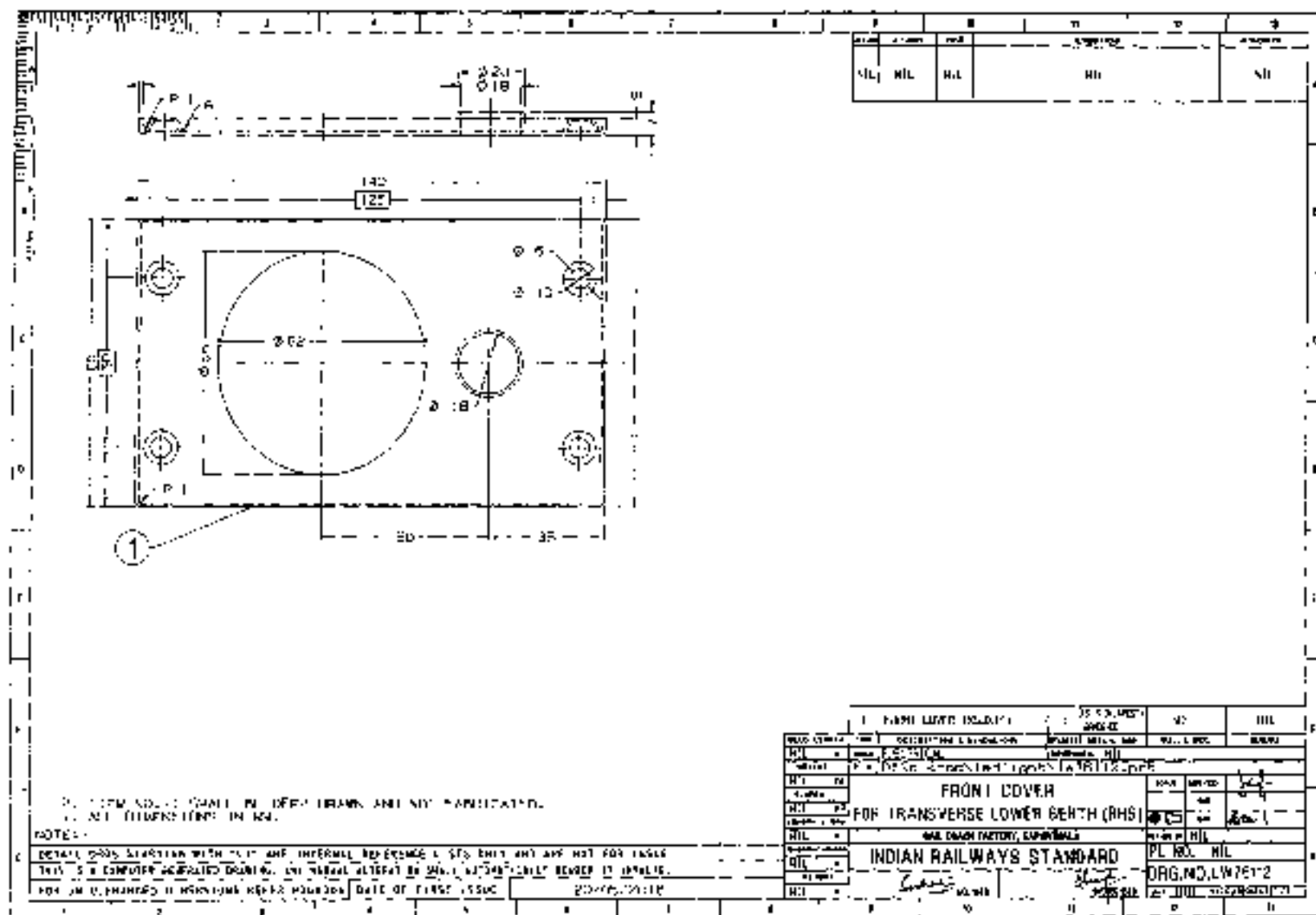


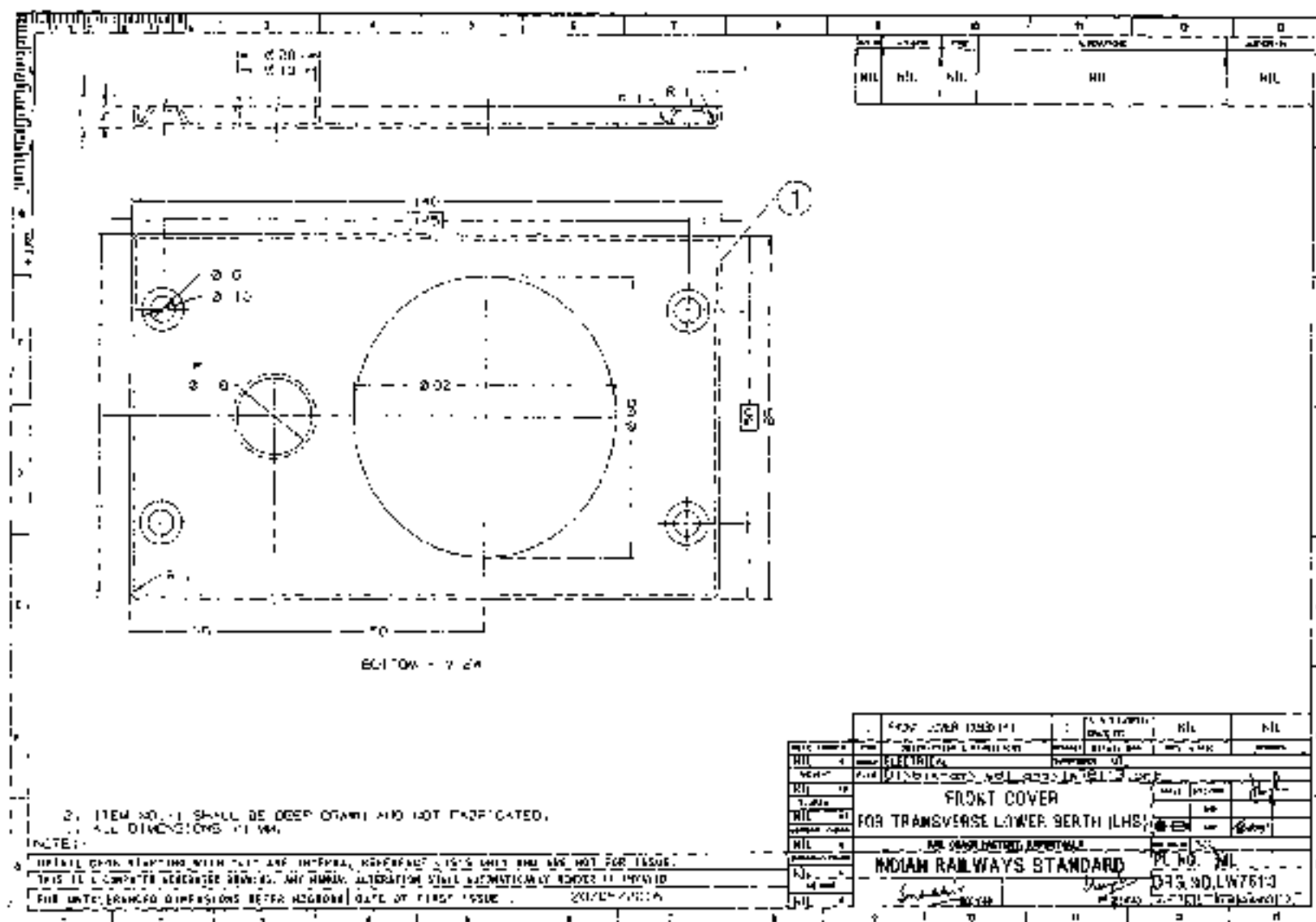














सत्यमेव जयते

भारत सरकार
रेल मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

अनुसंधान अभिकल्प एवं मानक संगठन
रेल मंत्रालय
RESEARCH DESIGNS AND STANDARDS ORGANISATION
MINISTRY OF RAILWAYS

TITLE

SPECIFICATION FOR ENERGY EFFICIENT LED BASED LUMINAIRE UNITS FOR PASSENGER COACHES

विशिष्ट सं० आर.डी.एस.ओ. / पी.ई. / एस.पी.ई.सी. / टी.एल. / 0091-2016 (रिव."1")
SPECIFICATION No. RDSO/PE/SPEC/TL/0091-2016 (Rev "1")

Sl.No	Date of Revision/amendment	Revision/ Amendment	Page no.	Remarks
1.	00.00.2016	Rev.1	39	Incorporating all Amendments to Specification No. RDSO/PE/SPEC/TL/D/0091-2008 (Rev.0) and incorporation of light fittings in all type of Passenger coaches including retro-fitment of LED lamps in the existing coaches.

अनुमोदित
APPROVED

कार्यकारी निदेशक / विद्युत आपूर्ति एवं ई.एम.यू. निदेशालय
ED (PS & EMU)

SPECIFICATION FOR ENERGY EFFICIENT LED BASED LUMINAIRE UNITS FOR PASSENGER COACHES

0.0 FORWARD

At present, conventional type luminaire are being provided inside the coaches of Indian Railways. With the introduction of white Light Emitting Diodes (LEDs) having the life not less than 50000 working hours, it, now, is possible to use these LED lamps in place of existing fluorescent /CFL lamps in the luminaire. These LEDs are almost maintenance free and the total saving in energy is expected to be more than 50%. Keeping in view the energy saving, increased life of the fitting, vibration resistant features, rugged, no warm up period, excellent color rendering, controllable & recurring savings on account of maintenance and being environmental friendly, the use of energy efficient LED based luminaire is, now considered for provision in place of fluorescent /CFL lamps in the luminaire in passenger coaches of Indian Railways.

1.0 SCOPE

- 1.1 **New Coaches:** The scope includes design, development, manufacturing, testing and supply of energy efficient luminaires suitable for operation on 110V AC/DC supply complete with all accessories, LED lamps compatible with suitable current control driver circuit including mounting arrangement for illumination in the all type of passenger coaches i.e. air conditioned coaches, non air conditioned (sleeper), Chair car, LHB and new coaches for all passenger Trains including Rajdhani and Shatabdi Express trains as per the drawings enclosed as ANNEXURES. The luminaires shall be of rugged and robust design suitable for Railway rolling stock working on Indian Railways under the operational and environmental conditions encountered during service as specified in clause 4.0. Types of luminaire covered in this specification are shown in table-1:

TABLE-1 (TYPE OF LUMINAIRE)

Sl.No.	Type of Luminaire	Maximum Wattage of complete Luminaire	Usage of Luminaire
For Conventional coaches			
1.	Type –A	18 Watt	Passenger area (Cabin) for conventional AC & LHB non AC coaches
2.	Type –B	9 Watt	<ul style="list-style-type: none"> Corridor of conventional AC coaches. Passenger area (Cabin & Corridor) of conventional non AC coaches. Doorway & Gangway of AC Coaches/Chair Car coaches
3.	Type –C	5 Watt	Doorway & Gangway of non AC Coaches
4.	Type –D	5 Watt	Lavatory/Mirror
5.	Type –E	1 Watt	Night light luminaire cum berth indication for Conventional AC coaches
6.	Type –F1	2 Watt	Berth reading light (Longitudinal)
7.	Type –F2	2 Watt	Berth reading light (Common)
8.	Type –G	1 Watt	Emergency Exit Indication light
9.	Type –H	1 Watt	Luminaire for Toilet indication in AC coaches
10.	Type–I	5 Watt	Passenger alarm chain indication light
11.	Type-J	5 Watt	Luminaire for SLR coaches
12.	Type-K	5 Watt	Entrance doorway

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For LHB AC Coaches			
13.	Type-L	18Watt	Passenger area (Cabin)
14.	Type-M	9 Watt+1W	Corridor light with night light
15.	Type-N	9 Watt	Doorway/ Gangway Area
For chair car			
16.	Type-O	18 Watt	Passenger area
17.	Type-P	--	Dummy fitting
18.	Type-Q1	2Watt	Reading light for AC chair car (2-Seater)
19.	Type-Q2	2Watt	Reading light for AC chair car (3-Seater)

Note: i. Tentative details of overall size and cut out of various types of Luminaire are shown in the Annexure-3.
ii. Each type of luminaire shall be supplied with the associated driver circuit and required optics. Driver card as well as complete luminaire shall have validation by LED manufacturer for its compatibility.

1.2 Retro-fitting of lamps in the existing/old coaches: The scope includes design, development, manufacturing, testing and supply of 9W and 5W tubular LED lamps with suitable in-built driver, to be fitted in the existing holders provided for 18W fluorescent lamp (FL) and 11W compact fluorescent lamp (CFL) respectively being used as a light source in all type of coaches of Indian Railways. The lamp shall have IP-65 protection as per IEC-60529.

1.3 Input to the luminaire will be fed through battery bank of 110V dc in parallel with alternator, rectifier cum regulator. The luminaire shall be suitable for operating voltage range available as input i.e. 90V to 140V DC with 15% ripple. There may be surges in input supply with peak value of approximately 350V. However, it is advised that the firm may measure the harmonic distortion and Surges in the Coach before designing the LED based luminaire. The over voltage trip shall be set between 150V to 155V DC.

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/ IS 16101	:	General lighting – Light emitting diode (LED) products and related equipment – Terms and definitions
IEC 62560/ IS 16102	:	Self-ballasted LED lamps for general lighting services Part-1-Safety requirements
IEC 62612/ IS 16102(Pt-2)	:	Self-ballasted LED lamps for general lighting services Part-1-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

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IEC 62722-2-1	:	Luminaire performance Part-1 : General requirements and Part-2-1 : Particular requirements for LED luminaire
IEC 62031/IS16103(Pt-1)	:	LED modules for general lighting – Safety specifications
IEC 61347-1	:	Lamp controlgear – General and safety requirements
IS 16107 (Part-1)	:	LED luminaires for general lighting purposes Part 1 safety requirements
IEC 62471/ IS 16108	:	Photobiological safety of Lamps and Lamp system
IS 16107 (Part-2)	:	LED luminaires for general lighting Part 2 Performance requirements
IS: 513	:	Cold-rolled low carbon steel sheets.
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)
LM-79 / 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

4.0 SERVICE CONDITIONS:

Recess mounting type light unit complete with luminaire and mounting accessories 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 : 55° C
temperature

Minimum ambient air : -5° C
temperature

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/m³

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 : 6 mg/ litre

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chlorine
 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 : 160 km/h
- Supply voltage : 110 V AC/ DC
- Voltage range : 90V-140 V AC/ DC
- 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

Because of track irregularities, level of shocks and vibrations to which the luminaire are exposed are far more than actually given in IEC for on board (Ceiling) mounting arrangement. Measured data of vibration levels at critical locations of light fitting and its mounting arrangement of existing fittings, which can be used for design and in case of any doubt, the manufacturer must carry out instrumented trials on existing stock for measurement of shocks and vibrations in consultation with Production Units at design stage only. The fitting and its mounting arrangement shall be so designed that the performance is not adversely affected due to such high vibrations and shocks.

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

5.0 CONSTRUCTION

- Tentative details of Luminaire-housing with outer dimensions are indicated in Annexure 4 to 22. These dimensions are tentative and shall be finalised based on the performance requirement i.e. uniformity level of at least 1:1.3 as per norm of UIC 555 shall be achievable in space available in accordance with Annexure-1. However, it is expected that only minor variations shall be accepted. The detailed calculation for lux level, uniformity in distribution as per clause no. 5.11 & 5.12 including the lux distribution curve /graph/spatial distribution shall be submitted in support of the dimensions selected and variation thereof. Housing of luminaire shall be made of 1.00 mm thick Steel sheet conforming to IS: 513 (Grade O) Or 1.50mm thick aluminum sheet having high conductivity preferably to grade of 6000 series or similar to high conductivity heat sink material or SS304 grade stainless steel. The front cover (if required) shall be made of 1.00 mm thick SS-304 grade stainless steel. Efforts shall be made to keep the overall outer dimensions as minimum as possible.
- Fire retardant polycarbonate diffuser (minimum 2.00mm thick) of sufficient strength shall be provided under the LED chamber to ensure glare free light and to protect the luminaire. Selection of diffuser shall be such that the individual LEDs are not visible and appearance looks like a brightly lighted surface.

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- c. All steel items excluding hardware shall be given surface treatment for anti-rust and anti- corrosion before finishing with powder coating. The thickness of powder coating shall not be less than 60 microns to white colour shade no 042 'IFB white' of M/s Berger or equivalent shade of other reputed make with glossy finish from inside and outside.
- d. Housing of the driver for the luminaire (if required) shall be made of Aluminum or fire retardant polycarbonate/ fibre sheet.
- e. Complete LED luminaire shall comply with LM-79 standard. The manufacturer shall submit the test report from the OEM at the time of testing.
- f. Minor changes in dimensions can be considered to achieve uniformity levels. Dimensions and uniformity levels achieved shall be submitted by the manufacturer
- g. Suitable number of LEDs shall be used in the luminaire. LED of NICHIA/OSRAM/ SAMSUNG/LUMILEDS/CREE/AVAGO 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.
- h. Suitable reflector may also be provided to increase the illumination angle.
- i. Manufacturer will be solely responsible for testing and performance of the luminaire after installation and shall also ensure the specified and uniform illumination and comfort level in the coach.
- j. Suitable WAGO/Phoenix make Connector shall be used between Driver and LED array (cage-clamp type) and between driver to input.
- k. Suitable grommets shall be provided for cable traversing.
- l. The weight of the luminaire shall not be more than 1.5Kg except for the luminaire for LHB/Chair car coaches, for which the weight shall be as minimum as feasible.
- m. Total harmonic distortion (THD) shall be less than 5% at full load.
- n. The power factor of the luminaire shall be more than 0.95.
- 5.1 High lumen and energy efficient LEDs with the following features shall be used:
 - a. The efficiency of the LED lamps at 115⁰C junction temperature shall be more than 85%.
 - b. The working life of the lamp at junction temperature of 115⁰C for 350mA/ 175mA/80mA/ 65mA current shall not be less than 50000 hours of accumulative operation and shall be suitable for continuous operation of 24 hours per day. These features shall be supported by datasheet.
 - c. Colour temperature of the white colour LED used in the luminaire shall be in the range of 5700k-6500k for cool day white.
 - d. The output of LED (efficacy) shall not be less than 150 lumen per watt at minimal operating current and shall ensure guaranteed operation life of not less than 50000 burning hours with controlled junction temperature of >115⁰C.
 - e. LED controller (Driver) shall be EMI/EMC compliant.

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- f. The LEDs used shall have white point stability less than 7 step (Macadam ellipse) or as per LM80. The manufacturer shall submit the compliance from OEM.
- g. The LEDs shall be LM80 certified for white LED along with TM21 projection for more than 50000 hours.
- h. The LEDs used shall be UL certified with UL number.
- i. The LED driving current shall not be more than 80% of the specified current.
- j. The LED beam/view angle (typical) shall be 120° or more.

6.0 TECHNICAL REQUIREMENTS

- 6.1 The luminaire casing/housing shall be made as per the requirement in Clause 5.0(a).
- 6.2 The electronic components used shall be as follows:-
 - a) All the electronic components used in the circuit shall be of industrial grade or above.
 - b) Metallic film / Paper/Polyester Capacitor shall be rated for 105°C or above.
 - d) The resistors shall be preferably made of metal film of adequate rating. The actual loading versus rating shall be 3.
 - e) The junction temperature of the Switching devices such as transistors and MOSFETs etc. shall not exceed 125°C (allowing thermal margin of 25°C).
 - g) The protective cum adhesive coating used on PCBs shall be clear and transparent and shall not affect color code of electronic components or the product code of the company.
 - h) The heavy components shall be properly fixed. The solder connection should be with good finish.
 - i) The electronic circuits, PCB and components shall meet the requirement of RDSO Spec. No. ELRS/SPEC/S1/0015-OCT, 2001 (Rev.0) for Electronics used in Rolling Stock Application. The electronics covered for this equipment shall pass all the tests called for in the specification. The manufacturer shall indicate the deviation or compliance.
 - j) The infrastructure for Quality Assurance facilities as called for in the specification shall be available with the manufacture for this product.
- 6.3 Low smoke, halogen free, fire retardant thin walled flexible e-beam cable with multi-strand copper conductors suitable for continuous operation at 120°C shall be used inside the luminaire as connecting wires and fuse protection shall be provided at input side.
- 6.4 Adequate heat sink with proper thermal management shall be provided. Design should not consider heat dissipation through roof top as roof is provided with heat insulation material.
- 6.5 Care shall be taken in the design that there is no water stagnation anywhere. The entire housing shall be dust proof and water spray having IP-65 protection as per IEC 60529.
- 6.6 The unit shall be maintenance free.
- 6.7 Temperature of diffuser's surface shall be lower than the fluorescent luminaire being used presently.

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- 6.8** The control gear shall be designed in such a way so that temperature of heat sink shall not be more than 45°C for air-conditioned coaches and 10°C above the ambient for non-air-conditioned coaches.
- 6.9** Diffusers used shall be such that the glare from individual LED is restricted and shall appear as a single source of light as in the case for lighted globe and it shall not cause inconvenience to the passengers.
- 6.10** The illumination of the luminaire provided in the coach shall not have multiple shadows under one Luminaire.
- 6.11** All the material used in the luminaire shall be halogen free and fire retardant conforming to UL94-V0.
- 6.12 Illumination Level:** The fitting shall be so designed that the illumination level shall be evenly distributed and shall be free from glare. Illumination level of different types of luminaire shall be as below:

Sl. No.	Type of Luminaire	Vertical Distance (Mtrs) from the floor level	Average Illumination Level (Lux)	Colour of illumination
1.	Type –A	0.84	120	Cool day white
2.	Type –B	0.84	80	Cool day white
3.	Type –C	0.84	80	Warm white
4.	Type –D	0.50	100	Cool day white
5.	Type –E	10.0*	Clear visible	Blue
6.	Type –F1/F2	0.75	100	Cool day white
7.	Type –G	10.0*	Clear visible	Green - Vacant Red – Occupied
8.	Type –H	10.0*	Clear visible	Cool day white
9.	Type –I	400*	Clear visible	Red
10.	Type –J	0.84	80	Cool day white
11.	Type –K	0.84	80	Cool day white
12.	Type –L	0.84	120	Cool day white
13.	Type –M	0.84	80	Cool day white
14.	Type –N	0.84	80	Cool day white
15.	Type –O	0.84	120	Cool day white
16.	Type –P	-	-	-
17.	Type – Q1/Q2	1.20	100	Cool day white

* Horizontal distances

- Note: 1. Variation in illumination level shall be $\pm 2\%$ for input voltage range from 90VDC to 140VDC.
2. The illumination shall not have infra-red and ultra-violet emission. The test certificate from the NABL approved laboratory shall be submitted.
3. Calibration of illumination level facility shall be provided inside the luminaire.
4. Electronic efficiency shall be in accordance with LM80-8.

- 6.13** After 50,000 burning hours, the luminaire intensity shall be at least 90% with degree of uniformity of at least 1:1.3 as per UIC 555. Data sheet showing year wise deterioration in the LED shall also be submitted along with design.

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- 6.14** Detailed design shall be furnished before manufacturing of prototype. However, information as per Annexure-2 shall be submitted by the manufacturers along with in-house test results while offering for witnessing the prototype testing at firm's premises.

7.0 TESTS:

Tests are classified as:–

- Prototype test
- Type test
- Acceptance test
- Routine test.

7.1 Prototype Test

Prototype test is conducted on the first unit developed by the firm as per the relevant specification.

7.2 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 or design of unit, 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.

7.3 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 luminaire from the lot on which type tests have already been conducted. Recommended sampling plan is given below.

7.3.1 Sample size and criteria for conformity

The luminaire 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.

7.4 Routine Tests:

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

7.5 Test Scheme:

Sl. No.	Description of test	Clause no.	Prototype Test	Type Test	Acceptance Test	Routine Test
1	Visual and Dimensional check	8 (i)	Y	Y	Y	Y
2	Checking of documents of purchase of LED	8 (ii)	Y	Y	Y	Y
3	Resistance to humidity	8 (iii)	Y	Y	-	-
4	Insulation resistance test	8 (iv)	Y	Y	Y	Y
5	HV test	8 (v)	Y	Y	Y	Y
6	Over voltage protection	8 (vi)	Y	Y	Y	Y

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7	Short circuit protection	8 (vii)	Y	Y	-	-
8	Surge protection	8 (viii)	Y	Y	-	-
9	Reverse polarity	8 (ix)	Y	Y	Y	Y
10	Temperature rise Test	8 (x)	Y	Y	-	-
11	Ra (Colour Rendering Index) measurement test	8 (xi)	Y	Y	-	-
12	Lux measurement	8 (xii)	Y	Y	Y	Y
13	Fire retardant Test	8 (xiii)	Y	Y		
14	Test for IP65 protection	8 (xiv)	Y	Y	-	-
15	Vibration and Shock test	8 (xv)	Y	-	-	-
16	Environmental tests	8 (xvi)	Y	-	-	-
17	Life test	8 (xvii)	Y	-	-	-
18	EMI/EMC Test	8 (xviii)	Y	-	-	-
19	Endurance Test	8 (xix)	Y	Y	-	-
20	Safety	8 (xx)	Y	-	-	-

8.0 Method of Testing

i) Visual and Dimensional Check:

The unit shall be checked visually for all dimensions as per approved design and drawing. General workmanship should be good; all the components properly secured and sharp edges shall be rounded off. Check the marking and quality of the workmanship visually. Check the rating and make of electronic / electrical items.

ii) Checking of Purchase documents of LED

Document of purchase of LED lamps from the approved sources viz. NICHIA/OSRAM/SAMSUNG/LUMILEDS/CREE/AVAGO along with validation of driver controller card and luminaire by the manufacturer of the LEDs to ascertain the life of the LEDs shall be checked.

iii) 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 to 48°C for 7 days and examining it for any sign of deterioration and corrosion of metal surface.

iv) Insulation resistance test

The insulation resistance of the unit between earth and current carrying parts shorted together shall not be less than 2 MΩ when measured with 500V megger before and after HV test.

v) 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 between the live parts and frame. There shall not be any kind of break down, flashover or tripping of supply.

vi) Over voltage protection

The Luminaire shall withstand at 200V dc/ac for two minutes.

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vii) Short circuit protection

The luminaire shall withstand Short circuit protection. The luminaire shall work normal after re-setting.

viii) Surge protection

It shall withstand a surge of 3kV \pm 3% for 50 microseconds \pm 20 % at the input terminals for all types of luminaire.

ix) Reverse polarity

The Luminaire 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 Luminaire shall operate in a normal way.

x) Temperature rise Test:

Temperature rise Test shall be conducted at 90VDC with full load. The temperature rise shall be recorded by temperature detectors mounted at the specified reference points on the body of semiconductors, capacitors and other components as agreed between purchaser and manufacturer. The maximum-recorded temperature under worst conditions shall be corrected to 55°C and compared with maximum permissible temperature (for power devices at junction). The thermal margin available shall be compared with the safety margin declared by the manufacturer. Under loading conditions as specified above, the corrected temperature of the power devices shall have a safety margin of minimum 10°C.

Temperature at junction shall not exceed 125°C when corrected to 55°C. The Luminaire shall also be subjected for short time rating after continuous loading to ensure the temperature rise is within the permissible limit. The maximum temperature rise of the electronics devices on the PCBs shall not be more than 20°C.

xi) 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 Annex. D of IEC 60081.

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

Certificate based on relevant standards to this measurement shall be obtained from the OEM.

xii) Lux measurement

Lux measurement with the help of Lux meter shall be carried out at a distance as shown in clause no. 6.12 above. Value obtained shall not be less than the, Lux specified in clause no. 6.12 of the specification.

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xiii) Fire retardant Test

Fire Retardant test shall be conducted as per UL-94 V0 for the insulating material used in the luminaire.

xiv) Test for IP protection

This test shall be conducted as per IEC 60529 except berth reading light.

xv) Vibration and Shock Test

The complete unit cubicle together with its mounting arrangements (including shock-absorbing devices, if provided) shall be subjected to the vibration and shock testing (for category B2) as per latest IEC 61373.

xvi) Environmental tests (On PCB Driver cards)

The Luminaire shall meet the following tests as prescribed in IEC – 60571:

- a) Dry heat test.
- b) Damp heat test
- c) Test in corrosive atmosphere
- d) Combined dust, humidity and heat test
- e) Burn-in test as per RDSO specification no. ELRS/SPEC/S1/0015-OCT, 2001 (Rev.0) for 45 hours

xvii) Life Test

- The lumen maintenance & life test shall be as per LM80/IS 16105 and TM-21 respectively.
- The lumen maintenance of the lamp shall not be less than 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 (if). The initial lumens will be taken after 100 hours aging. Certificate from OEM of LED manufacturer shall be submitted.

xviii) EMI/EMC Test

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

xix) Endurance Test

The Luminaire shall be kept “ON” with input voltage of 140VDC for 200 hours. After this the Luminaire is subjected to 20,000 cycles of “ON” and “OFF”, each cycle consisting of 3 seconds “ON” and 10 seconds “OFF” period. Luminaire should survive this test. Test is to be continued for one lakh cycles, followed by performance test.

xx) Safety:

The complete Luminaire unit, LED and driver shall comply with the safety requirements as per IEC mentioned in clause no. 3.0 above.

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9.0 MARKING:

9.1 The following information shall be distinctly and indelibly marked on the housing:

- Indian Railways Insignia
- Year of manufacture/Batch Number/ Serial Number (MMYY/XX/ABCD)
- Name of Manufacturer
- Rated watt and voltage (Input)
- Rated watt- Output

10.0 ISO CERTIFICATION:

Firm shall possess the ISO certification for design, development, manufacturing and supply of the complete Lighting Unit.

11.0 ELIGIBILITY CRITERIA

- The manufacturer shall have minimum three years experience in design, manufacturing, installation and commissioning of different type of LED based luminaire.
- The manufacturer should have technical collaboration / MoU with the LED manufacturer for supply of high power LEDs and know-how for adequate thermal management to ensure minimum guaranteed performance as given in the specification, the selection procedure for selecting right type of LEDs for such application.
- The MoU should also indicate the Quality Assurance Plan (QAP) for handling, storage and life cycle test of the LED proposed to be used.
- 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 Production Units.

12.0 GUARANTEE

The Luminaire shall have replacement guarantee for satisfactory performance and manufacturing defects for a period of 60 months from the date of commissioning or 72 months from the date of supply whichever is earlier.

13.0 APPROVAL

- 13.1 While seeking approval, the firm shall submit a sample to the Production Unit along with test results, circuit diagrams and dimensions drawing of the Luminaire. The prototype testing shall be carried out at manufacturer's work.
- 13.2 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.
- 13.3 Final approval is subject to field trials for a period of three months for performance / lumen measurement of the luminaire with compare to test results during prototype.

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13.4 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 i.e. Production Units approval or using components of inferior specification/quality compromising with the reliability.

14.0 DETAILS OF ESSENTIAL INFRASTRUCTURE

14.1 The following facilities/machinery and plant are considered essential for manufacturing of quality and reliable product:

- 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 machine for surface mounted devices with in-circuit testing facility.

All the above facilities are considered essential and shall be verified by Production Units as the case may be before considering the firm as a developmental source. However, the firm may outsource only LEDs/ PCB assembly and soldering with the sub vendor at the developmental stage, who 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.

14.2 MOCK UP Facilities for uniformity and lux level

Actual of the coach compartment /cabin (similar to at least two cabins of 3-tier AC coach) and lavatory etc shall be arranged by the manufacturer for measurement of lux level and uniformity level. Achievement shall be submitted along with the test data of prototype sample being offered for witnessing the prototype tests.

15.0 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 200 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,

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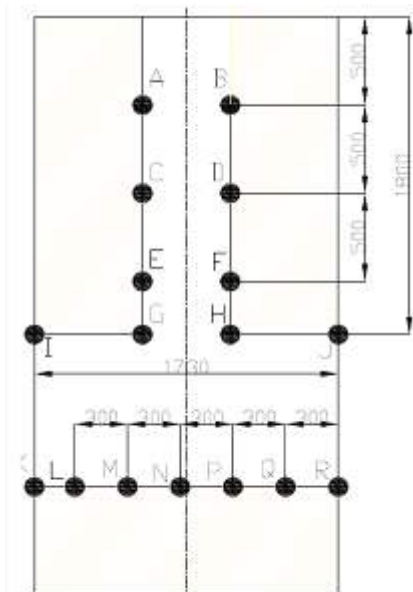
- Non-contact digital thermometer, contact less thermometer and room thermometer.
- Digital multimeter.
- Digital Weighing machine.
- Complete test bench for measuring the different parameters as mentioned in the specification.
- Milli-ohm/Micro-ohm meter
- Lux meter.
- Storage type Oscilloscope.
- Power analyzer
- Chroma meter
- 8-channel Digital temperature scanner
- Spectrometer MAS40 for single LED testing
- Computerised test bench for PCB testing
- Computerised test setup for electrical parameter of Light testing
- Fluctuation testing during Burn in for one hour at 2Hz

All the above facilities are considered essential at the developmental stage itself and shall be verified by Production Units before considering the firm as a developmental source

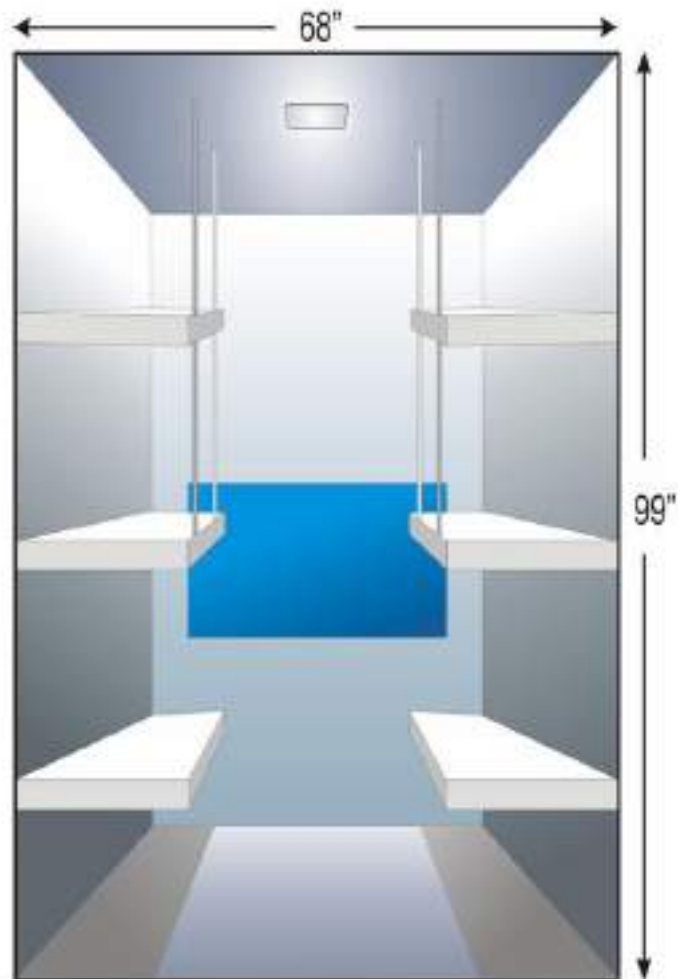
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Annexure –1

GENERAL LAYOUT OF COUPE (ACCN)



Measurement location	Lux measurement		
	Lower berth	Middle berth	Upper berth
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			
L			
M			
N			
P			
Q			
R			
Linearity			
Uniformity			



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Annexure-2

LUMINAIRE WISE DATA TO BE FURNISHED BY THE MANUFACTURER WHILE OFFERING FOR WITNESSING THE PROTOTYPE TESTS

1.0 CUP SPECIFICATION:

- a. Basic Mechanical dimension :
- b. Electrical and control :
- c. Light output :
- d. Cup's raw specification with operating characteristics :
- e. Mechanical characteristics of cup :
- f. Emission Spectrum :
- g. Spectral Intensity Distribution :
- h. I_f vs Luminous Flux :
- i. I_f vs Correlated Color Temperature :

2.0 ILLUMINATION CHARACTERISTICS: $T_j = 25^\circ\text{C}$, $I_t = 350\text{mA}$

Sl.No.	Parameter	Absolute Values		
		Min.	Typical	Max.
1	Luminous Flux (lm)			
2	Luminous Intensity (cd)			
3	Viewing Angle (Degree)			
4	Luminous Efficiency(lm/w)			
5	Spectral Length (nm)			
6	Dominant Wavelength (nm)			
7	FWHM (nm)			
8	Color temperature (K)			
9	Purity (%)			
10	Colour Rendering Index			
11	CIE Coordinates	Refer the chromaticity diagram		

3.0 ELECTRICAL CHARACTERISTICS:

Sl. No.	Parameter	Absolute value		
		Min.	Typical	Max.
1	Forward Voltage (V)			
2	Pulse forward current (mA)			
3	Reverse Leakage current (μA)			
4	Reverse Voltage (V)			
5	Storage Temperature ($^\circ\text{C}$)			
6	Thermal Resistance ($^\circ\text{C/W}$)			

(Pulse width 1ms with duty cycle 1/16)

3.1 Forward voltage vs Normalised V_f

3.2 I_f vs I_r

4.0 BIN RANKING : $T_j = 25^\circ\text{C}$, $I_f = 350\text{mA}$

Sl. No.	Rank	Forward Voltage V_f (Volts)		Luminous Flux ϕ_v, I_m	
		Max	Min	Max	Min
1	Rank WD_1				
2	Rank WD_2				

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3	Rank WD ₃				
4	Rank WD ₄				

5.0 **COLOR RANKING** : T_j = 25°C, I_t = 350 mA

Sl. No	Rank WD ₁ , WD ₂ , WD ₃ , WD ₄				
X					
y					

6.0 LED CUP DEGRADATION CHARACTERISTICS

- Flux measurement in lumens from Zero Hours to 1800Hrs at every 100 Hrs.

6.0 RELIABILITY REPORT :

a. Summary of results for day light cups

Sl.No	Stress	DUT	Conditions	Duration	failures
1	Operating life	5	I _f = 50mA, T _j = 80°C	1800 Hrs	
2	Humidity	8	I _f = 100mA, T _j = 100°C, RH = 85%	4058 Hrs	
3	Temperature cycle	10	T = -40°C to 105°C	1000 Cycle	

b. Operating life: Tested at I_f = 350mA, T_a = 25°C

Sl.No	Condition	Luminous flux (lm)			Color Temperature		
		t-0	t-1800	Δ	t-0	t-1800	Δ
1	Worst						
2	Mean						
3	Best						
4	σ						

7.0 ELECTRICAL SPECIFICATION OF DRIVERS:

DC/DC isolation converters shall intended to provide a step down conversion from 90/140V DC to lower voltage of 12VDC, 24VDC and 30VDC and shall be Variable with constant current of 0.35A to >1.0A .

Sl.No	Product (Luminaire)	Nominal Voltage	Voltage range	Output voltage	Current	Power
1	Cabin	110V DC	90-140VDC			
2	Corridor	110V DC	90-140VDC			
3	Toilet	110V DC	90-140VDC			
4	Entrance/Exit :	110V DC	90-140VDC			

- 8.1 Driver weight :
- 8.2 Driver dimension :
- 8.3 Oscillator frequency :

9.0 PROTECTIONS:

- Input polarity :
- Open circuit and low voltage conditions :
- Short circuit on the output terminals :
- Internal short-circuit (Fuse protection) :
- Lamp failure :
- Overload protection :

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- 10.0 Efficiency :
- 11.0 MTBF :
- 12.0 Dielectric (1500V-50Hz for one minute) :
- 13.0 Insulation resistance :
- 14.0 Operating temperature :

15.0 GENERAL CHARACTERISTIC

- Type of start :
- Internal control :
- Nominal input voltage: 110 Volt DC :
- Input voltage range 90 Volt DC to 140 Volt DC :
- Power 15 Watt maximum :
- Efficiency > 75% :
- CEC > 70% :
- 50,000 hours at 35⁰C(16 hours per day at 340days/year) :
- Operating temperature: -25⁰C to 80 ⁰C :
- Insulation resistance :
- High resistance to vibration :
- IP :
- No Load power losses :
- Output Ripple :
- Line Regulation :
- Load Regulation :
- Weight :
- Dimmable via wireless and manual control :
- Line under voltage and over voltage protection :
- Accurate Over Temperature and Overload protection :
- DON'T not Feedback Compensation :
- Digital Control :
- Auto restart for open protection :
- Hysteretic over temperature protection :
- Self powered :
- Current and voltage feedback provides constant current output and protection disconnected load :
- Operation (kHz) :
- U No load specification :
- Code of conduct of efficiency of external power supply :
- ROHS complaint :
- Remote ON & OFF :
- Warranty :

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Annexure-3

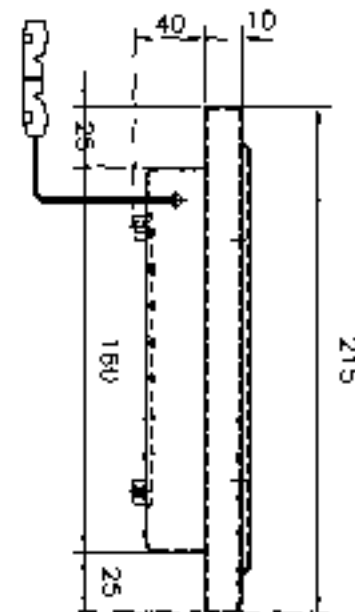
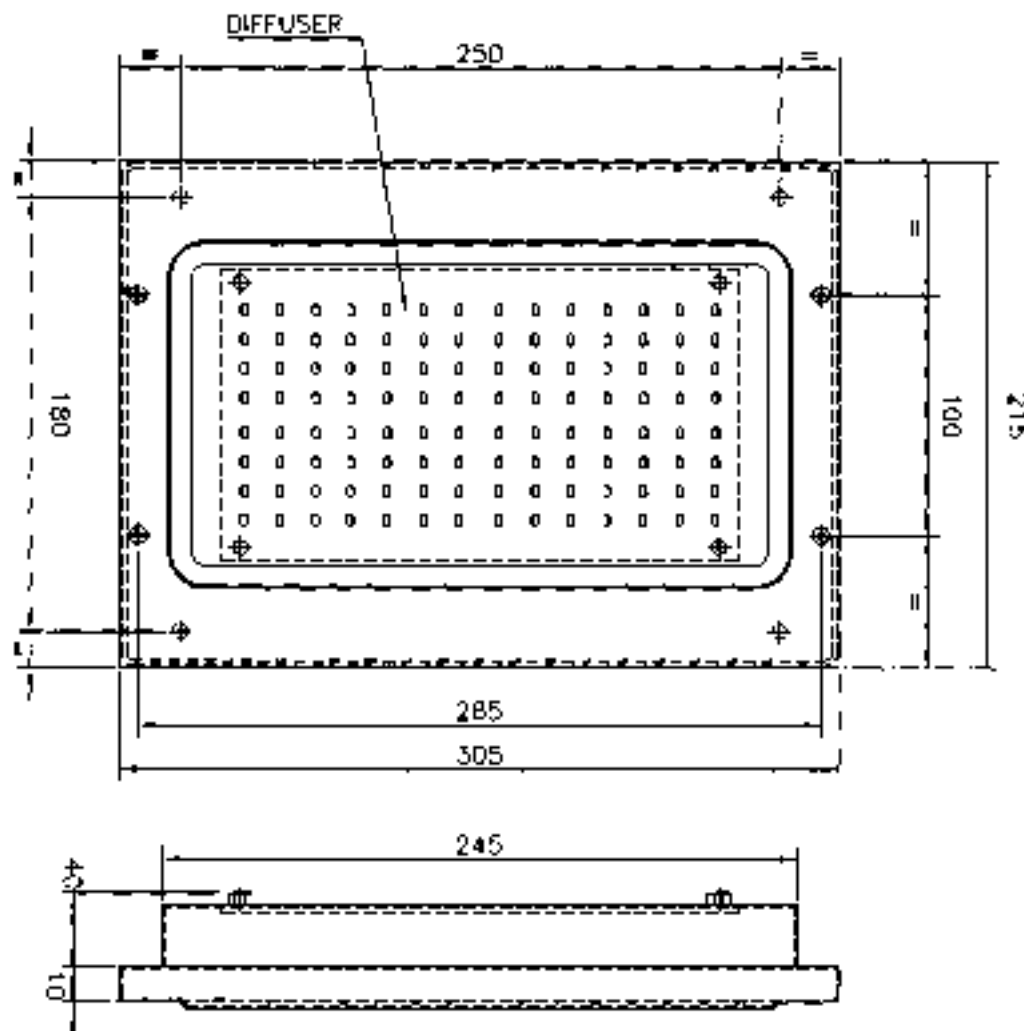
PROPOSED INDICATIVE DETAILS FOR FITMENT OF LUMINAIRE

Sl.No	Type of Fitting	LxWxD	Cut Out Size as per RCF	Mounting Dimensions
1	Passenger Area (Cabin/Corridor)	305x215x40	249x164	250x180
2	Door Way/Gang Way	305x215x40	249x164	250x180
3	Berth Indication Light	184x144x35	144x89	125x120
4	Lavatory / Mirror Light	297x57x85	Panel Mounting	255
5	Berth Reading Light	144x105x47	108x106	125x85
6	Berth Reading Light (Longitudinal)	160x126x63	145x110	140x100
7	Emergency Exit Light Indication	445x80x35	Panel Mounting	425
8	Toilet Indication	255x170x30	Panel Mounting	150x90
9	Passenger Alarm (Coach Indication)	146x80x55	Panel Mounting	102x45
10	SLR (Luggage)	325x150x25	284x104	300x125
11	LHB AC Coach (Cabin)	615x132x28	619x124	441X80
12	LHB AC Coach (Door Way/Gang Way)	615x132x28	619x124	441X80
13	LHB AC Coach (Corridor) with Night Light	615x132x28	619x124	441X80
14.	Entrance Door Way	315X100X60	274X64	250X80
15.	LHB Chair Car	1420X260X30	179 (Chanel)	150x650& 150x550
16.	LHB Chair Car (Dummy Fitting)	185x260x30	179 (Chanel)	135x150
17.	Retro fitment of CFL	243x55x31	-----	227x24
18.	Retro fitment of FL	615x40x40	-----	615x28

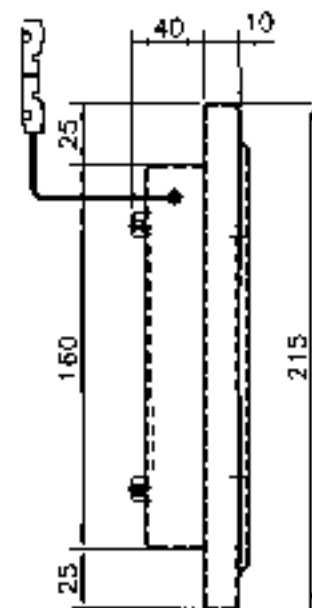
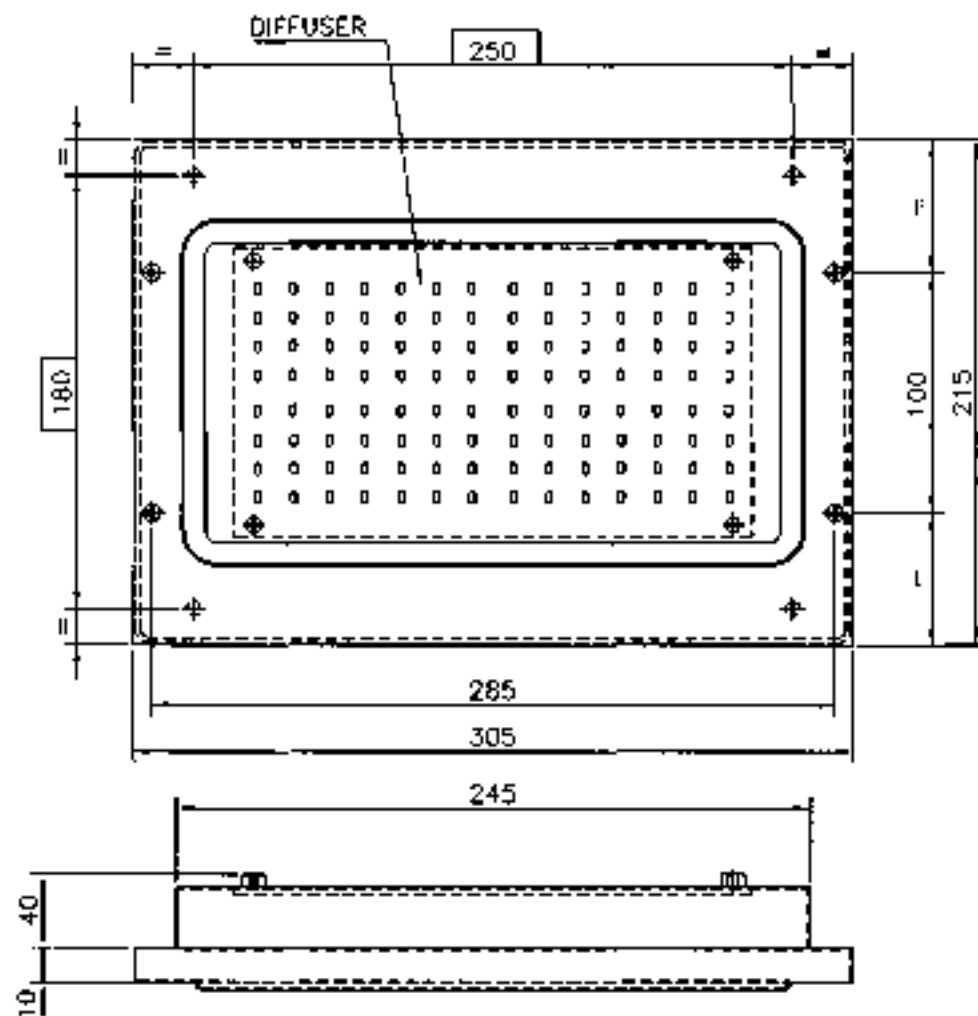
Note:

1. All dimensions are in mm.
2. Dimensions for cut-outs and mounting are indicative. Manufacturers shall verify the dimensions from the Production units/Railways/ Indent placing authorities before regular production.
3. Weight of the fittings shall be 1.5Kgs except the luminaire for LHB and Chair car coaches, for which the weight shall be as minimum as possible.

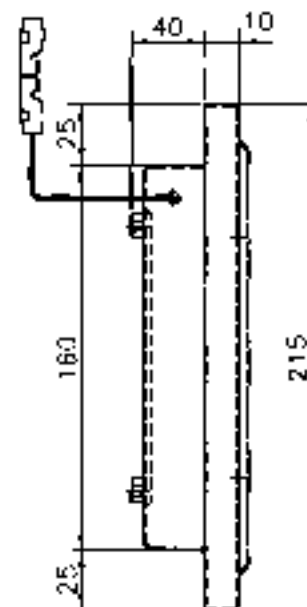
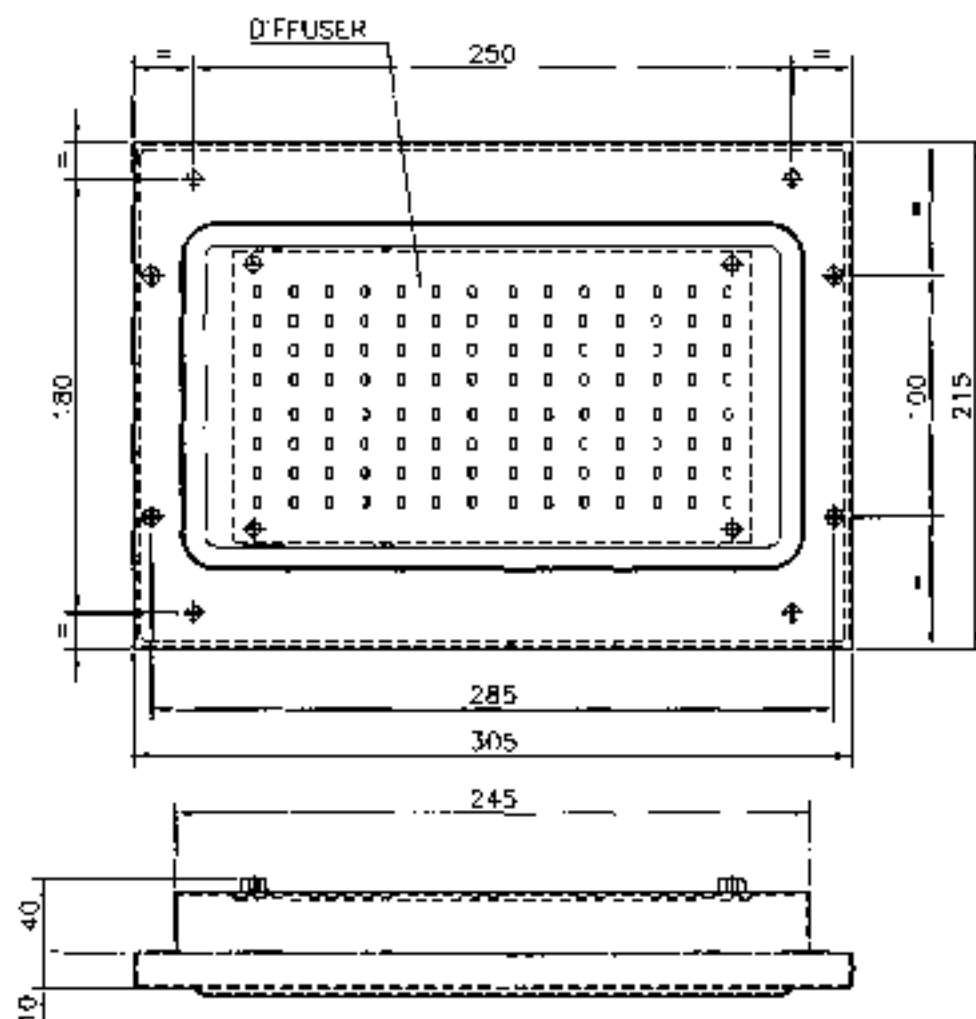
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LED LIGHT FITTING FOR CONVENTIONAL AC & NON AC-COACHES-CABIN/CORRIDOR AREA
TYPE-A (18 WATT)



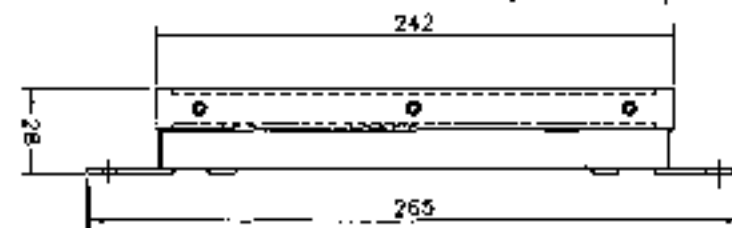
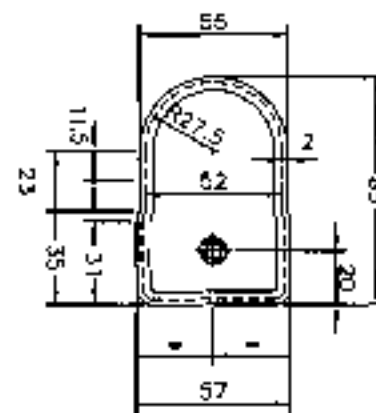
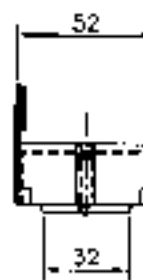
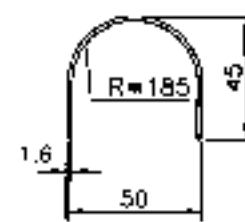
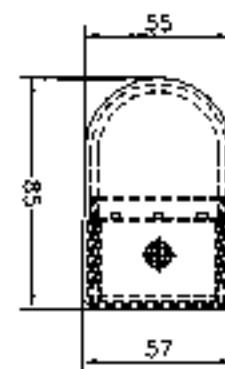
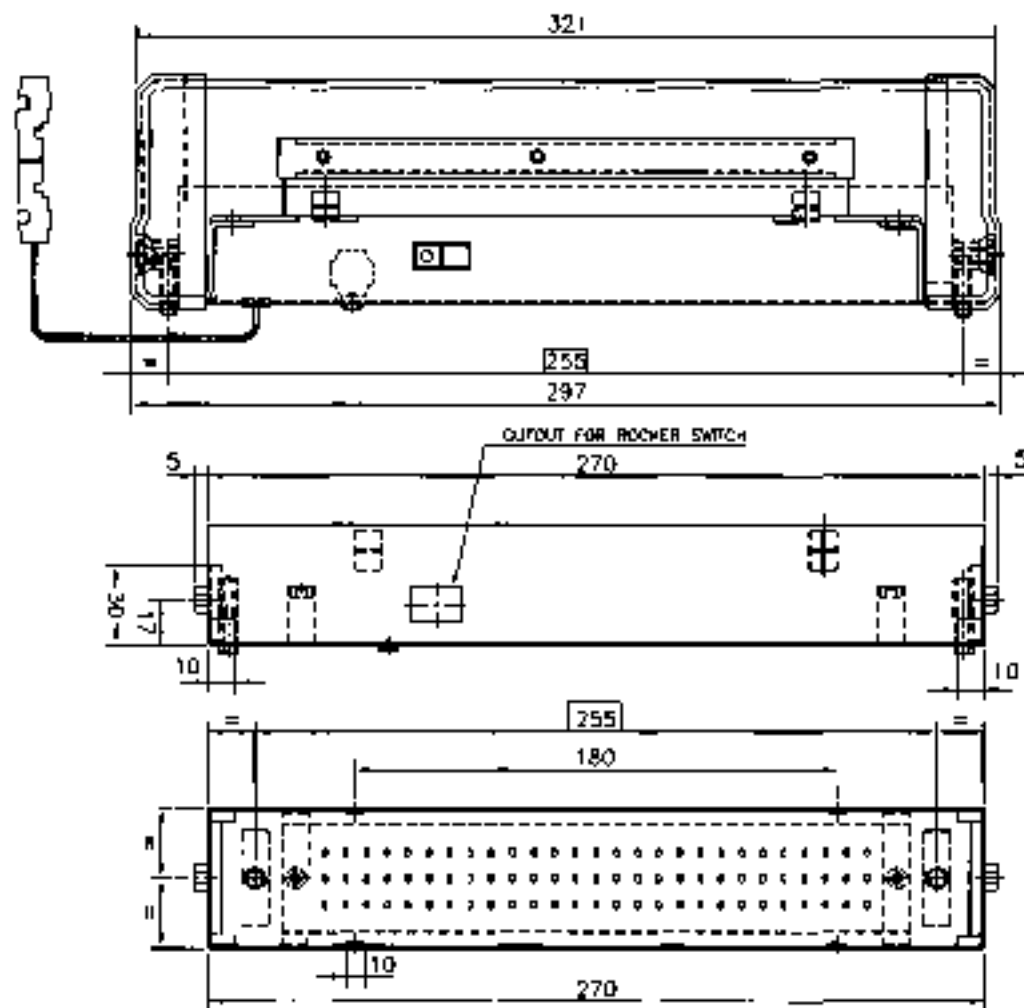
LED LIGHT FITTING FOR DOORWAY & GANGWAY OF AC COACHES/CC
TYPE-B (9 WATT)



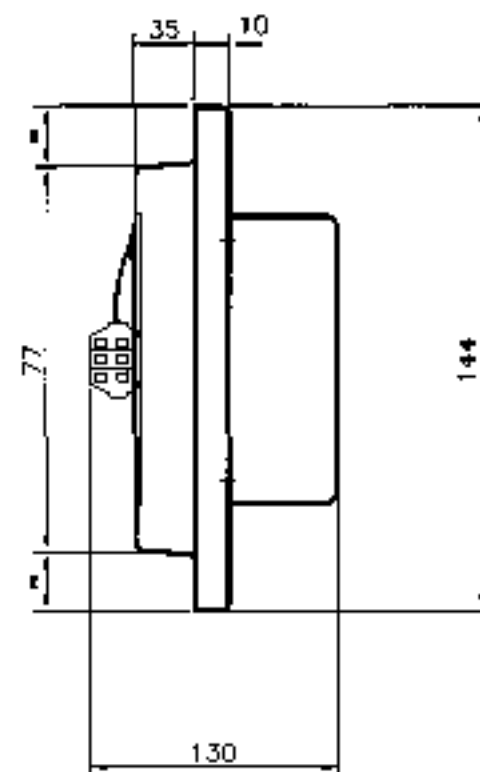
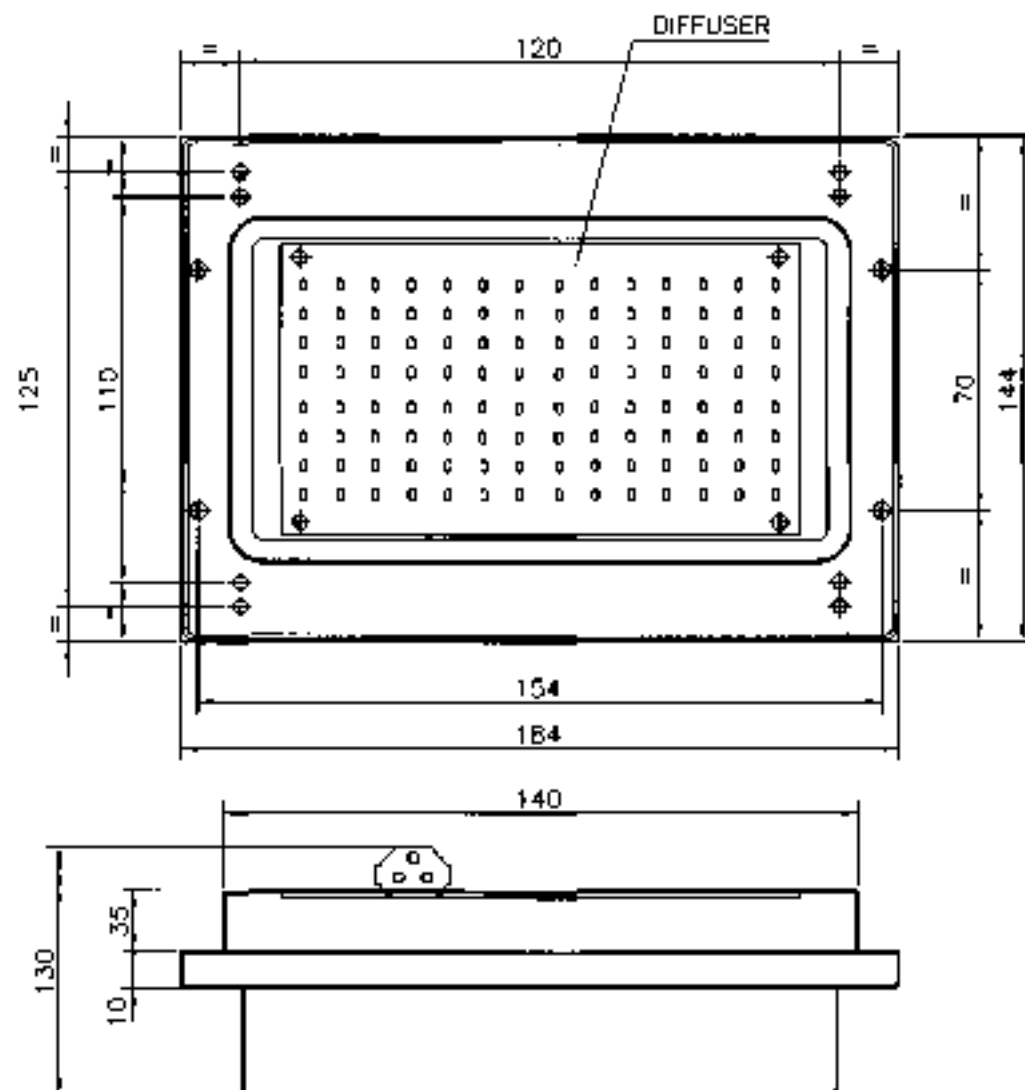
LED LIGHT FITTING FOR NON AC COACHES-DOORWAY & GANGWAY

TYPE-C (5 WATT)

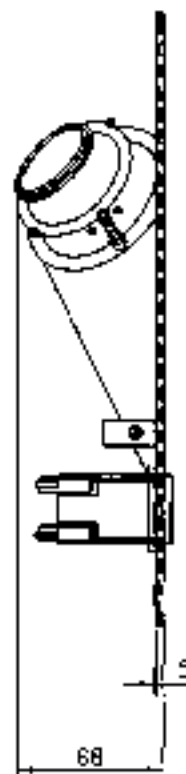
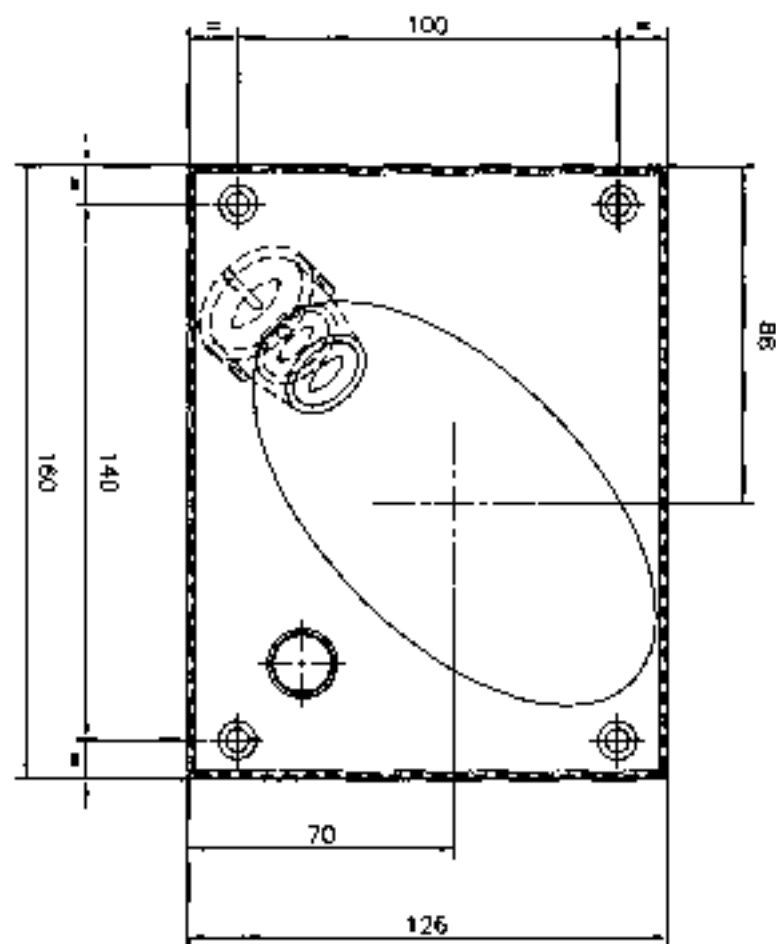
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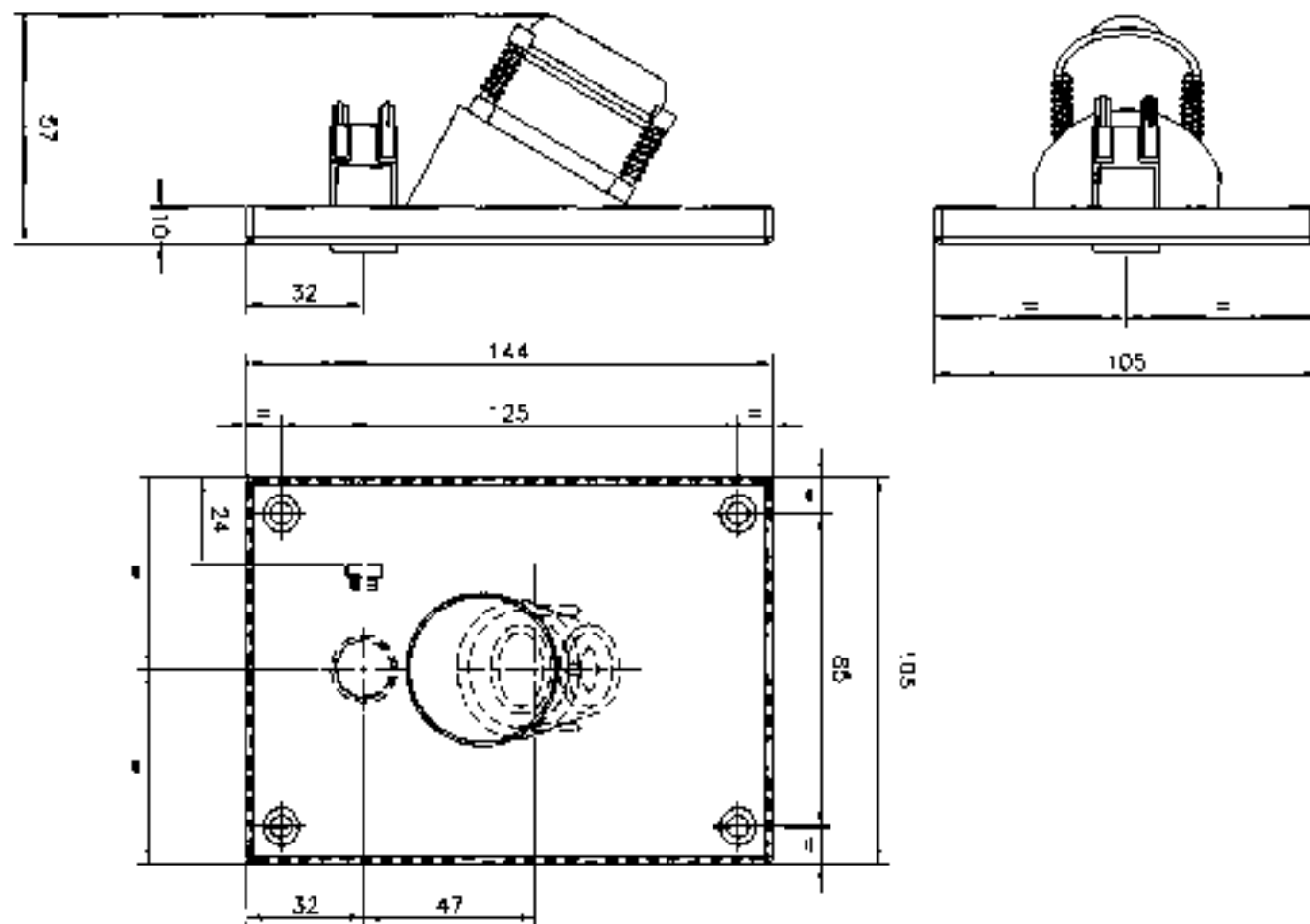
LED LIGHT FITTING FOR MIRROR/LAVATORY
TYPE-D (5 WATT)
page 93 of 115



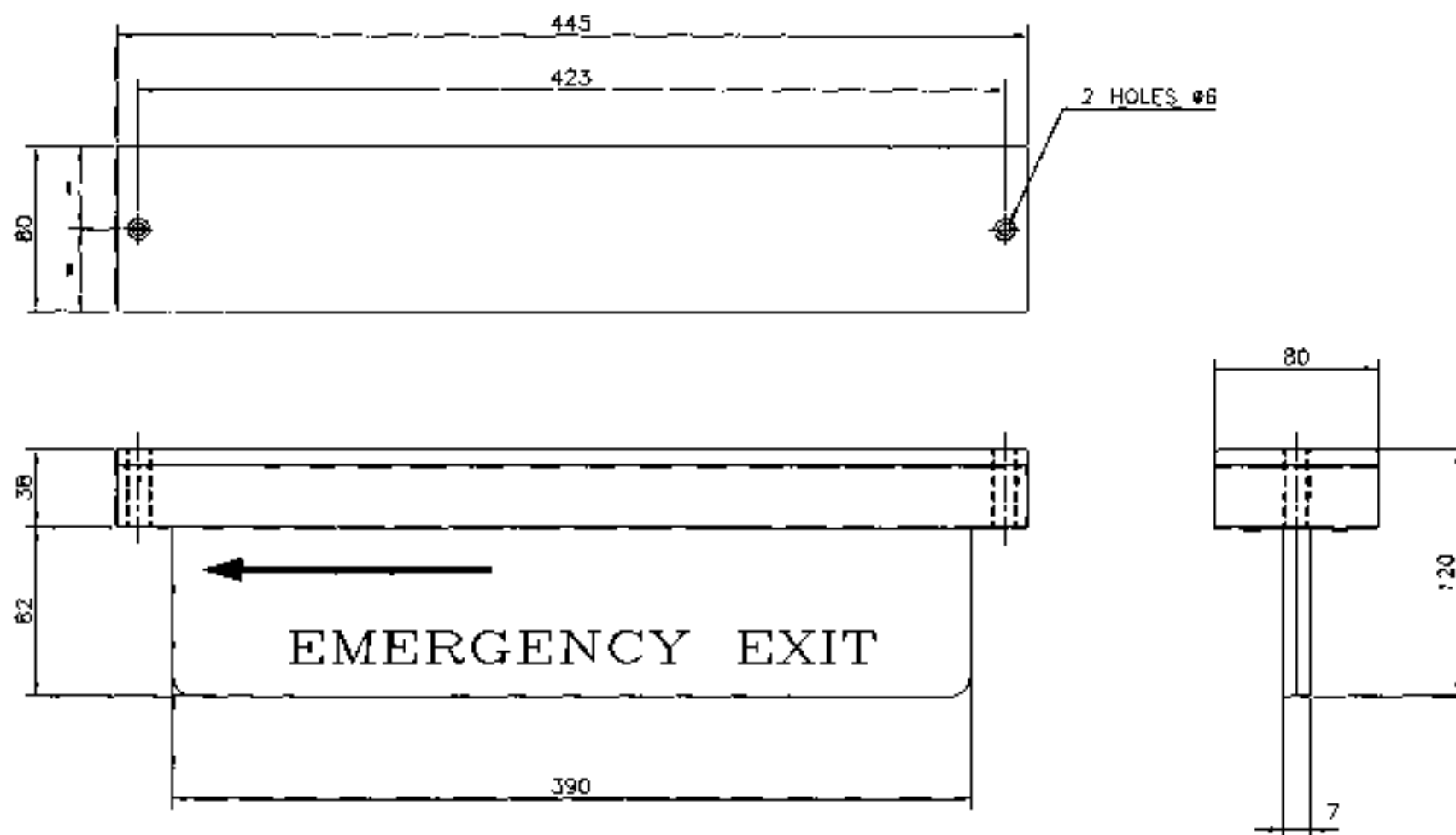
LED LIGHT FITTING FOR NIGHT LIGHT WITH BEARTH INDICATION- CORRIDOR AREA



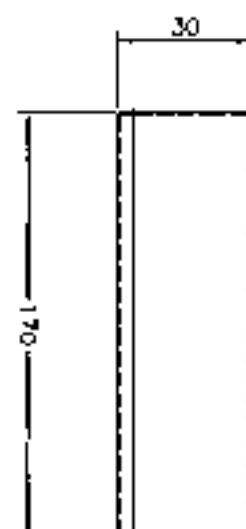
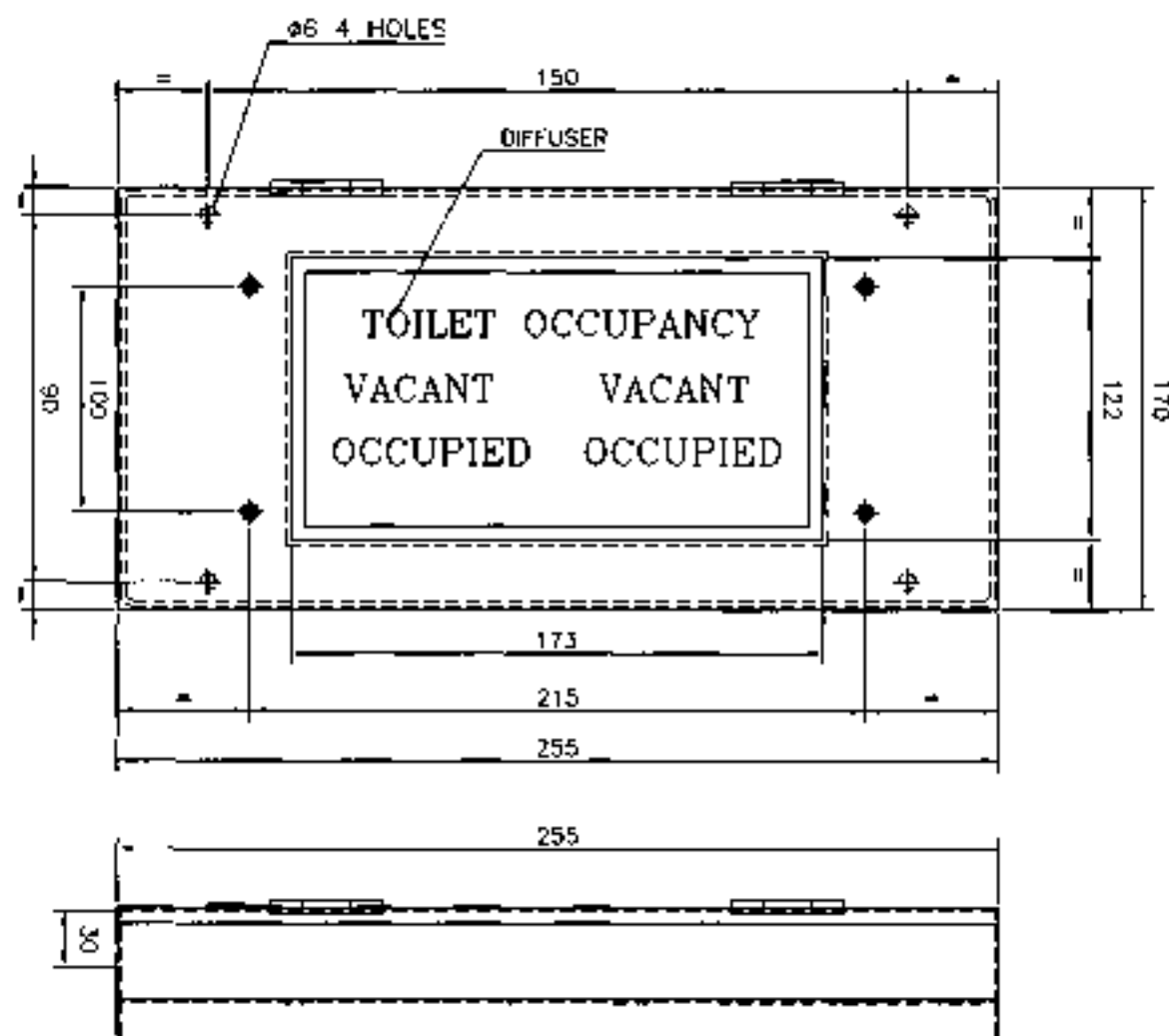
LED LIGHT FITTING FOR BERTH READING LIGHT (LONGITUDINAL)
TYPE-F1 (2WATT)



LED LIGHT FITTING FOR BERTH READING LIGHT (COMMON)
TYPE-F2 (2 WATT)

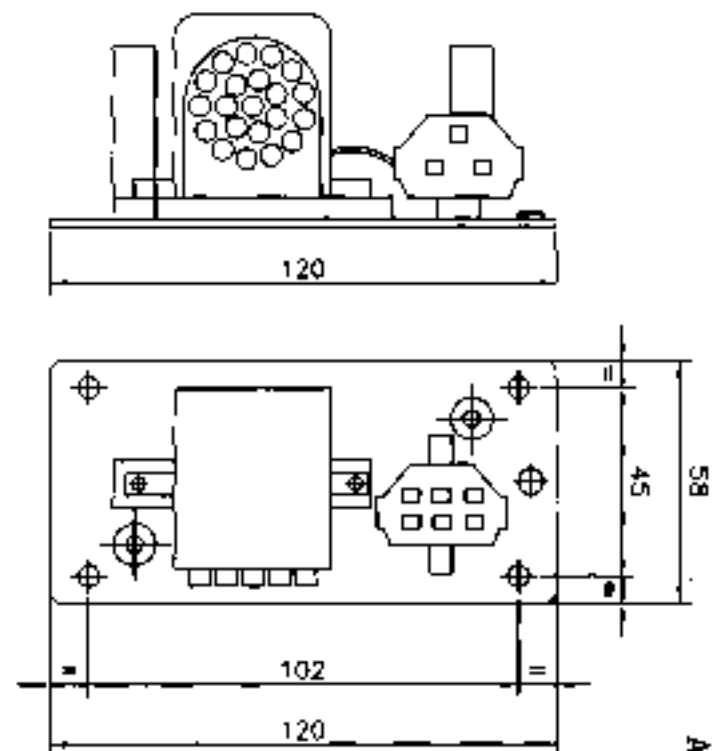
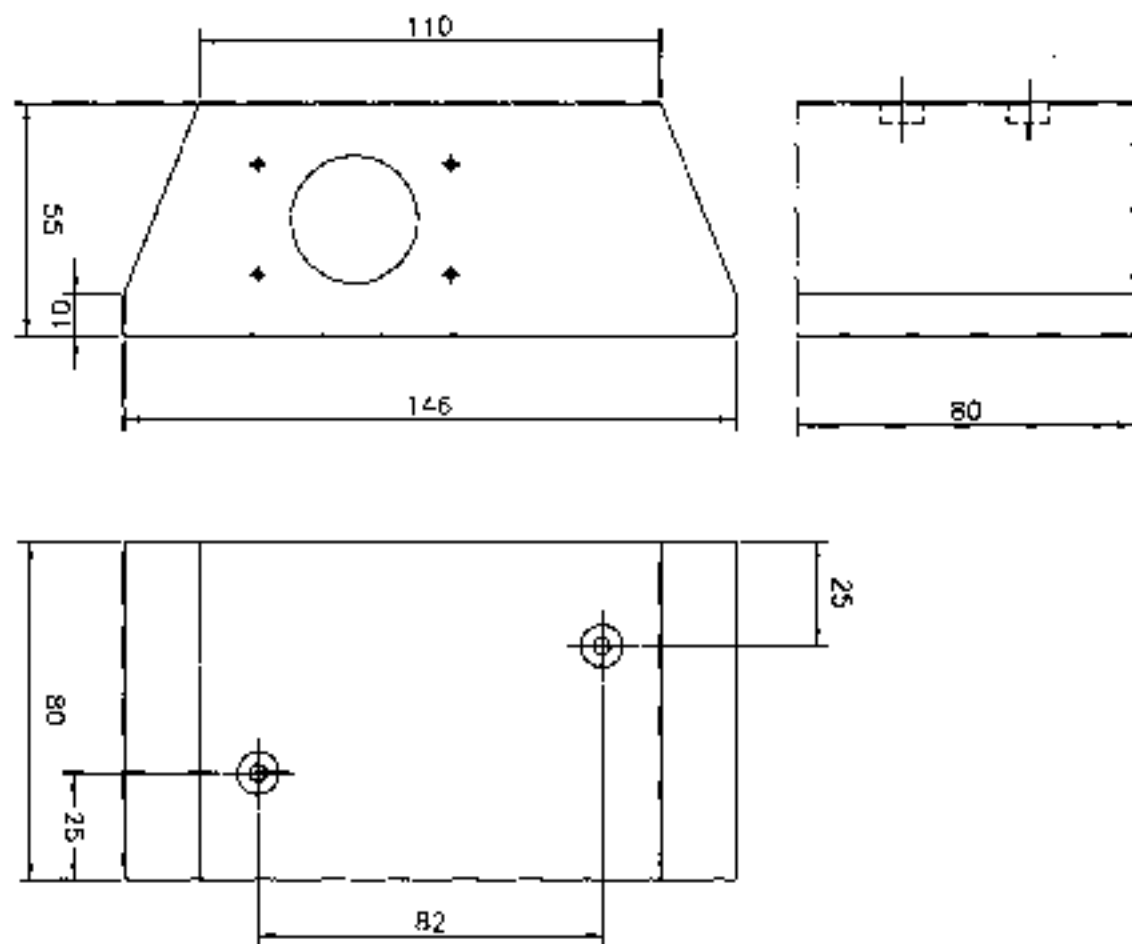


LED LIGHT FITTING FOR EMERGENCY EXIT WINDOW
TYPE-G (1 WATT)



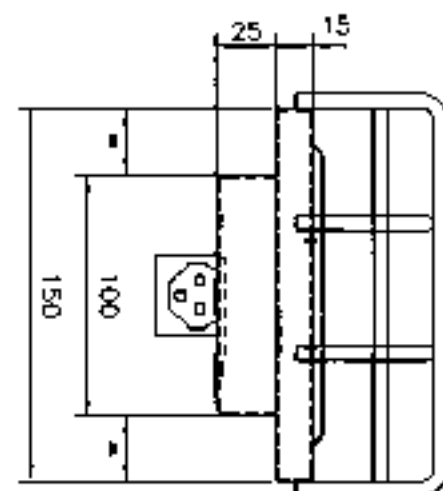
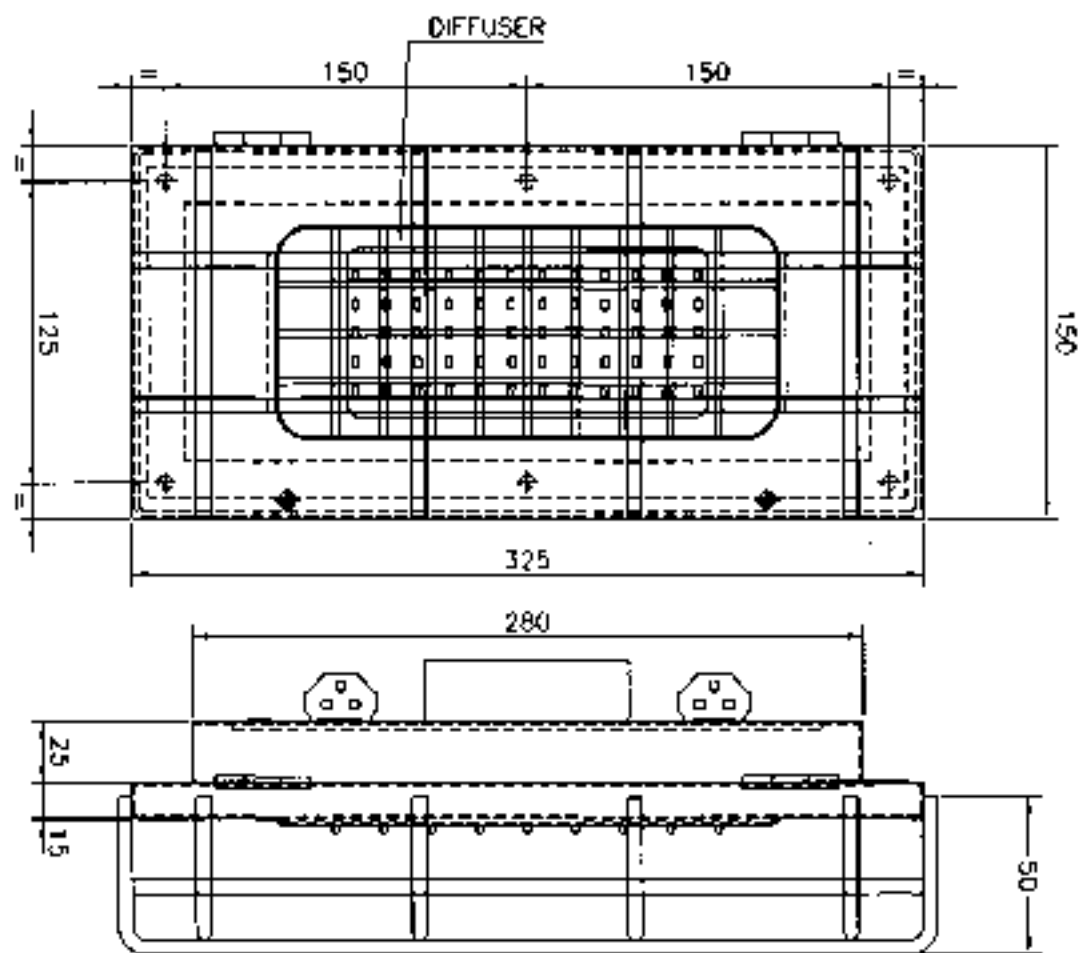
LED LIGHT FITTING FOR TOILET INDICATION IN AC COACHES

TYPE-H (1 WATT)

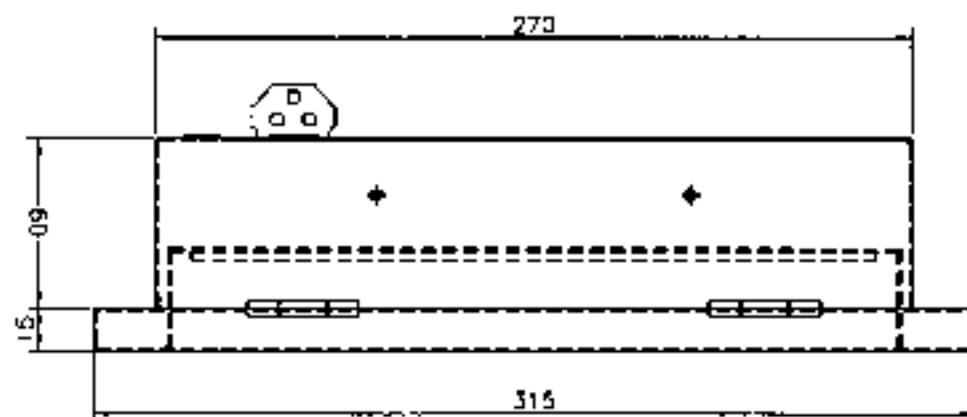
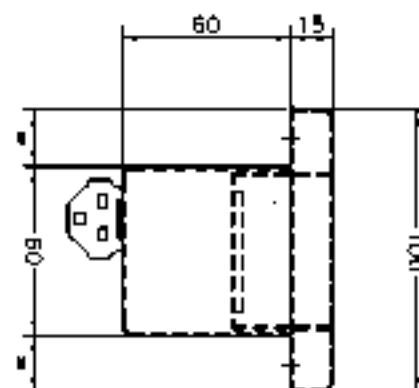
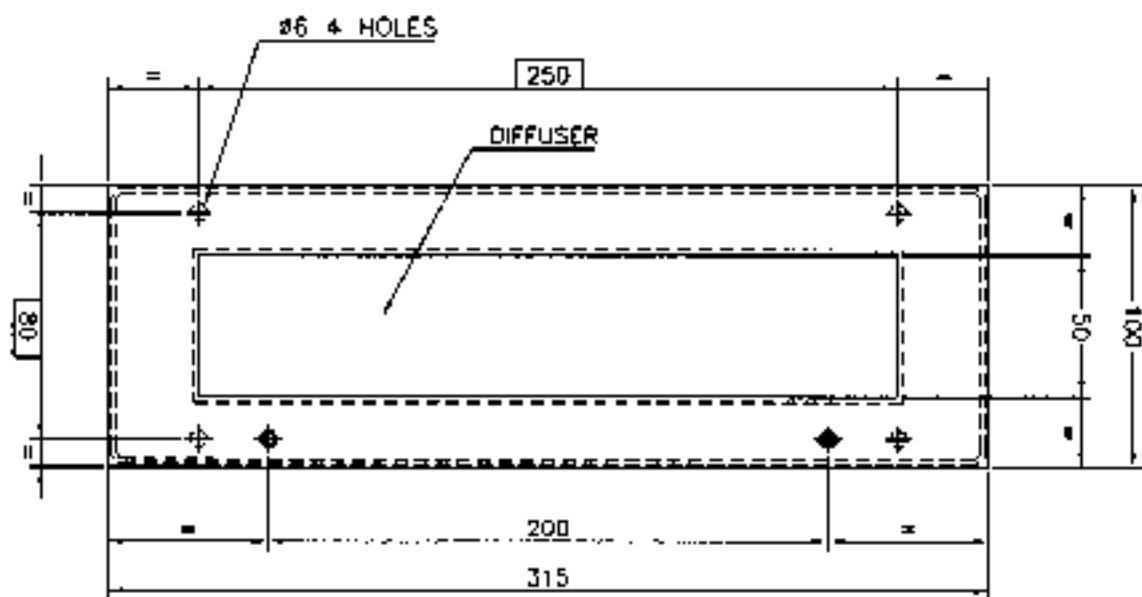


LED LIGHT FITTING FOR PASSENGER ALARM CHAIN INDICATION
TYPE-I (5 WATT)

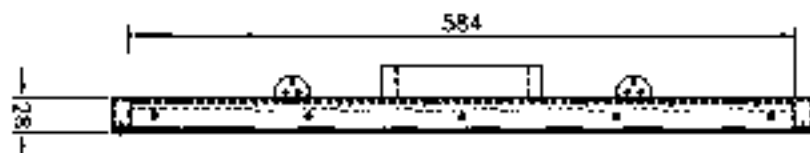
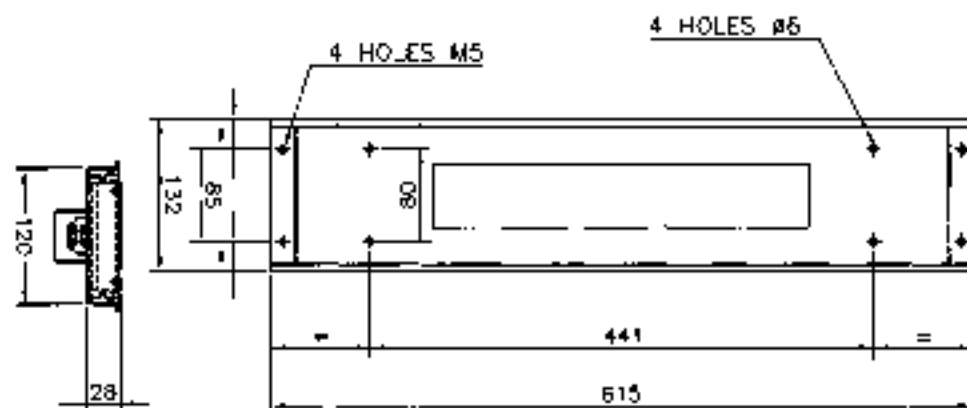
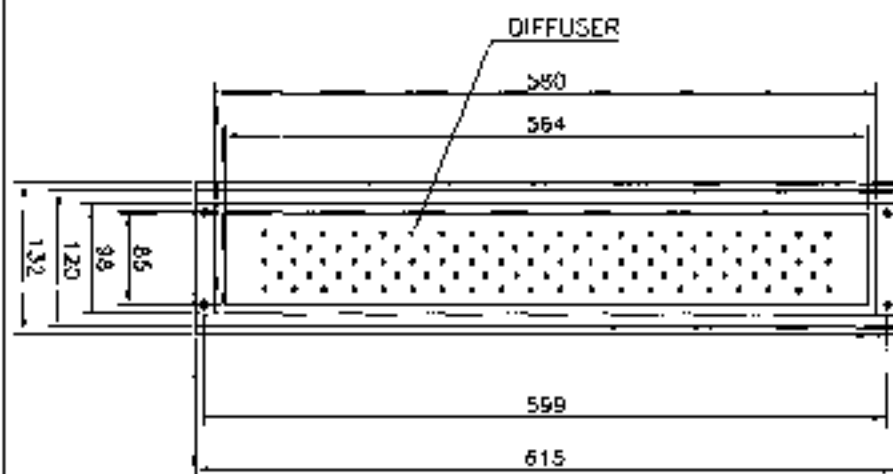
ANNEXURE-13



LED LIGHT FITTING FOR SLR COACHES
TYPE-J (5 WATT)

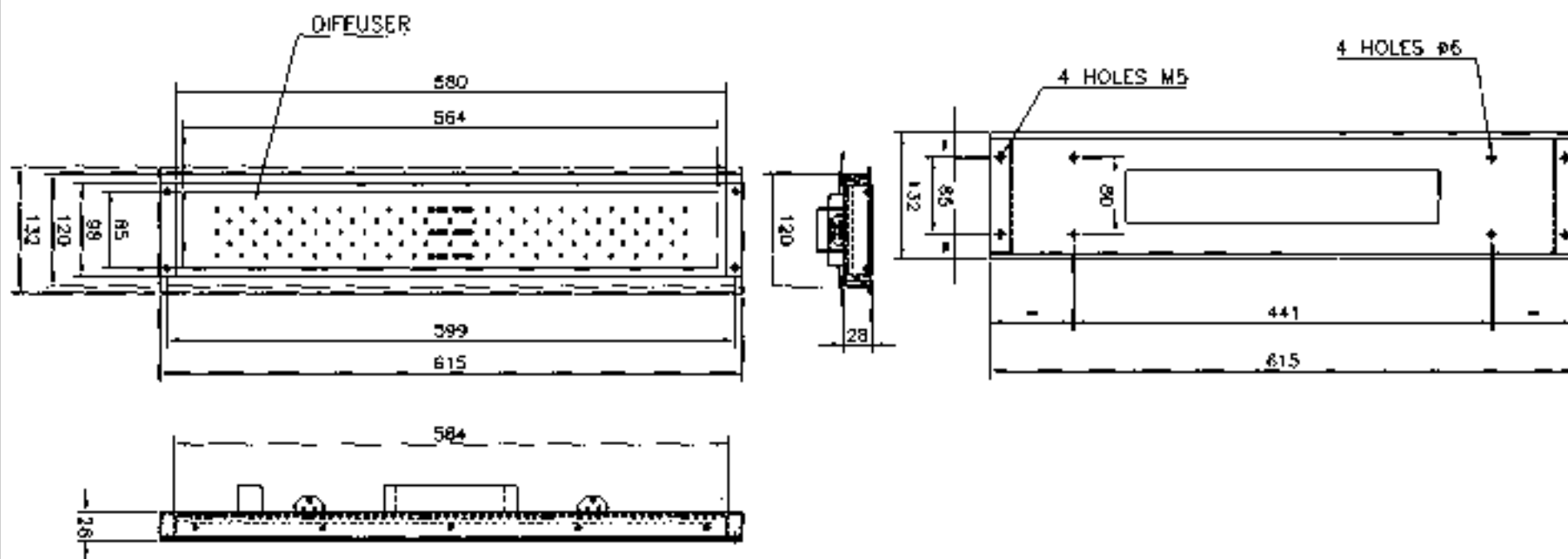


LED LIGHT FITTING FOR ENTRANCE DOORWAY
TYPE-K (3WATT)

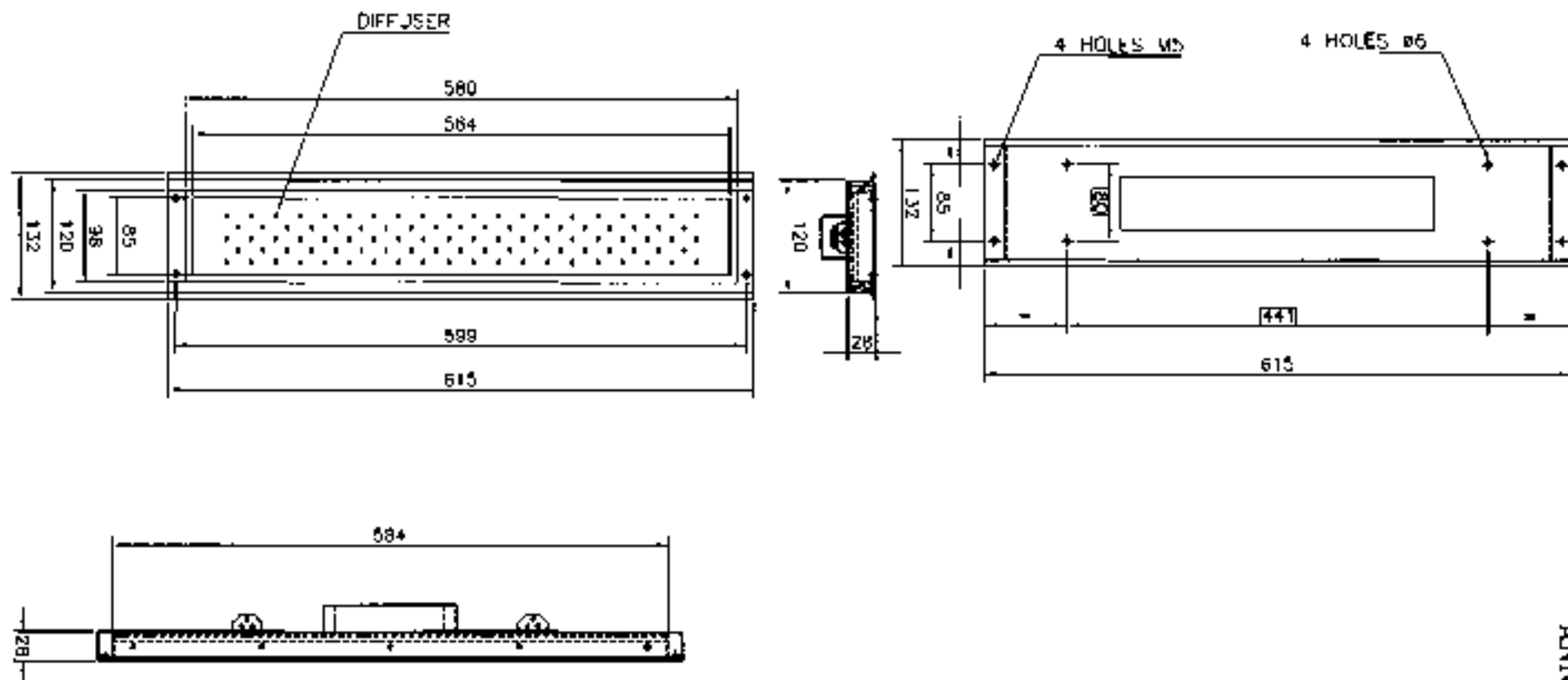


LED LIGHT FITTING FOR LHB TYPE COACHES- PASSENGER AREA (CABIN)
TYPE-I. (18 WATT)

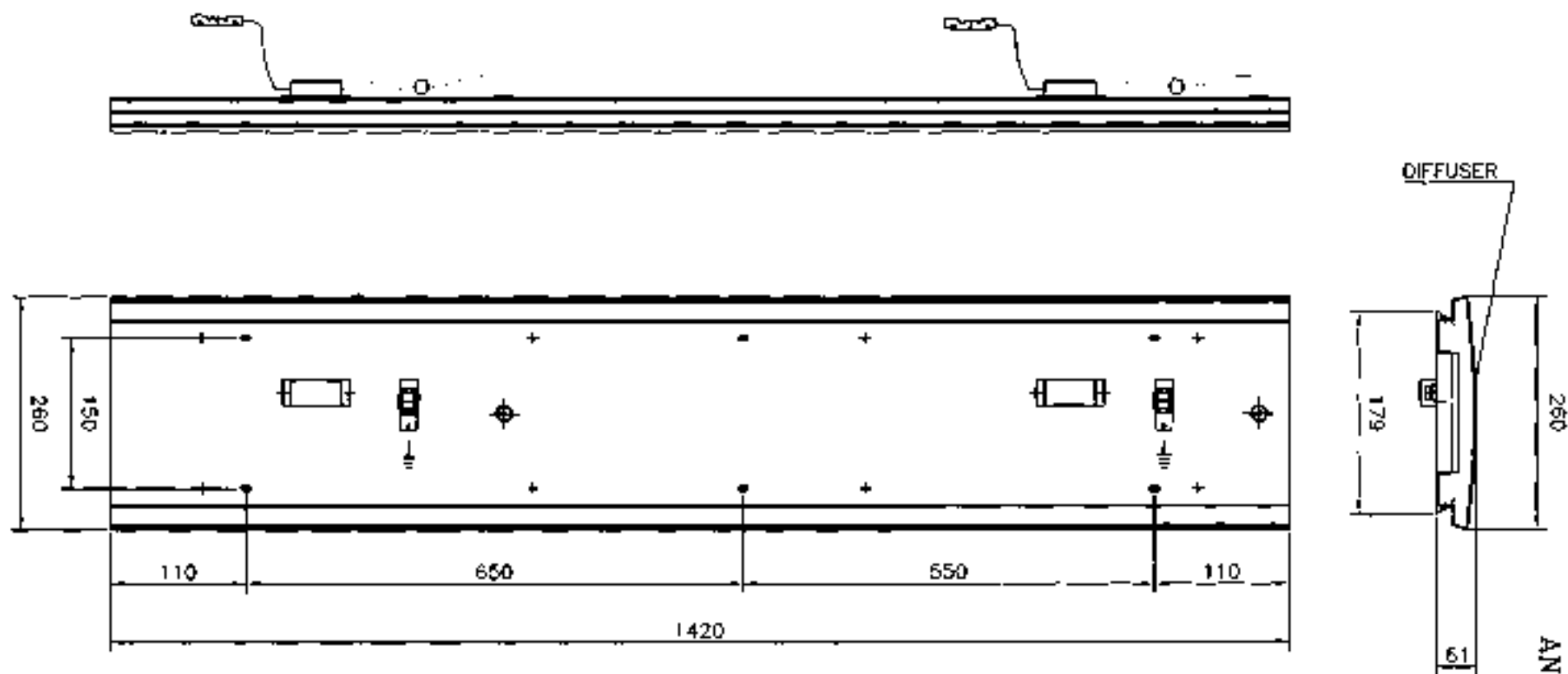
ANNEXURE-16



LED LIGHT FITTING FOR LHB TYPE COACHES WITH NIGHT LIGHT- CORRIDOR AREA
TYPE-M (9WATT+1WATT)

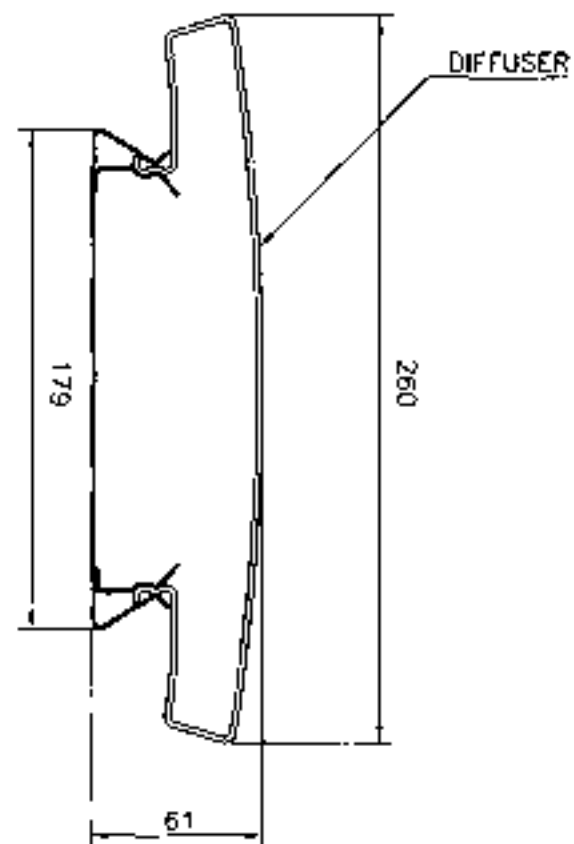
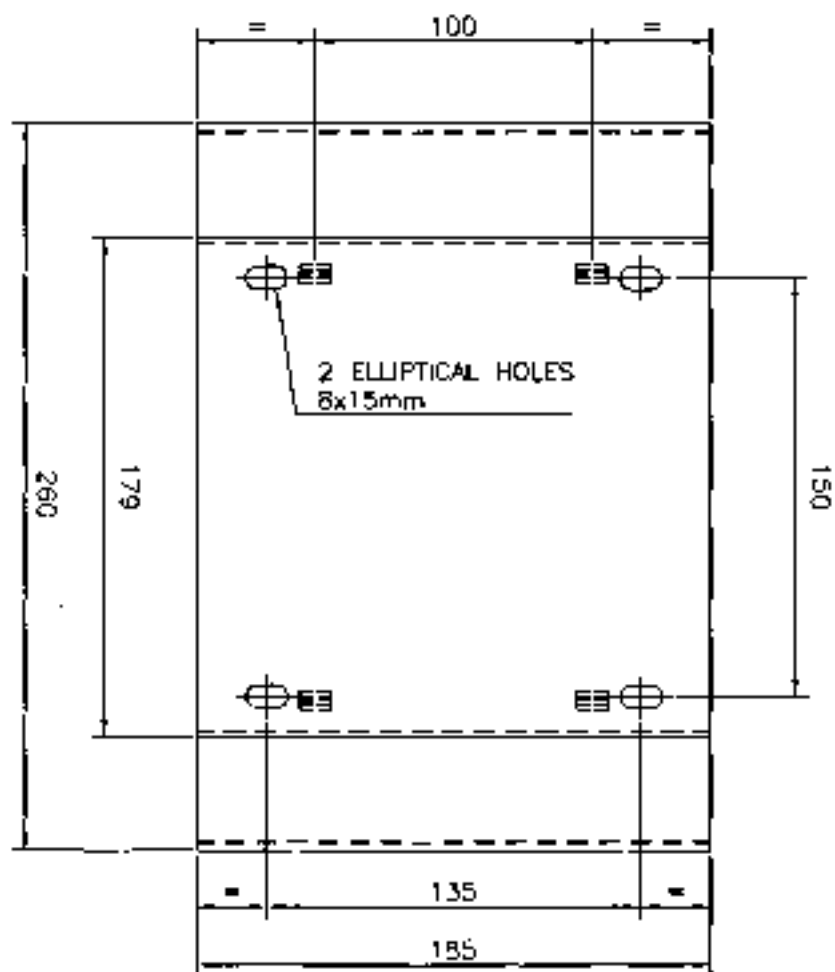


LED LIGHT FITTING FOR LHB TYPE COACHES DOORWAY/GANGWAY AREA
TYPE-N (9 WATT)

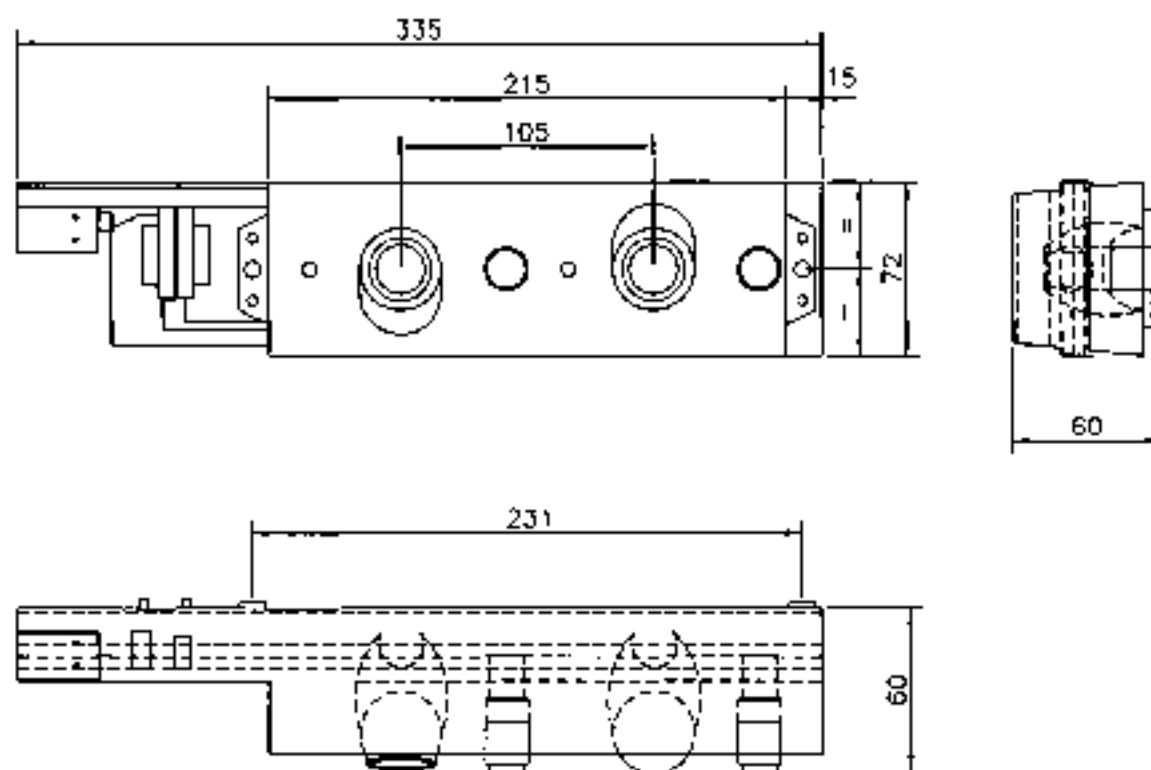


LED LIGHT FITTING FOR CHAIR CAR FOR LHB & CONVENTIONAL AC COACHES
TYPE-O (18 WATT)

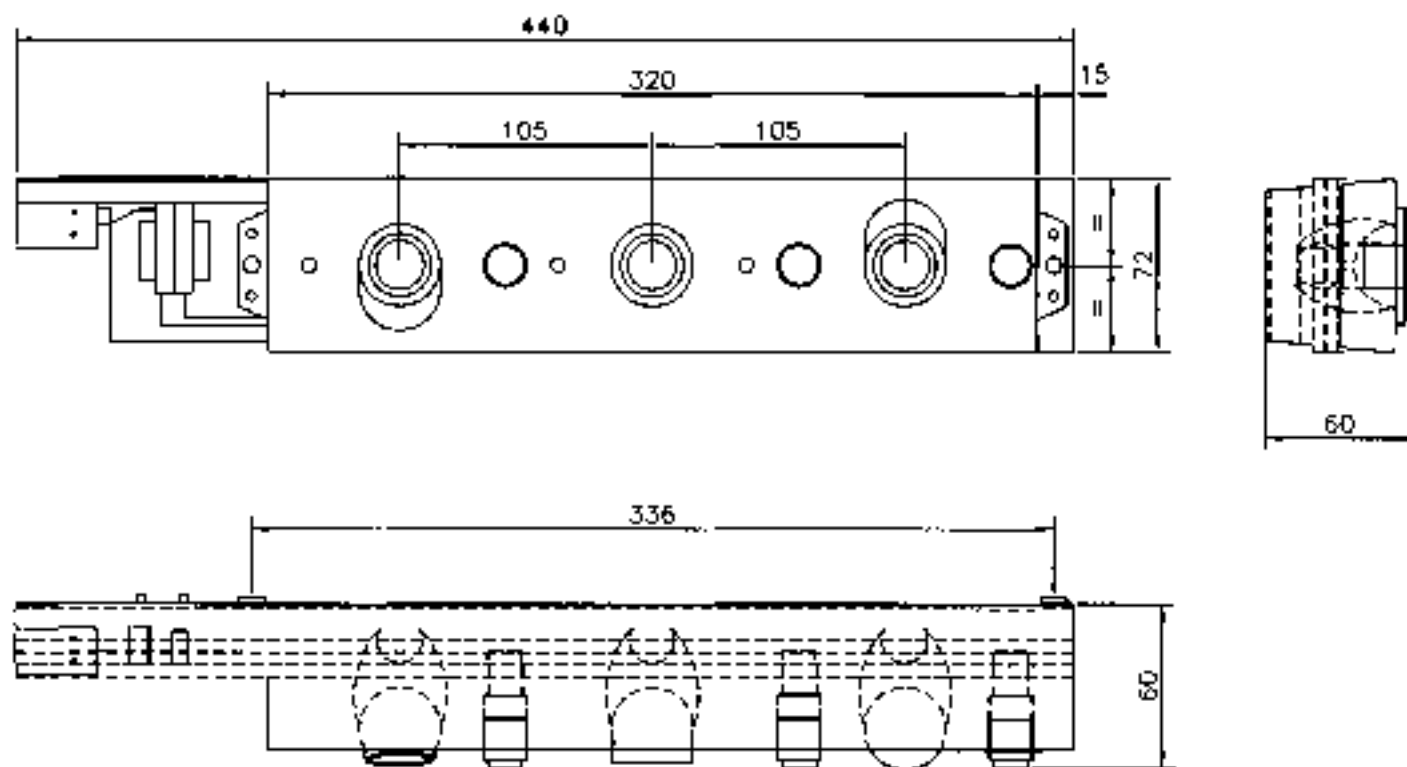
ANNEXURE-19



DUMMY FITTING FOR LHB & CONVENTIONAL CHAIR CAR AC COACHES
TYPE-P



LED LIGHT FITTING FOR READING LIGHT TWO SEATS LHB CHAIR CAR
TYPE-Q1(2 WATT)



LED LIGHT FITTING FOR READING LIGHT THREE SEATS LHB CHAIR CAR
TYPE-Q2 (2 WATT)



No. EL/ 6.4.8/1

5th July 2016

Chief Electrical Engineer,

- Eastern Railway, Fairlie Place, Kolkata - 700 001
- Northern Railway, Baroda House, New Delhi-110 001
- Central Railway, Parcel office, CST, Mumbai CST - 400 001
- Western Railway, Churchgate, Mumbai - 400 020
- Southern Railway, Park Town, Chennai - 600 003
- East Central Railway, Dighi, Distt- Vashali, Hajipur, Bihar-844 101
- East Coast Railway, Bhuvneshwar Orisa-751 016
- North Central Railway, Subedarganj, Allahabad- 211033
- North Eastern Railway, Gorakhpur -273 001
- North Western Railway, Jaipur 302006
- Northeast Frontier Railway, Maligaon, Guwahati - 781 001
- Western Central Railway, HQR's Office, Annexe Building, Indra market, Jabalpur (M.P.) - 482001
- South Eastern Railway, Garden Reach, Kolkata - 700 043
- South Central Railway, Nilayam, Secunderabad - 500 371
- South Western Railway, New zonal Hq. Office, First floor, west block, Hubli 580 020
- South East Central Railway, Bilaspur-495004
- Konkan Railway, Belapur Bhawan, Sector-11, Belapur, Mumbai - 400 614
- Rail Coach Factory, Kapurthala-144 602
- Integral Coach Factory, Chennai-600 038
- Modern Coach Factory, Lalganj, Raibareilly-229 120

मुख्य विद्युत इंजीनियर

- पूर्व रेलवे, फेयरली प्लेस, कोलकाता - 700 001
- उत्तर रेलवे, बड़ौदा हाउस, नई दिल्ली - 110 001
- मध्य रेलवे, मुंबई सी एस टी - 400 001
- पश्चिम रेलवे, चर्चगेट, मुंबई - 400 020
- दक्षिण रेलवे, पार्क टाउन, चेन्नई - 600 003
- पूर्व मध्य रेलवे, हाजीपुर दिघी, जिला वैशाली, बिहार - 844 101
- पूर्व तट रेलवे, बी-2, रेल विहार, चन्द्रशेखरपुर, भुवनेश्वर, 751 023 (उडीसा)
- उत्तर मध्य रेलवे, हेडक्वार्टर, ब्लाक ऐ, सुबेदारगंज, इलाहाबाद - 211 033
- पूर्वोत्तर रेलवे, गोरखपुर - 273 001
- उत्तर पश्चिम रेलवे, जायपुर - 302 006
- पूर्वोत्तर सीमान्त रेलवे, मालीगांव, गुवाहाटी - 781 011
- पश्चिम मध्य रेलवे, जबलपुर - 482 001
- दक्षिण पूर्व रेलवे, गार्डेन रीच, कोलकाता - 700 043
- दक्षिण मध्य रेलवे, 7 तल, रेल निलायम सिकंदराबाद - 500 071
- दक्षिण पश्चिम रेलवे, 4 तल, श्री लक्ष्मी नारायण काम्पलेक्स, स्टेशन रोड हुबली - 580 020
- दक्षिण पूर्व मध्य रेलवे, बिलासपुर - 495 004
- कोकण रेलवे, रायगंड भवन, 8 तल, बेलापुर भवन, सेक्टर 11, पीओबी 45, नवी मुम्बई 400 614
- आर० सी० एफ०, कपूरथला, 144 602 (पंजाब)
- आई०सी०एफ०, पेरम्बुर, चेन्नई-600 038
- माडर्न कोच फैक्टरी, लालगंज, रायबरेली-229120, उत्तर प्रदेश

Sub: Specification No. RDSO/PE/SPEC/TL/0091-2016 (Rev.'1') for Energy Efficient LED based Luminaire Units for Passenger Coaches.

RDSO has prepared and finalized the specification No. RDSO/PE/SPEC/TL/0091-2016 (Rev.'1') for Energy Efficient LED based Luminaire Units for Passenger Coaches.

A copy of the Specification No. RDSO/PE/SPEC/TL/0091-2016 (Rev.'1') for Energy Efficient LED based Luminaire Units for Passenger Coaches is enclosed herewith for reference and necessary action at your end.

(Handwritten Signature)
(लीला धर सिंह यादव)
निदेशक/पी.ई. एवं बैट्री
कृते महानिदेशक/पी.एस. एण्ड ई.एम.यू.

Copy to:-

सचिव विद्युत/जी,
रेलवे बोर्ड, रेल भवन,
रेल मंत्रालय, नयी दिल्ली-110 001

Kind Attn. Shri Vinayak Garg, DEE(G)

DOC.NO	VERSION	DETAILS OF PACKING INSTRUCTIONS.
PI148	VER.0	RIGID PVC PIPES:- TO BE WRAPPED WITH JUTE BAGS AND PACKED IN WOODEN CAGE: BOTH HORIZONTAL ENDS OF THE WOODEN CAGE TO BE BLOCKED WITH A WOODEN PLANKS. A LIST SHOULD BE PASTED ON EACH WOODEN CAGE SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO ,QTY, FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI149	VER.0	LIGHT FITTINGS:- EACH FITTING TO BE WRAPPED WITH BUBBLE SHEET AND PACKED IN A CARD BOARD BOXES(SINGLE PLY CORRUGATED). FINALLY UPTO 24 LIGHTS TO BE PACKED IN A CARD BOARD BOX (DOUBLE PLY CORRUGATED) AND TIED WITH 3 PACKING STRIPS HORIZONTALLY AND 3 VERTICALLY. A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO, QTY,FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI150	VER.0	EMERGENCY LIGHT FITTING:- WRAPPED IN TRANSPARENT POLYTHENE AND PACKED IN A CARD BOARD BOX(TWO PLY CORRUGATED) WITH THERMOCOL SHEET ON ALL SIDES AND TIED WITH 3 PACKING STRIPS HORIZONTALLY AND 3 VERTICALLY. A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO, QTY,FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI151	VER.0	VCB:- FIRST IT SHOULD BE WRAPPED WITH BUBBLE SHEET AND THEN COVERED WITH 20 MM THERMOCOL ON ALL SIDES, FINALLY IT SHOULD BE WRAPPED WITH CORRUGATED CARD BOARD SHEET. THEREAFTER TO BE PACKED IN WOODEN CAGE OF SIZE: BOTTOM FRAME TO BE MADE OF WOODEN PLANKS 20MM THICK & SHOULD HAVE SUPPORT OF ATLEAST 3 WOODEN BATTONS OF SIZE 100X100MM OF SUITABLE LENGTH TO FACILITATE LIFTING BY FORK LIFTER. EACH PANEL TO BE PACKED IN WOODEN CAGE OF SUITABLE DIMENSIONS MADE OUT OF WOODEN STRIPS OF 20X100MM SIZE. GAP BETWEEN EACH STRIPS SHOULD NOT BE MORE THEN 100MM. A LIST SHOULD BE PASTED ON EACH WOODEN CAGE SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO ,QTY, FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI152	VER.0	LHB LIGHT DIFFUSERS:- EACH DIFFUSER TO BE WRAPPED WITH BUBBLE SHEET AND PACKED IN A CARD BOARD BOXES(SINGLE PLY CORRUGATED). FINALLY UPTO 100 DIFFUSERS TO BE PACKED IN A CARD BOARD BOX (DOUBLE PLY CORRUGATED) AND TIED WITH 3 PACKING STRIPS HORIZONTALLY AND 3 VERTICALLY. A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO, QTY,FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI153	VER.0	LEAD ACID BATTERIES:- 06 MONOBLOCKS TO BE PACKED IN A WOODEN CAGE : BOTTOM FRAME TO BE MADE OF WOODEN PLANKS 20MM THICK & SHOULD HAVE SUPPORT OF AT LEAST 3 WOODEN BATTONS OF SIZE 100X100MM OF SUITABLE LENGTH TO FACILITATE LIFTING BY FORK LIFTER. EACH PANEL TO BE PACKED IN WOODEN CAGE OF SUITABLE DIMENSIONS MADE OUT OF WOODEN STRIPS OF 20X100MM SIZE. GAP BETWEEN EACH STRIPS SHOULD NOT BE MORE THEN 100MM. A LIST SHOULD BE PASTED ON EACH WOODEN CAGE SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO ,QTY, FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI154	VER.0	ALUMINIUM CONDUITS : BOTH ENDS SHOULD BE PLUGGED WITH NYLON/RUBBER PLUG OF MINIMUM 2 MM THICK TO AVOID DAMAGE TO THE ENDS. FURTHER CONDUITS ARE TO BE WRAPPED WITH JUTE BAGS AND PACKED IN WOODEN CAGE. BOTH HORIZONTAL ENDS OF THE WOODEN CAGE SHOWING ORDER NO. PLNO., DESCRIPTION AND SPEC OF THE AL. CONDUIT, QTY, FIRM'S NAME /ADDRESS AND DATE OF DISPATCH ALONG WITH PO DETAILS ETC.
PI155	VER.0	STAINLESS STEEL WASH BASIN EACH PIECE TO BE PACKED IN BUBBLE SHEET , THEN MAXIMUM 12 PIECES TO BE PACKED IN CARDBOARD BOX (DOUBLE PLY CORRUGATED). A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO, PLNO, DESCRIPTION OF ITEM , DERG NO/SPEC/SET LIST NO WITH VERSION QTY, FIRM'S NAME AND ADDRESS , DATE OF DISPATCH.
PI156	VER.0	STAINLESS STEEL (AUSTENTIC & FERRITIC STEEL ETC.): THE COIL SHALL BE PROTECTED IN REASONABLY GOOD CONDITION TO WITHSTAND NORMAL HANDLING HAZARD DURING TRANSIT WITH THE FOLLOWING PROVISIONS AS THE BAREST MINIMUM: <div style="margin-left: 40px;"> I) COIL SHOULD BE WRAPPED WITH A LAYER OF WATER PROOF PAPER THROUGH OUT THE WHOLE LENGTH. II) WHOLE COIL SHOULD BE WRAPPED WITH A LAYER OF PLASTIC BUBLED SHEET. III) OUTER & INNER OF COIL SHOULD BE WRAPPED WITH GI SHEET. IV) SIDE OF THE COIL SHOULD BE COVERED WITH CARD BOARD SHEET. V) AFTER THIS, OUTER & INNER OF COIL SHOULD BE WRAPPED WITH BLUE COLOUR PLASTIC THICK SHEET. VI) THE INNER EDGE OF THE COIL SHOULD BE PROTECTED BY GI RING, FOLLOWED BY ANOTHER IRON RING. VII) OUTER EDGE OF THE COIL SHOULD BE WRAPPED WITH GI RING. VIII) COILS SHOULD BE SECURELY STRAPPED WITH MINIMUM 5 BANDS THROUGH THE EYES OF THE COIL AND MINIMUM 3 BANDS ON THE CIRCUMFERENCE OF THE EYE. IX) WHOLE COIL SHOULD BE MOUNTED ON WOODEN BLOCKS FOR EASY LIFTING/STACKING. </div>

Enclosure to Lr.No MPO/F/251:

I.C.F. CHENNAI-38

ICF/CAM/MPO/RRM/F/009

PURCHASE REQUEST FOR THE YEAR 2020-21 AND 2021-22 PR.ID : E200001907

M.C.No :

No.M/D&P/F/187

DY.CME/PLG&IE OFFICE

COS/P06

DATE : 21.01.2020

DESCRIPTION : UNF SET OF LED BRL FTG,TY F,2W-LACCW
 DRG.NO. /SPECN. :
 First P.R. REFERENCE : E190024103 / 27.11.2019
 Prev. PR ID/DATE : E190024103/27.11.2019
 CHART REFERENCE NO. : 2020-21/Ver.04/Dt.23/12/2019 & 2021-22/Ver.01/Dt.04/07/2019
 U.L.NO. : 35 33769187 03 01

S.No	TYPE OF COACH	CODE	PCRT	2020-21	QTY	2021-22	QTY
1	LWACCW	851	1.000	213	213.000	112	112.000
Total				213	213.000	112	112.000
Deductions due to outsourcing/In-house					210.870		80.640
Deductions					0.000		0.000
Requirement Percentage (1 %)					2.130	(28 %)	31.360
Buffer @ % OF 2021-22					0.000		0.000
Allowance @ %					0.000		0.000
Spares					0.000		0.000
Toolroom Requirement					0.000		0.000
Additional Qty					0.000		0.000
Zonal Qty					0.000		0.000
Deductions					0.000		0.000
Fixed Quantity					42.000		112.000
Total					42.000		112.000
Total Requirement for 2020-21 and 2021-22 is					154	SET	

Stock and Dues to be adjusted as on 01/04/2020.

Inspection Agency :

Remarks :

.

Long Description :

SET OF LED BERTH READING LIGHT FITTINGS FOR LWACCW COACHES CONSISTING OF THE FOLLOWING ITEMS.

A) BERTH READING LIGHT (LONGITUDINAL) TYPE- F1, 2W AS PER RDSO SPEC NO.

RDSO/PE/SPEC/TL/0091- 2016 (REV.1) AND TO DRG NO. LW 76093 QTY- 9 NOS.

B) BERTH READING LIGHT UPPER BERTH TYPE- F2, 2W AS PER RDSO SPEC

NO.RDSO/PE/SPEC/TL/0091- 2016 (REV.1) AND TO DRG NO. LW 76094 QTY- 26 NOS.

C)BERTH READING LIGHT (TRANSVERSE) LOWER BERTH RHS, TYPE- F3, 2W AS PER RDSO

SPEC NO.RDSO/PE/SPEC/TL/0091- 2016 (REV.1) AND TO DRG NO. LW 76095 QTY- 9 NOS.

D)BERTH READING LIGHT (TRANSVERSE) LOWER BERTH LHS, TYPE- F4, 2W AS PER RDSO

SPEC NO.RDSO/PE/SPEC/TL/0091- 2016 (REV.1) AND TO DRG NO. LW 76096 QTY- 8 NOS.

NOTE: ICF APPROVED SOURCES SHALL BE CONSIDERED.

Special Condition :**Eligibility Criteria:**

h. Garguthi
 SSEMPO
 CHECKED BY

G. xie. n
 APLE-II
 For Dy. CME/Plg


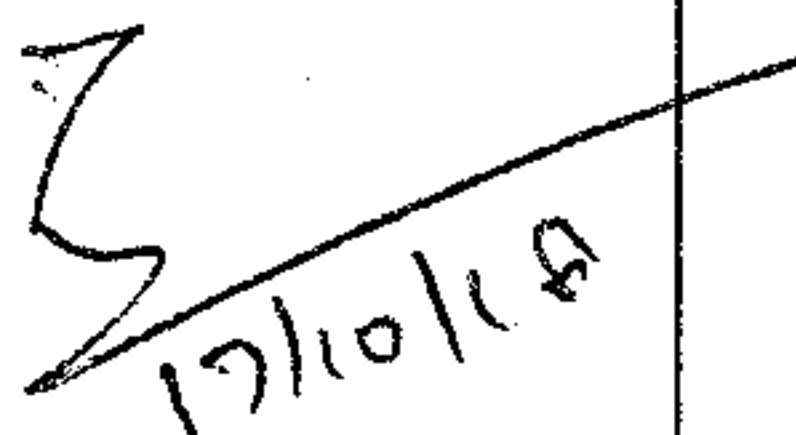

ICF AMENDMENT-01

ICF AMENDMENT 01 TO RDSO SPEC.NO. RDSO/PE/SPEC/TL/0091-2016 REV.1

SUB: SPECIFICATION FOR ENERGY EFFICIENT LED BASED LUMINAIRE UNITS FOR PASSENGER COACHES:

1. In Page No.21, Annexure – 3, S.No. 38 shall be added as follows:

Description	Type of fitting	Drg.No.
38. LED Foot step light fitting for LHB Non-AC second Class Cum luggage and Brake Van with compartment (LSLRD coach)	Type U (9W)	ICF/STD – 7-6-056

ICF AMENDMENT NO.01 TO RDSO SPEC.NO. RDSO/PE/SPEC/TL/0091- 2016 REV.1				PAGE 1 OF 1
DATE: 15.10.18	SSE/D	DY.CEE/D	CDE/E	PAGE NO.

SPECIFICATION FOR EPDM SPONGE

NAME	DESIGNATION	SIGNATURE	DATE	LEVEL
R. Duggal	SECTD		23.1.03	Prepared
Pradeep Sharma	ADDED		29.1.04	Agreed
Ravi Kumar	Dy.COMED		30.1.2004	Reviewed
Divya Vikas	CDE		31.1.2004	Approved

ISSUE	DETAILS OF CHANGE	DATE
0.0	FIRST ISSUE	11.7.97
1.0	1. TENSILE STRENGTH DELETED 2. REDUCTION IN TENSILE STRENGTH AFTER HEAT AGEING DELETED	24.9.99
2.0	1. HEAT AGEING REPLACED BY OVEN AGEING 2. LOW TEMPERATURE TEST ADDED 3. IN CL.3.4 70 HRS. & 15X MAGNIFICATION WERE 100 HRS. & 7X MAGNIFICATION AND TESTING PROCEDURE ADDED 4. IN CL.3.5 15% VALUE OF COMPRESSION SET AT 50% DEFLECTION WAS 40% AT 50% COMPRESSION. 5. IN CL.2.1 FLAME RESISTANT ADDED	03.3.2000
3.0	In Clause 3.5, 30% value of compression set at 50% deflection was 15% compression set at 50% deflection.	13.1.2004

SPECIFICATION: SPECIFICATION FOR EPDM SPONGE MDIS 046 REV 3
PAGE 1 OF 1
DATED 11/1/2004

1.0 SCOPE

1.1 This specification covers the requirement of Ethylene-Propylene-Diene Terpolymers (EPDM) sponge for sealing purpose.

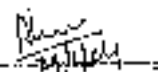
2.0 GENERAL REQUIREMENTS

2.1 The material shall be ozone resistant, weather resistant, chemical resistant, operate between temperature range of -40 to +80°C and shall have good stability against atmospheric degradation.

3.0 REQUIREMENTS:

3.1	Oven ageing	7 days at 70°C, change from original compression deflection $\pm 20\%$ (testing as per ASTM D1056)
3.2	Compression deflection (at 25% deflection)	14 to 35 Kpa (testing as per ASTM D1056)
3.3	Rubber content	50% (minimum)
3.4	Ozone resistance	70 hrs. at 40°C, 50 PPDM concentration, 50% elongation. No visible cracks at 7x magnification (testing as per ASTM D1171, Method-B).
3.5	Compression set	22 hrs at 70°C with 50% deflection. 30% Max (testing as per ASTM D1656)
3.6	Manufacturing process (curing)	Hot air/Microwave heating for uniform curing
3.7	Low Temperature Test	Change from original deflection values at -40°C $\pm 50\%$ (testing as per ASTM D4056)


Prepared by


Agreed by

DOC.NO	VERSION	DETAILS OF PACKING INSTRUCTIONS.
PI148	VER.0	RIGID PVC PIPES:- TO BE WRAPPED WITH JUTE BAGS AND PACKED IN WOODEN CAGE: BOTH HORIZONTAL ENDS OF THE WOODEN CAGE TO BE BLOCKED WITH A WOODEN PLANKS. A LIST SHOULD BE PASTED ON EACH WOODEN CAGE SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO ,QTY, FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI149	VER.0	LIGHT FITTINGS:- EACH FITTING TO BE WRAPPED WITH BUBBLE SHEET AND PACKED IN A CARD BOARD BOXES(SINGLE PLY CORRUGATED). FINALLY UPTO 24 LIGHTS TO BE PACKED IN A CARD BOARD BOX (DOUBLE PLY CORRUGATED) AND TIED WITH 3 PACKING STRIPS HORIZONTALLY AND 3 VERTICALLY. A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO, QTY,FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI150	VER.0	EMERGENCY LIGHT FITTING:- WRAPPED IN TRANSPARENT POLYTHENE AND PACKED IN A CARD BOARD BOX(TWO PLY CORRUGATED) WITH THERMOCOL SHEET ON ALL SIDES AND TIED WITH 3 PACKING STRIPS HORIZONTALLY AND 3 VERTICALLY. A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO, QTY,FIRM'S NAME &ADDRESS AND DATE OF DESPATCH ETC.
PI151	VER.0	VCB:- FIRST IT SHOULD BE WRAPPED WITH BUBBLE SHEET AND THEN COVERED WITH 20 MM THERMOCOL ON ALL SIDES, FINALLY IT SHOULD BE WRAPPED WITH CORRUGATED CARD BOARD SHEET. THEREAFTER TO BE PACKED IN WOODEN CAGE OF SIZE: BOTTOM FRAME TO BE MADE OF WOODEN PLANKS 20MM THICK & SHOULD HAVE SUPPORT OF ATLEAST 3 WOODEN BATTONS OF SIZE 100X100MM OF SUITABLE LENGTH TO FACILITATE LIFTING BY FORK LIFTER. EACH PANEL TO BE PACKED IN WOODEN CAGE OF SUITABLE DIMENSIONS MADE OUT OF WOODEN STRIPS OF 20X100MM SIZE. GAP BETWEEN EACH STRIPS SHOULD NOT BE MORE THEN 100MM. A LIST SHOULD BE PASTED ON EACH WOODEN CAGE SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO ,QTY, FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI152	VER.0	LHB LIGHT DIFFUSERS:- EACH DIFFUSER TO BE WRAPPED WITH BUBBLE SHEET AND PACKED IN A CARD BOARD BOXES(SINGLE PLY CORRUGATED). FINALLY UPTO 100 DIFFUSERS TO BE PACKED IN A CARD BOARD BOX (DOUBLE PLY CORRUGATED) AND TIED WITH 3 PACKING STRIPS HORIZONTALLY AND 3 VERTICALLY. A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO ,PL NO. DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO, QTY,FIRM'S NAME &ADDRESS AND DATE OF DESPATCH ETC.
PI153	VER.0	LEAD ACID BATTERIES:- 06 MONOBLOCKS TO BE PACKED IN A WOODEN CAGE : BOTTOM FRAME TO BE MADE OF WOODEN PLANKS 20MM THICK & SHOULD HAVE SUPPORT OF AT LEAST 3 WOODEN BATTONS OF SIZE 100X100MM OF SUITABLE LENGTH TO FACILITATE LIFTING BY FORK LIFTER. EACH PANEL TO BE PACKED IN WOODEN CAGE OF SUITABLE DIMENSIONS MADE OUT OF WOODEN STRIPS OF 20X100MM: SIZE. GAP BETWEEN EACH STRIPS SHOULD NOT BE MORE THEN 100MM. A LIST SHOULD BE PASTED ON EACH WOODEN CAGE SHOWING ORDER NO ,PL NO, DESCRIPTION OF THE ITEM, DRG.NO/SPEC.NO ,QTY. FIRM'S NAME & ADDRESS AND DATE OF DESPATCH ETC.
PI154	VER.0	ALUMINIUM CONDUITS : BOTH ENDS SHOULD BE PLUGGED WITH NYLON/RUBBER PLUG OF MINIMUM 2 MM THICK TO AVOID DAMAGE TO THE ENDS. FURTHER CONDUITS ARE TO BE WRAPPED WITH JUTE BAGS AND PACKED IN WOODEN CAGE. BOTH HORIZONTAL ENDS OF THE WOODEN CAGE SHOWING ORDER NO. PLNO., DESCRIPTION AND SPEC OF THE AL. CONDUIT, QTY, FIRM'S NAME /ADDRESS AND DATE OF DISPATCH ALONG WITH PO DETAILS ETC.
PI155	VER.0	STAINLESS STEEL WASH BASIN EACH PIECE TO BE PACKED IN BUBBLE SHEET , THEN MAXIMUM 12 PIECES TO BE PACKED IN CARDBOARD BOX (DOUBLE PLY CORRUGATED). A LIST SHOULD BE PASTED ON EACH BOX SHOWING ORDER NO, PLNO, DESCRIPTION OF ITEM , DERG NO/SPEC/SET LIST NO WITH VERSION QTY, FIRM'S NAME AND ADDRESS , DATE OF DISPATCH.
PI156	VER.0	STAINLESS STEEL (AUSTENTIC & FERRITIC STEEL ETC.): THE COIL SHALL BE PROTECTED IN REASONABLY GOOD CONDITION TO WITHSTAND NORMAL HANDLING HAZARD DURING TRANSIT WITH THE FOLLOWING PROVISIONS AS THE BAREST MINIMUM: <div style="margin-left: 40px;"> I) COIL SHOULD BE WRAPPED WITH A LAYER OF WATER PROOF PAPER THROUGH OUT THE WHOLE LENGTH. II) WHOLE COIL SHOULD BE WRAPPED WITH A LAYER OF PLASTIC BUBLED SHEET. III) OUTER & INNER OF COIL SHOULD BE WRAPPED WITH GI SHEET. IV) SIDE OF THE COIL SHOULD BE COVERED WITH CARD BOARD SHEET. V) AFTER THIS, OUTER & INNER OF COIL SHOULD BE WRAPPED WITH BLUE COLOUR PLASTIC THICK SHEET. VI) THE INNER EDGE OF THE COIL SHOULD BE PROTECTED BY GI RING, FOLLOWED BY ANOTHER IRON RING. VII) OUTER EDGE OF THE COIL SHOULD BE WRAPPED WITH GI RING. VIII) COILS SHOULD BE SECURELY STRAPPED WITH MINIMUM 5 BANDS THROUGH THE EYES OF THE COIL AND MINIMUM 3 BANDS ON THE CIRCUMFERENCE OF THE EYE. IX) WHOLE COIL SHOULD BE MOUNTED ON WOODEN BLOCKS FOR EASY LIFTING/STACKING. </div>