

1183185/2025/O/o PCME/HQ/NFR

**भारत सरकार (GOVERNMENT OF INDIA)**  
**रेल मंत्रालय (MINISTRY OF RAILWAYS)**  
**रेलवे बोर्ड (RAILWAY BOARD)**  
 \*\*\*\*\*

No. 2022/EDME(EnHM&Project)/Misc.12New Delhi, dt 26.12.2024

The General Managers,  
All Zonal Railways.

**Sub: Up-gradation of Toilet in LHB Non-AC coaches.**

**Ref: (i) Board's Ir no. 2022/EDME(EnHM & Project)/Misc.12 dated 25.11.2024. (Copy enclosed.)**

**(ii) NR's Ir No. 802-M/10/RSP/Up-gradation of Coaches/MC-II dated 05.12.2024.**

**(iii) NR's Ir No. 802-M/10/RSP/Upgradation of coaches/MC-II dated 07.11.2024**

Vide Board's letter under reference (i), the scheme of Toilet Upgradation had been circulated to all Zonal Railways with detailed scope of work and eligibility criteria for implementation in ICF AC/ Non AC coaches. The instructions were issued with the approval of Board (MTRS).


Now, it has been decided to upgrade the Toilets of LHB Non-AC coaches. Accordingly, the detailed scope and detailed guidelines are issued with the approval of Board (MTRS) which is on similar lines of the approved scheme for ICF coaches issued by ref (i) above.

Schematic layouts of Indian & Western Lavatories for LHB type Non-AC Coach is enclosed as NR Drg. No. CME SK.-2399 and CME SK.-2400 Alt-a.

For colour scheme of paneling, flooring and washbasin, design of washbasin and pressure reducer in taps, Northern Railway's letter referred at Ref-(iii) above may be followed.

Hence, all Zonal Railways are advised to follow the instructions issued by Railway Board regarding Upgradation of Toilets in LHB Non-AC coaches. This as an important project and to be executed expeditiously.

**DA: Annexures I and II**

  
 (Shailendra Singh )  
 PED/ME(EnHM & Project)  
 Railway Board.

Copy to PCMEs/ All Zonal Railways – For kind info & n.a. please.

## Annexure I

to the Railway Board letter No. 2022/EDME (EnHM & Project)/Misc.12 dated 26.12.2024

## 1. Scope of Work for Toilet Up-Gradation in LHB Non-AC Coaches

S.no	Area	Scope of Work	Ref.Drg./spec/make	Remarks
1.	Walls	Panelling of Coach toilet	6MM Thermoformable Decorative Polymerized Composite Panel (TDPCP) of make Kommerling/Aluplast/Alstone. Must qualify HL 3 as per EN 45545.	Minimum 6MM Thermoformable Decorative Polymerized Composite Panel (TDPCP) shall be used as final panelling on the metal frame. Material shall qualify EN-45545 HL-3 for fire worthiness. The skin surface shall be in wooden finishes, beige family or any other subtle design as used in aircrafts. All toilets must have screwless modular fixing features for ease of assembly & dismantling
2.	Ceiling	Existing Ceiling of Toilet Inside to be replaced with 6MM Thermoformable Decorative Polymerized Composite Panel (TDPCP) of make Kommerling/Aluplast/Alstone meeting HL 3 Compliance in thickness of minimum 6MM.	6MM Thermoformable Decorative Polymerized Composite Panel (TDPCP) of make kommerling/ Aluplast/ Alstone.	Light weight Thermoformable Decorative Polymerized Composite Panel (TDPCP) shall be used as ceiling material. The sheet installation shall be fixed or openable type as required. Branded hinges and panel lock of make Dorma, Southco, Industrias, Dirak shall be used for easy opening and closing. Ceiling shall be installed in such a way that sagging and unevenness shall not be visible even after repeated opening and closing. Colour of these sheets shall be white or light gray in LHB NON AC coaches.
3.	Toilet Door with Mortice type Door opening & Closing Arrangement	Existing Toilet Door to be replaced with 3MM Thermoformable Decorative Polymerized Composite Panel (TDPCP) make kommerling/	Both materials shall qualify EN 45545 HL 3 for fire worthiness.	Provision for replacement of existing door metal frame and having 3mm TDPCP as skin material. Fitment would be of Pivoted type or with Full Length Piano type continuous hinge. Existing handles, latch, and locks to be replaced with new

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		7. Dupast/Alstone complying to IN 45545 III 3.		type of opening & closing arrangement of mortice type lock & handle. The lock to have Handle, locking arrangement and engage/vacant indication all in one. Make – Dorma, Southco, Industrialas, Dirak. For proper strengthened fitment of Mortice latch Lock in lavatory doors of LHB coaches, side casing or side plates are required. It should also be ensured that striker plate which is fixed to door frame is also of the same make as the lock.
4.	Inside wash basin	Inside wash basin bowl of SS along with countertop to be made of Aluminium Polymer Composite Material	Drg No. MMDTS 18008	Provision for SS304 wash basin bowl with countertop in Aluminium Polymer Composite as per MMDTS 18008 inside each toilet.
5.	Inside Dustbin below Wash basin	Inside Dustbin panel beneath wash basin counter	MMDTS 18008	Supply & Fitment of compact dustbin panels below wash basin countertop area to be made of Aluminum polymer composite material as per specification MMDTS-18008 Rev-01 with easy to access dustbin having LID and SS 304 dustbin inside.  All hardware to be of Dorma, Southco, Industrialas, Dirak make.
6.	Inside Mirror	Large size flushed mirror of 5mm thickness with frame of Aluminium Polymer Composite Material inside toilet.	MMDTS 18008 Ref. Drg. No. JUDW/MECH/20/696	Mirror Frame to be of Aluminium Polymer composite with aesthetically pleasing inlay design as per MMDTS 18008 (Mirror in Brand like Saint Gobain, Modi Guard, Asahi Glass) etc. Ref. Drg. No. JUDW/MECH/20/696
7.	Toilet Light	Concealed LED light	RDSO specification RDSO/PE/SPEC/TL/0091- 2016 (Rev '1').	Toilet shall be equipped with inbuilt LED type aluminum spring free lights with aluminum screw concealer 3-5W/110V ACDC of diameter 76 +/-1mm and 1 number of





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				6- 9W/110V ACDC of diameter 100+/-1mm with 60000 hours LEDs and CRI>80 color temperature 6000-7000K. fire rating EN 45515 HL2 and tested as per RDSO Specification- RDSO/PE/SPEC/TL/0091-2016 (Rev1').
8.	Tap along with health faucet	Health faucet to be provided in each toilet with two way bib tap	Bib cock as per Model No. – F280003CP Health Faucet as per Model No. – F1610110CP	Length of Flexible pipe to be approx 900 mm. The sprinkler & flexible hose to be chrome plated. Bib Cock to be of Hindware Model no. F280003CP & Health Faucet to be of Hindware Model no. F160110CP or similar make of Jaquar/SuSa/ToTo/Kohler/CERA.
9.	Toilet Paper Holder	Stainless steel or ABS Plastic Paper Roll Holder for Western style toilet.	Kimberley Clark Model no. 69460 or similar Make SUSA/Jaquar/Kohler/Cera/Kimberley Clark.	To maintain the hygiene, and avoid pilferage, misuses & mishandling, the toilet paper should be in complete enclosed dispenser/holder.
10.	Bacteria Neutralizer Dispenser	Bacteria neutralizer dispenser with inbuilt air circulation system along with bio-enzyme bacterial refills in built with fragrance.	RDSO/2008/CG-11 (latest) or equivalent.	Automatic Hygiene & Odour Control system with inbuilt air circulation system along with bio-enzyme bacterial refills in built with fragrance. Capacity 610ML or above for uninterrupted service. Brand-TOTO, SUSA, ACME, Water Berry.
11.	Western Commode Lid Cover	Heavy Duty Commode lid with auto retractor seat cover.	Brand- Alpine, Tip Top, Susa or equivalent.	Existing western commode to be fitted with Auto Retractor seat cover of Tip Top, Alpine or equivalent make.
12.	Soap Dispenser	Modular type manual wall mounted liquid soap dispenser with inbuilt lock & key feature.	Brand/Make: Bobrick, Dolphin, Gojo, Merida, ACME, SUSA) Capacity – Approx. 800-1000ml.	Wall mounted liquid soap dispenser with the theft resistance installation arrangement in each toilet. Brand – Jaquar, Bobrick, Merida, SUSA, ACME.
13.	Water taps for inside of toilet at wash basin	Quarter turn Bib Cock	(Brand/Make- F280002CP of Jaquar/Hindware/Kohler/Grohe/Dolphin/Toto/Susa)	Taps for inside wash basins in all the LHB Non AC coaches to be quarter turn Bib Cock of make/Brand - F280002CP of Jaquar/Hindware/Kohler/GROHE/Dolphine/TOTO/SUSA).
14.	Western commode toilet bowl & seat cover	Existing western commode shall be replaced with SS toilet bowl and	Stainless steel toilet bowl similar to LHB toilet look.	Toilet Bowl commode shall be changed and shall be shrouded in FRP or FRCP material. Color of the shroud shall be in gray or



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	Commode	Additional shroud shall be used for better hygiene.		other color matching with overall aesthetics to interior of toilet.
15.	PU coated Grab Bar	Disabled Friendly grab bar to be used inside toilet door in approx. 18 inch sized x 25mm.	SS- 304	PU coated disabled friendly grab bar to be used inside toilet door in approx. 18 inch sized x 25mm. The same to have Anti Skid PU Skin Make Jaquar/SUSA/Hindware/Southco./Industrilas/DIRAK.
16.	Toilet Inlay	FRP or decorative Polymerised composite Panel (TDPCP) floor inlay for Indian pan and western inlay.	Make Kommerling/Aluplast/Alstone	Existing inlay to be replaced with new modular FRP as per MDTs 133 or TDPCP inlay. The surface shall be free from any damage, dent or undulation. The surface shall be anti-skid and shall comply with fire retardancy of HL-3 as per EN-45545. If required suitable Epoxy flooring as per MDTs 44289 or other PU coating complying to overall EN45545-HL3 compliance can also be used.
17.	Indian Pan	Existing Pan to be replaced with new pan with functionality of LHB type Pan.		Existing Indian Pan to be replaced with new type of pan having inner ring for water flushing to introduce concealed flushing system.
18.	All Types of Aluminium Profiles	Profiles/ Angles/ Flats of Aluminium		All types of Aluminium profiles used for screwless mounting of wall panels including J,H,F, 90 and 135 degree profiles
<b>Doorway &amp; Gangway Area</b>				
19.	Walls and Ceiling	Side wall and ceiling panel in Non AC doorway and gangway area.	Make Kommerling/Aluplast/Alstone.	Side Wall – 3MM decorative polymerised composite panel (TDPCP) panels qualifying to EN45545- HL3. Color light grey or light blue or wooden color shall be used in LHB Non AC coaches Doorway Ceiling – 3MM decorative polymerised composite panel (TDPCP) panels qualifying to EN45545- HL3. Gangway Ceiling & D Panel for Water Tank Cover – 6MM decorative polymerised composite panel (TDPCP) panels qualifying to EN45545- HL3. In case of TDPCP the surface



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				shall be decorated and it will not require additional GFRE or other skin material.
				Branded hinges and panel lock of Make – Dorma, Southco, Industrialas, Dirak make shall be used.
20.	Doorway & Gangway Light	Concealed light	LED	RDSO specification RDSO/PE/SPEC/TL/0091- 2016 (Rev '1').
				Doorway & Gangway shall be equipped with inbuilt LED type aluminum spring free lights with aluminum screw concealer 3-5W/110V ACDC of diameter 76 +/-1mm and 1 number of 6- 9W/110V ACDC of diameter 100+/-1mm with 60000 hours LEDs and CRI>80 color temperature 6000-7000K. fire rating EN 45515 HL2 and tested as per RDSO Specification- RDSO/PE/SPEC/TL/0091-2016 (Rev1').
21.	Outside Washbasin with Dustbin	Outside Wash Basin Bowl along with Countertop & Below Panel to be made of Aluminium Polymer Composite Material with SS Dustbin inside		Supply & Fitment of wash basin bowl with Countertop & Dustbin to be made of Aluminium polymer composite material as per specification MMDTS-18008 Rev-01 along with compact panels below wash basin countertop area to be made of Aluminum polymer composite material as per specification MMDTS-18008 Rev-01 with easy to access dustbin having LID
				All hardware to be of Make – Dorma, Southco, Industrialas, Dirak.
22.	Mirrors	Large size flushed mirror of 5mm thickness with frame of Aluminium Polymer Composite Material outside Toilet	MMDTS-18008	Mirror frame made up of Aluminum Polymer Composite as per MMDTS 18008 Rev-1 for making it aesthetically pleasing. (Mirror in Brand like Saint Gobain, Modi Guard, Asahi Glass) etc.
23.	Waste bin arrangement	Existing arrangement to be replaced with FRP Waste Bin Arrangement with matching aesthetics	FRP - RCF MDTS133 (latest) or equivalent. Ref. Drg. No.- JUDW/MECH/24-845 ALT-1	To be made in FRP as per MDTS 133. Color to be matched with paint shade in doorway gangway in water based PU paint as per MMDTS 20046





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		and nylon belt.		Ref. Drg. No.- JUDW/MECH/24-845 ALT-1
24.	CDTS Panel Door	Modified CDTS panel cover to Accommodate EPFS panel to be fixed with all S.S. fittings	FRP Panel for CDTS panel & Painted water base paint as per RCF MDTS 133 (latest) or equivalent	Color to be matched with paint shade in doorway gangway in water based PU paint as per MMDTS 20046
25.	Water tap for Basin	Quarter turn Bib Cock	(Brand/Make F280002CP Hindware/ kohler/Grohe/ Dolphin/TOTO/ Susa/Jaquar)	Quarter turn Bib cock for toilets in Brand/Make F280002CP of Hindware/ Kohler/Grohe/ Dolphin/ TOTO/ Susa/Jaquar)
26.	Braille Signage		As per ICF specification no. MD 253.	Braille signage for complete toilet, Doorway & Gangway to be provided as per specification, eligibility & related drawing



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## 2. Detailed guidelines for the work of Toilet Up-Gradation in LHB Non-AC Coaches

I. During execution of work of Toilet Up-Gradation in LHB non-AC coaches following will also be ensured:

1. Proper fitment of all CSK screws
2. Fitment of Toilet Door handle/latch etc with the help of template.
3. Proper workmanship during laying of epoxy to get proper finish around SS Pan and Epoxy interface.
4. Fitment of all standard Tower Bolts.
5. Proper fitment of Toilet threshold and toilet door hinge foot.
6. Provision of beading on Washbasin counter along side wall.
7. Painting in doorway gangway area should also include Pantry area, Linen Cabinet, Passenger Compartment doors, Main entrance Doors back side etc.
8. Refurbishment of Linen Cabinet and its doors. (Repair of doors, handles and latches.)

II. Major activity in the toilet up gradation work is towards repairing and fitment and supply of material may vary from coach to coach depending on condition of the coach. It is essentially a repair contract where the amount of work may vary from toilet to toilet and in-situ repair/ up-gradation work has to be done so that the continuous interaction with the supervisors and monitoring by the supervisors is required for successful execution of this project. It qualifies to be done under the works contract. Suitable provision may be made for nomination of supervisors for each coach to certify the quality of work done at different stages of work both in process and final.

III. PST requirements, anti-graffiti, scratch resistance and other quality parameters related to mechanical properties, hygiene and safety are the prime requirements and accordingly qualified material and technically capable participants shall be selected as per Works Contract eligibility and as per technical criteria given in the related specification of individual items.

IV. Bad odour, water stagnation on the toilet floor and improper flushing system is a common issue and attracts major passenger complaints. Railway may adopt any additional item or technology to address these issues at the time of tendering or even at execution stage by suitable contractual modifications.

V. Railway shall also explore the possibility of giving AMC for the toilets and bidders may be asked for it separately in tender. Duration of AMC and its actual requirements shall be decided by railways on requirement basis. Items like Bacteria Neutralizer, Toilet paper holders etc. for which regular Refills are required shall also be included in AMC. Railway will ensure sample audit of quality of incoming supplies from reputed labs / RDSO / PU / ZR.





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Name	Designation	Signature	Date	Level
Harikesh Kumar	SSE / Design		4/11/2020	Prepared
Sh. Trilochan Anthwal	SME / Design-II		04/11/2020	Agreed
Sh. Lalit Kishore	Dy. CME / Design		4.11.20	Reviewed
Sh. Mahesh Kumar	CDE		04/11/2020	Approved

  
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## 1. INTRODUCTION

Polyurethane waterborne 2 components coating system to be applied in interior of Railway coaches.

## 2. SCOPE

This chapter provides information regarding surface preparation, details of various components of coating system, aspects to be adhered to by manufacturers, procurement details to be followed by the users and other important aspects.

## 3. This specification has been divided in three (03) sections designated as under:

- i) General : Section-I
- ii) Polyurethane waterborne 2 components basecoat : Section-II
- iii) Polyurethane waterborne 2 components clear coat : Section-III

### SECTION-I

#### 1. General:

This Section provides information regarding surface preparation, details of various components of coating system, aspects to be adhered to by manufacturers, procurement details to be followed by the users and other important aspects.

#### 2. Surface preparation:

The substrate shall be prepared with non-woven abrasive pads similar to Scotch Brite model 7447 Red Type A very fine or sanding paper manually or mechanical. After cleaning, remove the dust by using tack cloth. Degrease the surface with Isopropanol or other OEM approved solvent. Check the result with water-break test as per ASTM F22. A good adhesion should be obtained without the use of primer on aluminium, steel, laminate, polycarbonate, FRP etc.

#### 3. Components of the coating system: The coating system has the following components:

SN.	Coating operation	Description of coating	Method of application	Chapter of specification
1	Basecoat	PU Topcoat (two components)	Airless spray	Section-II
2	Clear coat	PU Clear coat (two components)	Airless spray	Section-III

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#### 4. Important instruction:

##### A) For manufacturers:

- The coating manufacturers shall measure the presence of un-reacted monomer in the system to insure freedom from pollution hazards. It shall not exceed 2%.
- For touch up, during POH, the coating supplier shall supply the material in one-kg packing. However, for bulk supply of coating shall be packed in 4 kg or 20kg packs.
- Manufacturers/supplier shall submit test certificate of each product from Indian NABL/ international accredited lab along with all the acceptance test parameters specified, at the time of supplying the material.
- Manufacturers shall submit material safety data sheet along with the supplies.
- Manufacturer shall certify that the coating material is free from health hazardous material like Cr, Pb, Hg Asbestos etc. and also that the material is free from carcinogenic and estrogen minimal solvents.
- Marking and packaging: Each container shall be marked with the following:
  - Name of the material
  - Colour
  - Weight of the material
  - Batch no.
  - Month and year of manufacture
  - Shelf life of coating in container
- For touch up the material shall be supplied in one Kg container.

##### B) Procurement:

All components of the coating system including base (component A) and hardener (component B) must be procured from the same source to ensure compatibility.

##### C) Testing authorities:

- The coating shall be tested after mixing base and hardener in the stipulated ratio as mentioned in the corresponding section of different components of coating system. Water for dilution shall be employed quantity as recommended by the manufacturer.
- The following tests in this specification are defined as acceptance tests.

SN	Name of the coating component	Type test
1.	Basecoat	Colour and gloss
2.	Clear coat	Gloss

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## SECTION- II

### Specification For Polyurethane Waterborne Basecoat Coating (Two Components)

1. **SCOPE:**  
This standard specifies requirements and methods of testing a two-pack polyurethane waterborne basecoat intended to be used for decoration of interiors of Railway coaches. It is primarily suitable for application by spraying. It may also be applied by brush for touching up small areas by using a specific version designed for brush application.
2. **USES:**  
Material complying with this standard is intended to be used as base coat in coating system for the protection of decoration of interior of Railway coaches.
3. **DEFINITION:**  
For the purpose of this standard, the glossary of terms given in ASTM D16-19, shall apply.
4. **COMPONENT**  
The term used to describe each of the two parts of the coating which, when mixed together, form a pigmented polyurethane coating.
5. **COATING:**  
The mixture of the two components in the proportion recommended by the manufacturer.
6. **COMPOSITION:** The coating has two components, namely COMPONENT A and COMPONENT B.  
  
COMPONENT A (normally referred to as Basecoat) shall consist of:
  - (i) an appropriate oil free polyacrylate Polyol.
  - (ii) Appropriate pigments, co-solvents (max. 4 % wt.) and additives.  
COMPONENT B (normally referred to as HARDENER or catalyst solution) shall consist of:
  - (i) an aliphatic poly isocyanate.
  - (ii) Appropriate solvents (max. 30% wt.).
7. **MIXING RATIO:** The mixing ratio of the Component A and Component B shall be in ratio of:
  - By weight 5/1
  - By volume 4/1
8. **Physical properties of the waterborne basecoat coating (two components):**

SN	Characteristics	Requirements	Test method
1	Drying time (27+-2°C, RH 65+-5%) a. Set to touch	4 min	ASTM D5895/ IS:101-86(Part3/Sec.1)

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	b. Tack free c. hard Dry d. Dry through e. Full cure	8 min 21 min 50 min 7 days	
2	Finish	Smooth surface with appropriate gloss level	IS:101-87 (Part3/Sec.4)
3	Consistency	Smooth and uniform, and suitable for spray application.	IS:101-89 (Part 1/Sec.5)
4	Colour	Self-standard grey or as per requirement	IS:101-89 (Part 4/Sec.2)
5	Dry film thickness	30 to 40 microns	ASTM D1400/ IS:101-89 (Part 3/Sec.2) by coating thickness gauge
6	Volume solids, % Min content	Component A: 53% +/-3% (by weight) Component B: 70% +/-2% (by weight)	ASTM D5201-05
7	Scratch hardness (1.5 Kg load)	No such scratch so as to show base metal	ASTM D2197/ IS:101-88 (Part 5/Sec.2)
8	Flexibility & adhesion (6.25 mm Mandrel)	No visible damage or detachment of film	ASTM D522/ IS:101-88 (Part 5/Sec.2)
9	Flash Point (a) Component A (b) Component B	Non inflammable. Above 85°C	ISO: 3679/ IS:101-87 (Part 1/Sec.6)
10	Pot life (after induction time) at 27+ <sub>2</sub> °C	3 hours	ISO: 9514-2019
11	Gloss at angle of 60°	The 60° gloss of the final colour dried film shall be 20 +/-5 for semi-gloss Or 3-5 for matt	ASTM 523/ Gloss meter
12	Theoretical spreading rate (Basecoat + hardener)	9.4-9.5 m <sup>2</sup> /L @ 50µm 7.9-8.5 m <sup>2</sup> /kg @ 50µm	ASTM D2697
13	Keeping properties/ shelf life	24 months component A 12 months component B	See Appendix A
14	Unreacted monomer, % by mass, Max	2.0	By Gas chromatograph method in reference to ASTM D4827 -03.
15	NCO- contain, in hardener, Min	13	ISO:11909
16	Viscosity at 20°C (DIN)	Dilute with water (max 20%)	DIN 53211/

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	CUP 4)	To obtain 40 +/-2 sec	IS:101-89(Part1/sec.5)
17	Specific gravity	Component A: 1.25 +/- 0.10 kg/L Component B: 1.10 +/-0.01 kg/L	ASTM D1475
18	Volatile organic compound (VOC) mixed less water.	190 – 210 g/L	ASTM D 3960
19	Cross cut adhesion	Should be minimum 4B on shot or grit blast/ phosphating / any appropriate chemical treatment of Mild steel	ASTM D3359-02
20	Abrasion resistance 1000 cycles	Average weight loss shall not exceed 70mg/1000 cycles by using CS17 wheel and 500g weight.	ASTM D4060
21	Soil resistance	Slight discoloration after cleaning is acceptable. A light mark of mustard after cleaning is acceptable	See Appendix B
22	Fire & smoke resistance	R1-HL3 On aluminium	ISO EN 45545, Part-II
23	Humidity resistance	On aluminium No sign of corrosion & no sign of deterioration viz. Blistering detachment of film up to 1000 hours	ASTM D 2247/ IS:101-88 (Part 6/Sec.1)
24	Impact resistance test at height 0.7 m and weight 1Kg	On aluminium Shall be free from deformed coating by dropping the indenter on coated side of panel	ASTM D 2794
25	Corrosion resistance	Corrosion resistance on aluminium shall be done 500 hrs	ASTM B 117
26	Salt fog Resistance of coating system	Shall pass 1500 Hrs, on aluminium no blistering or spot rust, creep age, no face blistering	ASTM B 117 ASTM D1654
27	Resistance to accelerated weathering (QUV test)	650 hours, on aluminium (no cracking or Checking)	ASTM G 154

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### Section- III

#### Specification For Polyurethane Waterborne Clearcoat Coating (Two Components)

#### 1. SCOPE:

This standard specifies requirements and methods of testing a two-pack polyurethane waterborne clear coat intended to be used for decoration of interiors of Railway coaches. It is primarily suitable for application by spraying. It may also be applied by brush for touching up small areas by using a specific designed for brush application.

#### 2. USES:

Material complying with this standard is intended to be used as top coat in coating system for the protection of decoration of interior of Railway coaches.

#### 3. DEFINITION

For the purpose of this standard, the glossary of terms given in ASTM D16-19, shall apply.

#### 4. COMPONENT

The term used to describe each of the two parts of the coating which, when mixed together, form a polyurethane coating.

#### 5. COATING:

The mixture of the two components in the proportion recommended by the manufacturer.

#### 6. COMPOSITION:

The coating has two components, namely COMPONENT A and COMPONENT B

COMPONENT A (normally referred to as clearcoat) shall consist of:

- i) an appropriate oil free polyacrylate Polyol
- ii) Appropriate co-solvents (max. 4 % wt.) and additives

COMPONENT B (normally referred to as HARDENER or catalyst solution) shall consist of:

- i) an aliphatic poly isocyanate
- ii) Appropriate solvents (max. 30% wt.)

#### 7. MIXING RATIO

The mixing ratio of the Component A and Component B shall be in ratio of:

- By weight 5/1
- By volume 5/1

#### 8. Physical properties of polyurethane waterborne clear coat coating (two components)

SN	Characteristics	Requirements	Test method
1	Drying time (27+2°C, RH 65+/-5%)	4 min	ASTM D 5895/ IS:101-86 (Part3/Sec.1)
	a. Set to touch	8 min	
	b. Tack free	21 min	
	c. hard Dry	50 min	

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	d. Dry through e. Full cure	7 days	
2	Finish	Smooth surface with appropriate gloss level	IS:101-87 (Part3/Sec.4)
3	Consistency	Smooth and uniform, and suitable for spray application.	IS:101-89 (Part1/Sec.5)
4	Colour	Self-standard grey or as per requirement	IS:101-89 (Part4/Sec.2)
5	Dry film thickness	30 to 40 microns	ASTM D1400
6	Volume solids, % Min content	Component A: 53% +/-2% (by weight) Component B: 70% +/-2% (by weight)	ASTM D 5201-05
7	Scratch hardness (2 Kg load)	No such scratch so as to show base metal	ASTM D2197
8	Flexibility & adhesion (6.25 mm Mandrel)	No visible damage or detachment of film	ASTM D522/
9	Flash Point (c) Component A (d) Component B	Non inflammable. Above 85°C	ISO: 3679
10	Pot life (after induction time) at 27+ 2°C	2 hours	ISO: 9514-2019
11	Gloss at angle of 60°	The 60° gloss of the final colour dried film shall be 20 +/-5	ASTM 523/ By Gloss meter
12	Theoretical spreading rate (Basecoat + hardener)	11.5 m <sup>2</sup> /L @ 40µm DFT 10.75m <sup>2</sup> /kg @ 40 µm DFT	ASTM D2697
13	Keeping properties/ shelf life	12months component A&B	See Appendix A
14	Unreacted monomer, % by mass, Max	2.0	By Gas chromatograph method in reference to ASTM D4827 -03
15	NCO- contain, in hardener, Min	13	ISO 11909
16	Viscosity at 20°C (DIN CUP 4)	Dilute with water (max 20%). To obtain 40 +/-2 sec	DIN 53211/ IS:101-89 (Part1/Sec.5)
17	Specific gravity	Component A: 1.06 +/- 0.10 kg/L Component B: 1.10 +/-0.01 kg/L	ASTM D1475
18	Volatile organic compound (VOC) mixed less water.	165 g/L	ASTM D 3960
19	Cross cut adhesion	Should be minimum 4B on shot or grit blast/ phosphating / any appropriate chemical	ASTM D3359-02

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Specification	Technical Specification For Polyurethane Waterborne Decorative Coating System (Two Components) For The Interiors Of Railways Coaches On Supply And Apply Basis.	MMDTS-20046 REV-Nil PAGE 9 OF 13 Date: 4.11.2020
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		treatment of Mild steel	
20	Abrasion resistance 1000 cycles	Average weight loss shall not exceed 70mg/1000 cycles by using CS17 wheel and 500g weight.	ASTM D4060
21	Soil resistance	Slight discoloration after cleaning is acceptable. A light mark of mustard after cleaning is acceptable	See Appendix B
22	Fire & smoke resistance	R1-HL3 On aluminium	ISO EN 45545, Part-II
23	Humidity resistance	On aluminium. No sign of corrosion & no sign of deterioration viz. Blistering detachment of film up to 1000 hours	ASTM D 2247/ IS:101-88 (Part 6/Sec.1)
24	Anti-graffiti test	Graffiti completely removed with permanent marker	ASTM D 6578
25	Impact resistance test at height 0.7 m and weight 1 Kg	On aluminium. Shall be free from deformed coating by dropping the indenter on coated side of panel	ISO:6272/ ASTM D 2794
26	Corrosion resistance	On aluminium. Corrosion resistance shall be done 500 hrs	ASTM B 117
27	Salt fog Resistance of coating system	On aluminium. Shall pass 1500 Hrs, no blistering Or spot rust, creep age, no face blistering	ASTM B 117 ASTM D1654
28	Resistance to accelerated weathering (QUV test)	On aluminium. 650 hours, (no cracking or Checking)	ASTM G 154
29	Antibacterial performance	E-coli initial $2.2 \times 10^4$ E-coli after 24 hr $< 5 \times 10^3$ Staphylococcus aureus initial $2.2 \times 10^4$ Staphylococcus aureus after 24hr $< 7 \times 10^2$	ISO: 22196-2016

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## 5. GENERAL

The coating shall comply with the requirements specified in TABLE 1& 2 of the specification.

5.1 Unless otherwise specified, the following testing conditions shall apply:

5.2 The preparation of metal panels shall be in accordance with ISO 1514

5.3 All tests shall be conducted at room temperature ( $27 \pm 20^\circ\text{C}$ ) and a relative humidity of  $60 \pm 5\%$  in a well-ventilated chamber free from draughts and dust.

5.4 The two components P.U. Clear coat (component 'A' & 'B'), shall be mixed in the ratio before conducting the test or tests. However, during mixing of the two components in large quantities for coating coach, the mixing may be done by using a high-speed stirrer for 5 minutes max. (Rise in temp. shall not be more than  $50^\circ\text{C}$ ). After thorough mixing of the two components, an induction time of 10 to 15 minutes shall be allowed before use. Where the clear coat is required to be applied on panels, it shall be done so by using suitable spraying apparatus (as per Section-I, Para 3).

5.5 The spray gun shall be thoroughly cleaned before use. It shall be fitted with the correct size of nozzle and air-cap. In case of airless spray, the pressure ratio of air cylinder to hydraulic cylinder shall be adjusted in accordance with the viscosity of the material to be sprayed. The pressure ratio shall be adjusted in accordance with the viscosity of the material to be sprayed. The material shall be sprayed carefully to obtain an even and uniform coat having a dry film thickness of 30 microns minimum per coat.

5.6 The mixed coating shall show good spraying properties on vertical panels. The film, when dry, shall be free from sags, runs, streaks, and any other film defects.

## 6. Test & test certificate:

- Decorative coating shall be accepted based on OEM test certificate or certificate of conformity. However, purchaser reserves right to conduct test for any parameter at any point of time.
- Certificate against above parameter mentioned in clause 8 of section-II & 8 of section-III shall be submitted from any NABL/national/international accredited lab.
- Type test:** Fire & smoke resistance test, Corrosion resistance, Salt fog Resistance of coating system, Resistance to accelerated weathering (QUV test), and Humidity resistance.
- All test certificate of waterborne basecoat & clear coat coating shall be considered as acceptance test except type test and shall be submitted at each lot of purchase order.

## 7. Prototype approval

First time supplier shall have to submit sample for testing & trial to MCF. Prototype approval shall be given by CDE/MCF after successful trial of reports of the material.

All testing certificates along with OEM certificates of material being theirs shall be submitted by tenderer.

## 8. Documents to be submitted along with offer, prototype and bulk supply

- Technical data sheets & material safety data sheet.
- All Test reports from national or international/NABL accredited labs.
- Clause wise comment and technical deviation if any.
- Material complied global Harmonized system labelling of chemicals (GHS).

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- e. Tender specific OEM authorisation or long-term tie-up certificate between OEM and tenderer.
- f. Credentials, performance and areas of usage of offered material in Indian or International Railways applications.

**Note:**

1. In absence of above details, offer shall not be considered as technically complete/suitable.
2. All equipment like Pycnometer, gloss meter, DFT gauge etc provided by supplier.
3. Gloss measurement is not applicable to metallic and effect coatings

**9. Warranty**

The life of the coating system shall be minimum 3 years from dated of the application. The supplier shall give warranty for above period against peeling, cracking, blistering excessive chalking & fading. The coating system should be maintained according to OEM specifications. The detachment arises during warranty period shall be repaired by the supplier on own cost.

**10. Shelf life: 12 months each for Base coat and clear coat.**

**11. Supply Condition**

- a. The required coating shall be procured from either OEM or authorized dealer / agent of the OEM. To ensure the genuineness of the material, the material shall be supplied with original Delivery challan / invoices copy along with the batch wise certificate from OEM for material being originally theirs.
- b. Credentials, performance and areas of usage of offered material in Indian or International Railways applications
- c. Material has to be supplied for minimum one coach set with all related testing documents mentioned in table 1 and 2 and OEM certificates.

**12. PREPARATION OF COATINGED PANELS FOR TESTING**

For the preparation of coated panels for conducting different tests mentioned in Table-1 & Table -2 shall be followed.

**Table 1: DETAILS OF PREPARING COATINGED SAMPLES FOR POLYURETHANE WATERBORNE BASECOAT COATING (TWO COMPONENTS)**

SN	Test	Type of panel	Size in MM	Coating detail	D.F.T.	Method of application	Duration of air drying before testing	Special instructions
1	Drying time	Glass or FRP or Steel	700 x 25 x 7	-	30-40 $\mu$ m	Applicator		
2	Colour						40 Min flash off 40 Min 60°C	

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3	Gloss	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	
4	Scratch hardness	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	
5	Flexibility Mandrel	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	
6	Adhesion	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	
7	Abrasion	Metal	100 x 100 x 1.25 Centrally located hole of size as per specific design of the testing machine	Double coat of PU coating (2 components)	Minimum 70 $\mu$ m			
8	Soil resistance	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	

**Table 2: DETAILS OF PREPARING COATINGED SAMPLES FOR POLYURETHANE WATERBORNE CLEAR COAT COATING (TWO COMPONENTS)**

SN	Test	Type of panel	Size in MM	Coating detail	D.F.T	Method of application	Duration of air drying before testing	Special instructions
1	Drying time	Glass or FRP or Steel	700 x 25 x 7		30-40 $\mu$ m	Applicator		
2	Colour						40 Min flash off 40 Min 60°C	
3	Gloss	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	

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4	Scratch hardness	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	
5	Flexibility Mandrel	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	
6	Adhesion	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	
7	Abrasion	Metal	100 x 100 x 1.25 Centrally located hole of size as per specific design of the testing machine	Double coat of PU coating (2 components)	Mini mum 70 $\mu$ m			
8	Soil resistance	Panel A-36	15 X 8	Double coat of PU coating (2 components)	50 $\mu$ m		7 days	

#### APPENDIX A

##### KEEPING PROPERTIES

When stored under cover in a dry place in the original sealed containers under normal temperature conditions (5-25°C), the material shall retain the properties prescribed in the specification for the stipulated period from the date of manufacture which shall be subsequent to the date of placement of contract.

#### APPENDIX B

##### SOIL RESISTANCE

Prepare one panel for each test. Panel A36 Aluminium (0.6x76x152 mm).

The coating must be cured 72h minimum before testing.

The panels shall be soiled with the following items, allowed to dry for at least 2h and then evaluated after cleaning by scrubbing with spray neutral detergent diluted 1:10 with water. Each item shall be used to soil an area of about 10cm<sup>2</sup>.

Butter (any brand)

Chocolate (a syrup or melted chocolate, any brand)

Gravy sauce (any brand)

Hair oil

Ketchup (any brand)

Mayonnaise (any brand)

Mustard (any brand)

Orange juice (any brand)

-Soup

-Tomato juice (any brand)

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## EN 45545-2 – Fire Protection on Railway Vehicles

The aim of European Standard EN 45545 is to define a harmonized procedure for fire protection on railway vehicles. The standard consists of 7 parts. Part 2 deals with the requirements for fire behavior of materials and components and it is a complicated standard with different test procedures depending on the application and the type of train. To judge if a material is compliant with EN 45545-2, it is necessary to know the application requirement (varying from R1 to R26) and the hazard level which is attributed to the train (varying from HL1 to HL3).

### Definition of the Hazard Level of a type of train

The Hazard Level is determined by the operation category and the design category of a train. Already at the very beginning of a project the Hazard Level is defined, usually by the rail authorities. It is estimated that approx. 90% of all trains must comply with HL1 or HL2.

Operation category	Design category			
	N Standard trains	A Automatic trains	D Double decked trains	S Sleeping vehicles
1 – no tunnels	HL 1	HL 1	HL 1	HL 2
2 – tunnels max. 5 km	HL 2	HL 2	HL 2	HL 2
3 – tunnels > 5 km	HL 2	HL 2	HL 2	HL 3
4 – no side evacuation	HL 3	HL 3	HL 3	HL 3

### Definition of the Requirement

EN 45545-2 contains a list of 68 listed components, each referring to an application in a train, which is defined by the type of application and where it is situated (Interior/Exterior). For example: the listed component IN1A refers to interior vertical surfaces, defined as:

- Interior components (structure and covering) such as side walls, front walls / end-walls, partitions, room dividers, flaps, boxes, hoods, louvres.
- Interior doors, interior lining of the front-/end-wall doors and external doors.
- Windows (including plastics and glazing) Insulation material and interior surface of body shell.
- Kitchen interiors surfaces (except those of kitchen equipment).

To each listed component a requirement is attributed; the standard defines in total 26 different requirements (R1 to R26). Each requirement lists different fire tests which need to be passed to comply to a certain Hazard Level. Next to that, the standard defines requirements for non-listed products, and complex grouping rule for small parts (with a mass <100 g for interior products and <400 g for exterior products).



## EN 45545-2 – Fire Protection on Railway Vehicles

Requirement R1						
	Test method	Parameter	Unit	HL1	HL2	HL3
Flame spread	ISO 5658-2	CFE	kW/m <sup>2</sup>	> 20 <sub>a</sub>	> 20 <sub>a</sub>	> 20 <sub>a</sub>
Heat release	ISO 5660-1 @ 50 kW/m <sup>2</sup>	MARHE	kW/m <sup>2</sup>	– <sub>a</sub>	< 90	< 60
Smoke development	ISO 5659-2 @ 50 kW/m <sup>2</sup>	D <sub>s</sub> (4)		< 600	< 300	< 150
		VOF <sub>4</sub>	min	< 1200	< 600	< 300
Toxicity	ISO 5659-2 @ 50kW/m <sup>2</sup>	CIT <sub>G</sub>		< 1.2	< 0.9	< 0.75
<p>a : If flaming droplets/particles are reported according to 5.3.7 during the test ISO 5658-2, or for the special case of materials which do not ignite in ISO 5658-2 and are additionally reported as unclassifiable, the following additional requirements shall be added:</p> <p>Test to the requirements of EN 11925-2 with 30 s flame application. The acceptance requirements are: flame spread &lt; 150 mm within 60 s and no burning droplets/particles.</p>						
IN1A	Interior vertical surfaces					
IN1B	Interior horizontal downward-facing surface					
IN1D	Interior surfaces within cavities					
IN4	Luggage storage areas					
IN5	Driver's desk					
IN6A	Interior surfaces of gangways; type A - for railway vehicles in which there are no fire barriers at both bulkhead ends of the gangway					
IN7	Window frames					
IN8	Curtains and sunblind in passenger and staff areas & compartments					
IN9B	Tables, folding tables downward facing surfaces; type B – downward surfaces					
IN11	Litter bins and ashtrays					
IN12A	Air ducts – interior surfaces					
IN12B	Air ducts – exterior surfaces					
IN14	Devices for passenger information					





–	Non-listed products in interior with an exposed area > 0.20 m²					
<b>Requirement R2</b>						
	Test method	Parameter	Unit	HL1	HL2	HL3
Flame spread	ISO 5658-2	CFE	kW/m²	> 13 <sub>a</sub>	> 13 <sub>a</sub>	> 13 <sub>a</sub>
Heat release	ISO 5660-1 @ 50 kW/m²	MARHE	kW/m²	– <sub>a</sub>	– <sub>a</sub>	< 90
Smoke development	ISO 5659-2 @ 50 kW/m²	D <sub>s</sub> (4)		< 600	< 300	< 150
		VOF <sub>4</sub>	min	< 1200	< 600	< 300
Toxicity	ISO 5659-2 @ 50kW/m²	CIT <sub>G</sub>		< 1.2	< 0.9	< 0.75
a : see remark in table Requirement 1						
IN2	Limited surfaces (area < 0.20m², maximum dimension in any direction < 1 m)					
IN9A	Tables, folding table tops and toilet wash basins; type A – Upper surfaces					
IN10	Containers					

Requirement R3						
	Test method	Parameter	Unit	HL1	HL2	HL3
Flame spread	ISO 5658-2	CFE	kW/m²	> 13 <sub>a</sub>	> 13 <sub>a</sub>	> 13 <sub>a</sub>
Heat release	ISO 5660-1 @ 50 kW/m²	MARHE	kW/m²	– <sub>a</sub>	– <sub>a</sub>	– <sub>a</sub>
Smoke development	ISO 5659-2 @ 50 kW/m²	D <sub>s</sub> (4)		–	< 480	< 240
		VOF <sub>4</sub>	min	–	< 960	< 480
Toxicity	ISO 5659-2 @ 50kW/m²	CIT <sub>G</sub>		< 1.2	< 0.9	< 0.75
a : see remark in table Requirement 1						
IN3A	Strips (width < 0.20m, separated from each other by > 0.20 m of R1 compliant material)					

## EN 45545-2 – Fire Protection on Railway Vehicles

Requirement R4						
	Test method	Parameter	Unit	HL1	HL2	HL3
Flame spread	ISO 5658-2	CFE	kW/m <sup>2</sup>	> 13	> 13	> 13
	ISO 11925-2, 30 s	Flame spread	Mm	150 (within 60 s)	150 (within 60 s)	150 (within 60 s)
		Flaming droplets		0	0	0
Toxicity	ISO 5659-2 @ 50kW/m <sup>2</sup>	CIT <sub>G</sub>		< 1.2	< 0.9	< 0.75
IN3B Light diffusers						

Requirement R6						
	Test method	Parameter	Unit	HL1	HL2	HL3
Heat release	ISO 5660-1 @ 50 kW/m <sup>2</sup>	MARHE	kW/m <sup>2</sup>	< 90	< 90	< 60
Smoke development	ISO 5659-2 @ 50 kW/m <sup>2</sup>	D <sub>s</sub> (4)		< 600	< 300	< 150
		VOF <sub>4</sub>	min	< 1200	< 600	< 300
Toxicity	ISO 5659-2 @ 50kW/m <sup>2</sup>	CIT <sub>G</sub>		< 1.2	< 0.9	< 0.75
F1C Passenger seat shell - Base						
F1D Passenger seat shell - Back						



## EN 45545-2 – Fire Protection on Railway Vehicles

Requirement R7						
	Test method	Parameter	Unit	HL1	HL2	HL3
Flame spread	ISO 5658-2	CFE	kW/m <sup>2</sup>	> 20 <sub>a</sub>	> 20 <sub>a</sub>	> 20 <sub>a</sub>
Heat release	ISO 5660-1 @ 50 kW/m <sup>2</sup>	MARHE	kW/m <sup>2</sup>	– <sub>a</sub>	< 90	< 60
Smoke development	ISO 5659-2 @ 50 kW/m <sup>2</sup>	D <sub>s</sub> max		–	< 600	< 300
Toxicity	ISO 5659-2 @ 50kW/m <sup>2</sup>	CIT <sub>G</sub>		–	< 1.8	< 1.5
a : see remark in table Requirement 1						
IN6B	Interior surfaces of gangways; type B: for railway vehicles in which there are fire barriers at both bulkhead ends of the gangway					
IN12C	Air ducts on locomotives					
EX1A	Walls of external body shell					
EX1C	External surfaces of enclosures containing technical equipment					
EX3	Under frame of external body shell					
EX4	Exterior ducts					
EX5	External design features					
EX6A	Containers mounted in under frame					
EX7	Exterior surfaces of gangways					
–	Non-listed products in exterior with an exposed area > 0.20 m <sup>2</sup>					



## EN 45545-2 – Fire Protection on Railway Vehicles

Requirement R22						
	Test method	Parameter	Unit	HL1	HL2	HL3
Oxygen content	ISO 4589-2	Oxygen content	%	>28	>28	>32
Smoke development	ISO 5659-2 @ 25 kW/m <sup>2</sup>	D <sub>s</sub> max		<600	< 300	< 150
Toxicity	NF X 70-100-1 and -2	CIT <sub>NLP</sub>		<1.2	< 0.9	< 0.75
E6A Supply line system and high-power devices – interior						
– Non-listed products in interior with an exposed area < 0.20 m <sup>2</sup>						

Requirement R23						
	Test method	Parameter	Unit	HL1	HL2	HL3
Oxygen content	ISO 4589-2	Oxygen content	%	>28	>28	>32
Smoke development	ISO 5659-2 @ 25 kW/m <sup>2</sup>	D <sub>s</sub> max		–	< 600	< 300
Toxicity	NF X 70-100-1 and -2	CIT <sub>NLP</sub>		–	< 1.8	< 1.5
E5 Supply line system devices – exterior						
E6B Supply line system and high-power devices – exterior						
– Non-listed products in exterior with an exposed area < 0.20 m <sup>2</sup>						

Requirement R24						
	Test method	Parameter	Unit	HL1	HL2	HL3
Oxygen content	ISO 4589-2	Oxygen content	%	>28	>28	>32
– Only used for certain electrical components (depending on the grouping rules)						

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## INDIAN RAILWAYS



Chief Engineer

Signature

Date

Dir/std/Carr.

### SCHEDULE OF TECHNICAL REQUIREMENTS FOR AUTOMATIC HYGIENE & ODOUR CONTROL SYSTEM FOR TOILETS OF IR COACHES

S.No.	Month/Year of Issue	Revision / Amendment	Page No.	Reason for Amendment
1.	December, 2008	-	-	First issue

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**Research Designs and Standards Organization**  
Manak Nagar, Lucknow - 226011.

Ref: CGW 0001 (Rev. – 4)	Page 2 of 6	Date of issue: December, 2008	RDSO/2008/CG-11 Revision-NIL
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**SCHEDULE OF TECHNICAL REQUIREMENTS  
FOR AUTOMATIC HYGIENE & ODOUR CONTROL SYSTEM FOR  
TOILETS OF IR COACHES**

**1. SCOPE**

- 1.1 This specification lays down the general and technical requirements for the Automatic hygiene and odour control systems to be provided in the toilets of IR BG coaches.
- 1.2 The automatic hygiene and odour control system to be provided in the toilets of IR BG coaches is a system which automatically releases metered doses of the product contained in the refill container at predetermined durations in the flush water to maintain the cleanliness, hygiene and provide a continuous pleasing fragrance.

**2. GENERAL REQUIREMENTS**

- 2.1 Railways may maintain the system themselves by procuring the equipment & consumables. Alternatively the work may be awarded on rental basis.
- 2.2 The tenderers have to submit the details of the active ingredients in their product for cleaning, disinfecting and deodorizing coach toilet.
- 2.3 The capacity of the refill should be able to serve/last for a minimum period of one month.
- 2.4 Generally the system should release around 0.1 ml of drip /dose at an interval of every 15 minutes. The minor variation is permissible. The tenderer should specify the following:
  - i) Quantity of the drip/dose released at an interval of every 15 minutes.
  - ii) Volume of the refill cartridge and its replacement interval
- 2.5 The tenderer have to submit the following documents along with the tender for their offers to be technically evaluated:
  - 2.5.1 Documentary evidence of being the OEM or an authorization certificate in original as proof of being an authorized distributor of the original equipment manufacturer.
  - 2.5.2 Test report from a Govt. Accredited Test Lab that the contents of the refill cartridges are biodegradable.
  - 2.5.3 Certificate of performance from at least any two reputed organisations and their contract details.
  - 2.5.4 Printed/published technical data/ brochure and material safety data sheet (MSDS) of the product proposed to be used along with test certificate and details of the test method from a government-accredited laboratory for the tests mentioned below for the refill:
    - i) Non-corrosiveness of refill material.
    - ii) CE Certification or equivalent international/Indian certification for the product.



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iii) RoHS compliant certification or equivalent Indian certification for dispenser.

### **3. SUPPLY**

- 3.1 The system must be supplied as a complete unit including dispenser with all the components, accessories, battery, refill and adequate size aesthetic looking stainless steel cage with lock & key to prevent the system from pilferage. A certificate from the OEM must accompany each lot of supply certifying the product to be theirs and meeting the requirements of this specification.
- 3.2 In case the work is contracted out on rental basis the contractor will perform the activities enlisted as below:
- Supply, installation, operation and maintenance of the Automatic Hygiene and Odour Control system along with all accessories including container, dispenser and aesthetic looking stainless steel cage with lock and key, consumables and spares.
  - Disposal of refilling cartridges, replaced batteries and other related wastes should be done by the contractor according to the environmental laws of India.
- 3.3 The contract should be awarded for a minimum period of one year, extendable on mutually agreed terms & conditions. On the completion of the contract, the dispenser and other accessories/material supplied will be returned to the firm.

### **4. MARKING**

The unit shall be marked at a visible location to show:

- Manufacturer's and supplier's name with the serial/batch number alongwith month and year of manufacture
- IR logo as per drawing No.CSC-I124A but the dimensions may be suitably scaled down in proportion.

### **5. INSTALLATION AND COMMISSIONING**

- 5.1 The supplier should carry out installation and commissioning of the system.
- 5.2 One unit of Automatic hygiene and odour control system should be installed in each toilet of the coach.

### **6. OPERATION & MAINTENANCE**

The supplier will carry out the complete operation and maintenance as per clause No. 3.2

### **7. INSPECTION**

The inspection shall be done by the consignee/authorized representative of consignee, either at the consignee or the firm's premises as mutually agreed to by the purchaser and the supplier.

Ref: CGW 0001 (Rev. – 4)	Page 5 of 6	Date of issue: December, 2008	RDSO/2008/CG-11 Revision-NIL
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## 8. OPERATING CONDITIONS

The system should function satisfactorily under the following operating conditions of the coaches:

- i) Ambient conditions:  $-4^{\circ}\text{C}$  to  $50^{\circ}\text{C}$  with 100% humidity and dust. Temperature variations can be quite high in the same journey or short period of time. Coaches also operate in coastal areas where there may be continued exposure to salt laden air.
- ii) The journey time of the coaches may be upto 80 hrs.
- iii) The coaches may remain stabled in yards under the sun for prolonged periods without the air conditioning being available. The temperature under sun may be upto  $70^{\circ}\text{C}$ .

## 9. DESIGN REQUIREMENTS

- 9.1 The system offered must be of a proven and established design.
- 9.2 One unit of Automatic hygiene and odour control system should be sufficient for one toilet.
- 9.3 The system should dispense measured doses of cleaning, disinfecting and deodorizing solution. The frequency of the doses should be at an interval of every 15 minutes.
- 9.4 It should prevent build up of organic deposits in the pipeline, toilet pan and remove unsightly stains on the fixtures.
- 9.5 It should eliminate offensive odour & give a continuous pleasant smell.
- 9.6 It should destroy bacteria and germs from the system.
- 9.7 The chemical should reduce existing scale over time by softening and weakening the structure of the scale.
- 9.8 The product should be biodegradable and non-corrosive and have no banned or hazardous chemicals. The presence of any such substance, which is required to be disclosed as per international laws, should be provided to IR alongwith the permissible exposure limits.
- 9.9 The system should be designed with one-way valve to handle high water pressure.
- 9.10 The system should be digitally programmable to adjust dosing quantity.
- 9.11 The unit should have ON/OFF button and other necessary buttons such as to enable adjustment of settings, programming etc.
- 9.12 It should have automated dosing mechanism. It should be simple in construction and easy to operate without using electronic components. If electronic components are used, they

Ref. CGW 0001 (Rev. - 4)	Page 6 of 6	Date of issue: December, 2008	RDSO/2008/CG-11 Revision-NIL
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should have user friendly programming facility with visual display (LED/LCD type) of sufficient size on the unit.

- 9.13 The unit should be compact and secured with inbuilt lock and key. The protection & anti-pilferage cage should be made of stainless steel and have a locking system for prevention of theft.
- 9.14 The system should use drip delivery.
- 9.15 The details of the contents should to be displayed on the refill shall be meeting relevant EC directives/laws/rules of Central Pollution Control Board of India or equivalent international law/standards.
- 9.16 The delivery pipe should be properly integrated with the flush pipe and should be properly clamped.

#### **10. User Requirements (Handling/storage):**

- 10.1 User may protect the product from the direct sun light. Usually it should able to withstand temperature up to 70°C but users have to take care that it should not expose to temperature exceeding.
- 10.2 Do not puncture or burn the cartridge/refill can, even after use.
- 10.3 Store in cool, dry and well ventilated area away from heat or open flame.

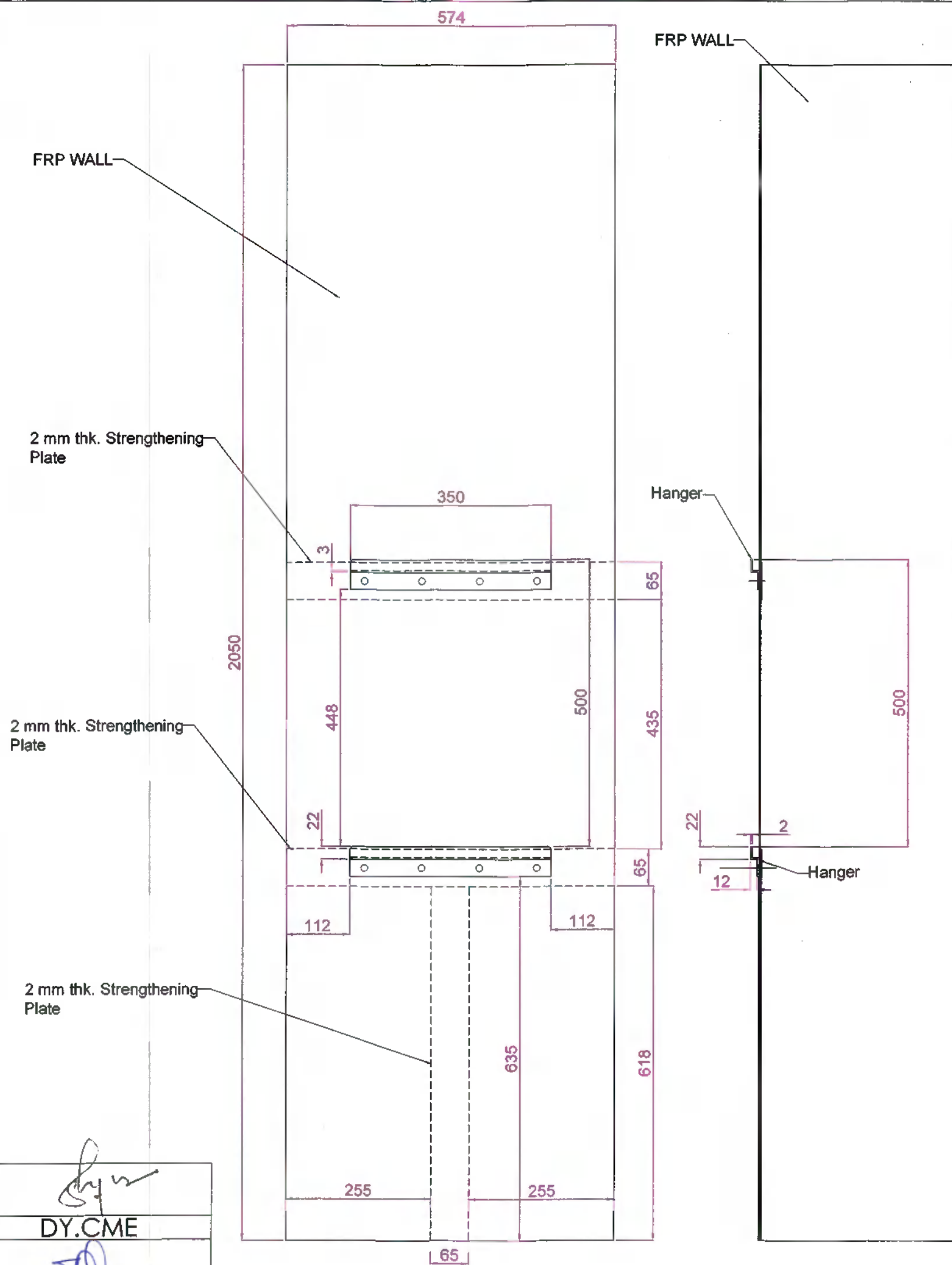
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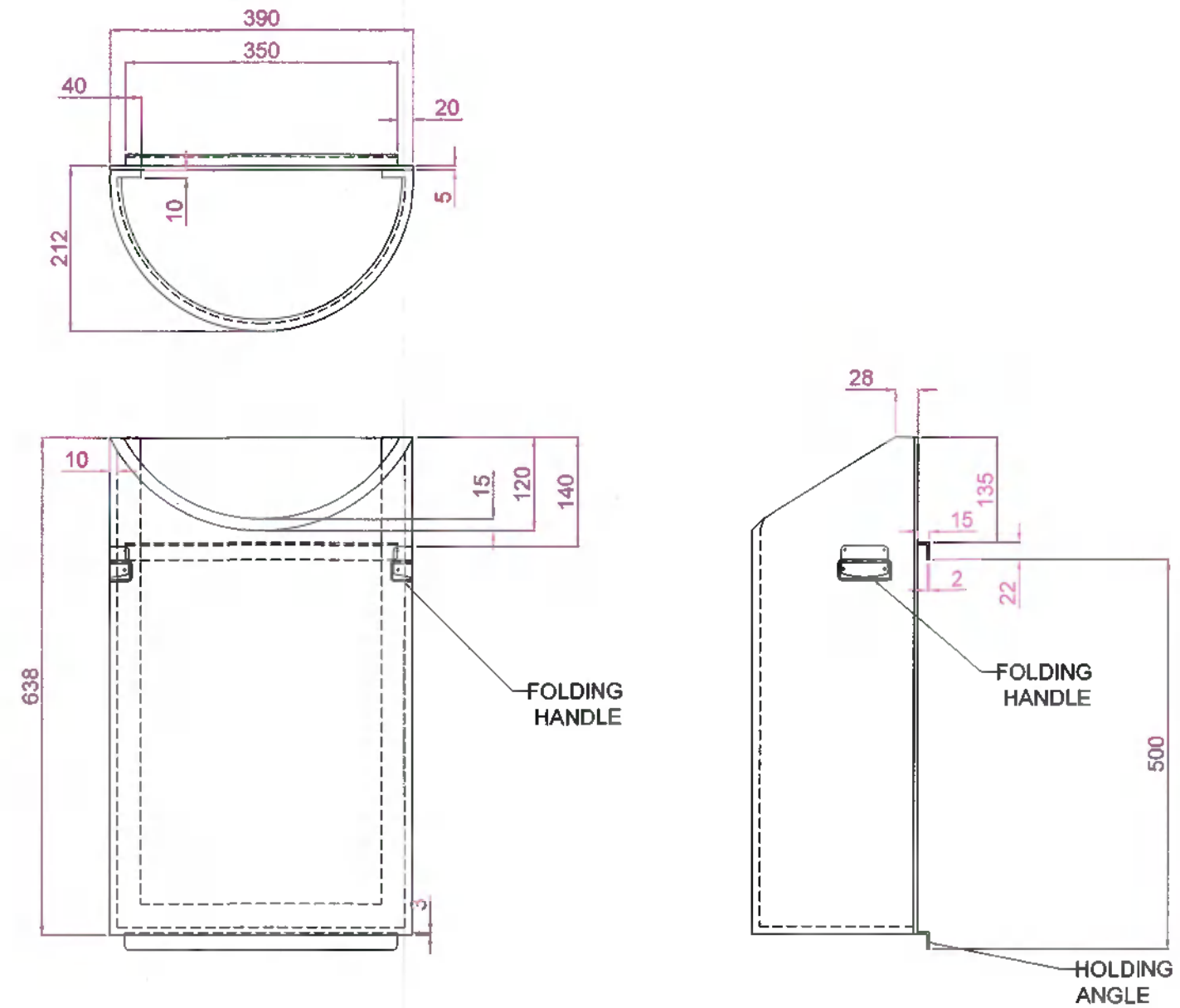
ANY MANUAL ALTERATION SHALL AUTOMATICALLY RENDER THIS DRAWING INVALID



	
DY.CME	
	
WM	
DT. 04.3.24	
SSE	
CR	
DRN	
DRG NO. JUDW/ MECH/24-845	

SSE/CR-AC

ALTERATIONS				
Alt.	DESCRIPTION	DATE	AUTHY:	SIGN.
01	MATERIAL OF HANGER & HOLDING ANGLE SPECIFIED.	07.06.2024	WM/W	



NOTE:-

1. ALL DIMENSIONS ARE IN MM.
2. ALL DIMENSIONS ARE INDICATIVE MINOR CHANGES ARE ADMISSIBLE SUBJECT TO THE APPROVAL OF COMPETENT AUTHORITY.
3. TENDERER SHALL SUBMIT ADVANCE SAMPLE FOR APPROVAL OF SHADE, PATTERN AND APPEARANCE.
4. MATERIAL SHALL BE SUPPLIED IN ASSEMBLED CONDITION.
5. MATERIAL:MDTS-133 WITH LATEST ALTERATION.
6. MATERIAL OF STRENGTHENING PLATE : AISI-304.
7. MATERIAL OF HANGER & HOLDING ANGLE : AISI-304.
8. MATERIAL OF FOLDING HANDLE : AISI-202.

**TENTATIVE**

ITEM	DESCRIPTION	QTY. PER ASSLY.	REF. DRG	MAT & SPEC.	REMARKS
FRP OUTSIDE DUST BIN	उत्तर रेलवे अफिसरी एवं माल डिब्बा कारखाना जगाधरी वर्कशॉप NORTHERN RAILWAYS, C&W WORKSHOP JAGADHRI				
	ड्राईंग कार्यालय यांत्रिक जगाधरी वर्कशॉप DRAWING OFFICE MECH, JAGADHRI WORKSHOP				
NOTE:-	MATL.	DRG. NO. JUDW/MECH/24-845			Alt-01
	SCALE:	SOURCE:		SHEET: 1 OF 1	SIZE A-3

<b>INTEGRAL COACH FACTORY, CHENNAI-38</b>	
<b>SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE AND SUPPLY OF PHOTOSENSITIVE ANODIZED ALUMINUM STICKERS / PLATE FOR EXTERIOR AND INTERIOR NOTICES ON RAILWAY COACHES</b>	<b>ICF/MD/SPEC.-253 ISSUE STATUS : 01 REV. No: 00 DATE : 12-07-2013</b>
<b>IDENTIFICATION SHEET</b>	<b>No. of PAGES : 7</b>

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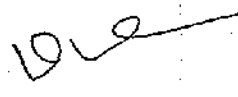


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<p align="center"><b>INTEGRAL COACH FACTORY CHENNAI- 600 038</b></p>	<p><b>ICF/MD/SPEC- 253</b>  <b>ISSUE STATUS:01</b>  <b>Rev.:00</b>  <b>DATE: 12.07.2013</b>  <b>Page 1 of 7</b></p>
<p align="center"><b>SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE AND SUPPLY OF PHOTOSENSITIVE ANODIZED ALUMINUM STICKERS / PLATE FOR EXTERIOR AND INTERIOR NOTICES ON RAILWAY COACHES</b></p>	

## 1. Scope

This specification covers general, technical and special requirements of Photo sensitive anodized aluminum Stickers and plates to be used as signage for persons with impaired vision and normal vision. These stickers will be provided onto interior and exterior of coaches.

## 2. General Requirement

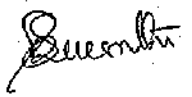
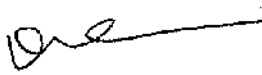
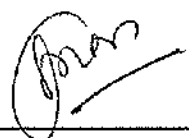

- 2.1 The intended use of these stickers is for both interior and exterior application in coach. It integrates the requirements of persons with impaired vision and normal vision.
- 2.2 The physical properties, text and colour of the stickers shall be as per the following drawings with latest alterations and specifications indicated in the respective drawings.

	Drawing Numbers.
For Exterior lettering	ICF/STD-8-3-011
	ICF/STD-8-3-012
	ICF/STD-8-3-013
For Interior lettering	ICF/STD-6-4-008
	ICF/SK3-6-4-038
	ICF/SK3-6-4-039

- 2.3 The tenderer shall submit the following documents along with offer, at the time of prototype sample approval and also along with bulk supply.

- 2.3.1 The Braille text printed on the stickers shall be certified by the National Association for the Blind (NAB) or equivalent or competent agency / organization of national or international repute and certificate enclosed.

- 2.3.2 Clause-wise compliance on the specification without which ICF / Railways reserves the right to summarily reject the offer.

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<p align="center"><b>SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE AND SUPPLY OF PHOTSENSITIVE ANODIZED ALUMINUM STICKERS / PLATE FOR EXTERIOR AND INTERIOR NOTICES ON RAILWAY COACHES</b></p>	

2.3.3 Deviation Statements with respect to specifications, if any should be indicated against the relevant clause.

2.3.4 Supply Credentials, performance reports and where used in Railways applications.

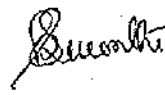
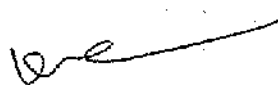


2.3.5 Material Safety Data Sheet and test result from NABL accredited lab or OEM test certificate.

## 2.4 Operating Conditions for stickers

### 2.4.1 Ambient conditions.

On fitment in the coaches, the stickers will be subjected to the following climatic conditions.

1. Ambient temperature -  $-4^{\circ}\text{C}$  to  $50^{\circ}\text{C}$
2. Altitude - Sea level upto 2500m
3. Max. Sun temperature -  $70^{\circ}\text{C}$
4. Relative humidity - Maximum up to 100%
5. The rainfall - Fairly heavy.
6. During dry weather, the atmosphere is likely to be dusty.
7. Temperature variation can be quite high in the same journey for different durations of time.
8. Coaches may operate in coastal areas with continued exposure to salt laden air.

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#### 2.4.2 Maintenance Conditions

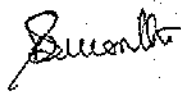
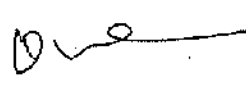


The coach exteriors are cleaned with liquid cleaning agent to RDSO Spec. No. M&C/PCN/101/2007 using brushes with nonmetallic bristles or in automatic car washing plants. The interiors are cleaned by Wet/Dry wiping.

### 3 Technical requirements

- 3.1 The sticker shall be manufactured from photosensitive anodized alloy 1100A series aluminum as per ASTM B209-10 standard, in accordance with GG-P-455b (Federal Specification) with characters, text, image etc integrated into the anodized layer and sealed within the anodic layer. The sticker shall be homogenous and non porous. It shall be free from dents and other defects. No top coating layer should be used as protection to the top surface. Acids, Chemicals, cleaning agents to RDSO Spec. No. M&C/PCN/101/2007 must not damage the stickers. The stickers shall not include any materials having harmful effects on human beings, painted surfaces or environment. To make it tamper proof the Sticker / Labels should be integrated either with the high strength transfer tape of 3M 467 or equivalent to the base plate. In addition holes have to be provided for pop riveting as per drawings.

The thickness of finished sticker without adhesive and backing shall be between 0.08mm to 0.2mm or as per the drawing. The test procedure for measuring thickness is ASTM-D- 3652.

- 3.2 The base material of the sticker should be of anodized alloy 1100A Series aluminum as per ASTM B209-10 standard and dimensions as per drawing specified.
- 3.3 The thickness of the sticker with base plate should be as per drawing specified.

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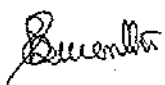
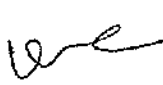


#### 4 Properties and performance characteristics.

##### 4.1 Acceptance tests:

S. No	Performance Characteristics	Method & Result
1	Abrasion Resistance	As per Federal specification GG-P-455b, Clause No. 3.7.1 & 4.6
2	Acid Corrosion	As per Federal specification GG-P-455B, clause no. 3.7.1.1 & 4.7
3	Heat Resistance	As per Federal specification GG-P-455B clause no. 3.7.1.2 & 4.8)
4	Accelerated Oxygen Aging	As per Federal specification GG-P-455B clause no. 3.7.1.5 & 4.11)
5	Stain Resistance	As per Federal specification clause no. 3.7.1.7 & 4.13)
6	Cleaning Resistance	As per Federal specification clause no. 3.7.1.8 & 4.14)
7	Low Temperature resistance	As per Federal specification clause no. 3.7.1.9 & 4.15)
8	Organic Solvent Resistance	As per Federal specification clause no. 3.7.1.10 & 4.16

##### 4.2 Type tests (to be conducted once in two years or as required)

S. No	Performance Characteristics	Method & Result
4	Salt Spray Corrosion test	As per Federal specification GG-P-455B clause no. 3.7.1.3 & 4.9)
5	Accelerated Light & Weather Resistance test	As per Federal specification GG-P-455B clause no. 3.7.1.4 & 4.10

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<p align="center"><b>INTEGRAL COACH FACTORY CHENNAI- 600 038</b></p>	<p><b>ICF/MD/SPEC- 253</b>  <b>ISSUE STATUS:01</b>  Rev.:00  <b>DATE: 12.07.2013</b>  Page 5 of 7</p>
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- 4.3 The Performance Characteristics, test methods and results mentioned above should either be certified by NABL accredited lab or should form part of OEM test certificate. These should be submitted along with the offer. These shall also be submitted while seeking prototype approval and along with bulk supply.

## **5 Prototype Approval**


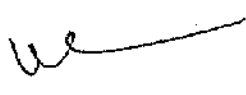


- 5.1 The supplier shall supply a sample sticker as per the properties and performance characteristics mentioned above. (Clause 4)
- 5.2 The prototype sample shall be examined and tested as per the tests specified at clause 4. Suppliers shall incorporate changes suggested by Railway in the prototype as well as in the bulk supply. The bulk manufacturing shall be undertaken only after approval of prototype. This clause of prototype approval is applicable for first supply of the supplier. However, Railway shall have right to repeat prototype approval in subsequent orders also. The decision of Railway in this regard shall be final.

## **6 Marking**

- 6.1 Unless otherwise specified in the Purchase order every sticker / label must have a logo of Indian Railways either appearing as a water mark or as a separate logo on the front of sticker sheet.
- 6.2 Each sticker should have identification number as given in the respective drawings printed on the back of the sticker. The sticker shall also contain manufacture's code, month and year of manufacture.

## **7 Colour Scheme**

Colour scheme of the sticker should be as per drawing.

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<p align="center"><b>INTEGRAL COACH FACTORY</b> <b>CHENNAI- 600 038</b></p>	<p><b>ICF/MD/SPEC- 253</b> <b>ISSUE STATUS:01</b> <b>Rev.:00</b> <b>DATE: 12.07.2013</b> <b>Page 6 of 7</b></p>
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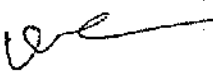


## 8 Requirement of Self Adhesive

The self adhesive should be able to withstand washing and cleaning of the coach with cleaning agents to RDSO Spec. No. M&C/PCN/101/2007, adverse weather, operating conditions and vandalism.

- 8.1 Sticker should have high adhesion to low surface energy substances like PU painted FRP, Colour Coated aluminum, PU painted metal surface, Polycarbonate panels, Aluminum panels, LP sheet etc.
- 8.2 Release paper shall be used to protect the adhesive against dirt and to prevent the film from unintended agglutination.
- 8.3 The release paper of the adhesive shall be easy to remove from the finished stickers/labels. The release paper shall be resistant to climatic changes.
- 8.4 The release paper shall not wrap or distort into tunnel formation within a period of one year. In addition the adhesive power of the release paper shall not be so strong to damage the sticker while removal for application.
- 8.5 After removal of stickers, there should be no stain or marks.

## 9 Printing of stickers

- 9.1 If multi colour printing is called for in the drawing print has to be sub surface, sealed and non destructible by abrasion, solvents and acids.
- 9.2. The shine (finish) of the sheet shall not change under any normal weather conditions and upto a temperature of 350 ° Fahrenheit.
- 9.3. Instructions in Braille should be embossed. The text, text size, distance between two text and word embossed on the sticker should be as per the Braille standard only.

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9.4 Considering space limitation Braille printing may be done over the text or image without affecting the text and image for clear vision to normal persons. In case sufficient space is available, it is advisable to have a separate Braille printing on the same sticker plate without infringing the text or image.

## 10 Warranty

10.1 The Photosensitive anodized aluminum Stickers / plate (multiple colour) supplied shall be deemed to bear warranty against defective material and performance for a minimum period of 3 years for interior application and one and half year(Up to P.O.H for exterior application.

10.2 In case the material shows any defect / fades or fails to perform within the warranty period, it shall be replaced free of cost by the supplier.


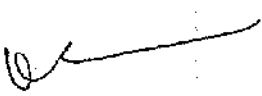


## 11. Installation

11.1 The installation involves pasting and pop riveting and shall be tamper proof.

11.2 In case of pasting the material with the help of self adhesive, the surface should be cleaned for better adhesion.

11.3. Supplier shall carry out the installation if required and the same shall be quoted separately.

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**RAIL COACH FACTORY, KAPURTHALA**

MD46111

Date: 11.07.2016

**Sub:** Schedule of Technical Requirements of Two part solvent free Epoxy Resin Coating for flooring material of IR Passenger coaches to MDTS-44289 Rev-00.

Please find enclosed a copy of Schedule of Technical Requirements of Two part solvent free Epoxy Resin Coating for flooring material of IR Passenger coaches to MDTS-44289 Rev-00.

**Encl. MDTS-44289 Rev-00.**

  
Dy CME/D-2

Dy CPLE-III  
Dy CPLE-II

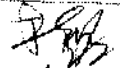

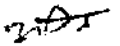
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SSE/Lib/Design  
SE/Design/RCF/TKJ

  
12/7/16


SPECIFICATION No. MDTS 44289 Rev-00	Schedule for Technical Requirements for two part solvent free Epoxy Resin Coating to be used as flooring material in Railway coaches	DATED 07.07.2016 PAGE 1 OF 6
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9

Designation	Name	Signature	Date	Level
SSE/Fur	T P Singh		07/07/16	Prepared
Dy.CME/D-2	Suraj Prakash		07-7-16	Agreed & Reviewed
CDE	A. K. Kathpal		7.7.16	Approved

Issue/Rev	Details of Changes	Date

  
Prepared by

  
Agreed by 07-7-16

<b>SPECIFICATION No.</b> <b>MDTS 44289</b> <b>Rev-00</b>	<b>Schedule for Technical Requirements for two part solvent free Epoxy Resin Coating to be used as flooring material in Railway coaches</b>	<b>DATED 07.07.2016</b> <b>PAGE 2 OF 6</b>
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## 1. SCOPE:

- 1.1 This specification provides the general & technical requirements for supply and application of two part fire safe solvent free epoxy resin coating for flooring in Indian Railways coaches including the toilets.
- 1.2 This specification covers requirement of two part Fire Safe solvent free modified Aliphatic Polyamine Epoxy Resin Coating to be used as flooring material for all type of Railways coaches. The subject flooring provides an impermeable barrier to prevent coach structure from corrosion, helps noise dampening and at the same time provides aesthetically pleasing surface contributing to improved habitability conditions onboard. The criteria for selection & acceptance of the material, application process, technical requirements and warranty are covered under this specification. The application of the coating in coaches is to be carried out by the supplier.

## 2. PURPOSE:

Polyamine Epoxy resin coating is to be used as a floor covering material for all type of coaches. The material is indented to prevent the covered surface from corrosion, water & moisture ingress and create a slip resistance, anti graffiti, aesthetically pleasing finish.

## 3. ELIGIBILITY CRITERIA:

While quoting, the Tenderer shall submit the following details for technical scrutiny of the offers:

- i) Past performance of the offered material in Indian Railway Passenger Coaches/ International Railways or Aircraft or Ships in similar applications. Credentials and performance of the product is required through OEM.
- ii) Technical and safety data sheet of the offered product.
- iii) Clause-wise comments on the specification including test certificates for the parameters specified.
- iv) Test certificates for Fire properties shall be required from the reputed labs like LAPL, Crepim, Exova, DNV, TUV, NORD, Warringtonfire or any other lab of International reputation having requisite accreditation for carrying out these tests according to EN ISO/IEC 17025.

In absence any of the above details for the offered product, the offer would not be considered.

## 4. COMPOSITION :

Polyamine Epoxy resin coating flooring schemes comprises of 3 sub-systems:

- a) Two part Epoxy Resin Primer.
- b) Two part Epoxy Resin main coat with decorative Flex and
- c) Two part Polyurethane Sealer Coat.

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## 5. APPLICATION & PROPERTIES:

Floor coating shall be applied in four stages as mentioned below:-

### 5.1 Surface Preparation

Adequate surface preparation of the coach floors, receiving the Epoxy resin coating, forms an important component of the entire scheme. Proper surface preparation is essential from adhesion point of view and bonding of the coating may get loosened up and chipped out, if applied on insufficiently prepared surface. Prepared Surface should be clean & dry and free from any oil, grease, dirt or foreign contaminants.

### 5.2 Primer

#### 5.2.1 Application:

Post surface preparation, the surface is to be applied with one coat of two part Epoxy Resin Zinc Oxide Primer with a DFT of 100-150 microns by means of brush/trowel/roller. The specified primer is to be used for the better adhesion to the surface and epoxy resin coating. Primer is to be prepared by mixing Part A and Part B in ratio defined by the manufacturer. Full curing time for primer should be approximately one hour.

#### 5.2.2 Technical Specification of Primer:

Table-I

S.No.	Property	Test Method	Specified Value
i.	Moisture Absorption	As per Appendix-II of NCD 1471 Issue 1, Part 2	<0.5%
ii.	Pull off test for adhesion	EN ISO 4624:2016	Pass
iii.	Adhesion strength	Minimum strength adhesion- 4A when tested as per ASTM D 3359 or 4 N/mm <sup>2</sup> when tested with ASTM D-4541	
iv.	Accelerated Corrosion Test	IS: 101-88 (Part 6/Sec.1)	No signs of corrosion on steel plate upto 500 hrs.
v.	Flexibility	As per section 5.6 of NCD 1471 Issue 1, Part 2	Should not crack or detach
vi.	Flow Time	ISO 2431	100/6s

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### 5.3 Two part epoxy Resin main coat with decorative flex application.

#### 5.3.1 Application

The epoxy resin main coat is a compound laid on properly on primed surface to cover the floor undulations and provides aesthetically pleasing, hard and even surface. The recommended thickness of this coating is between 2-3mm. Colour of epoxy resin main coat and flex should be as per approved shades.

Contents of Pack A with Pack B should be blended in the ratio defined by the manufacturer by mechanical blender. However, it should also be able to mix manually also. The blended material should be self-levelling free flow material, which can be spread evenly by masonry/ notched trowel to the desired thickness. Spiked roller should be used to release any entrapped air. The coating should be hard touch dry in 08-10 hours.

#### 5.3.2 Technical Specification of Resin Main coat:

Table-II

S.No.	Parameters	Test Method	Values
i.	Density	DIN EN ISO 2811-1:2011-06	1600-1800 kg/m <sup>3</sup>
ii.	Hardness (Shore D)	DIN 53505	60 - 80
iii.	Peel off Strength on the primed surface	DIN EN ISO 4624	>11 MPa
iv.	Tensile strength	DIN EN ISO 527	60-70 N/mm <sup>2</sup>
v.	Elongation of Break	DIN EN ISO 527	30-40 N/mm <sup>2</sup>
vi.	Water absorption	DIN 53475	Max 0.1%
vii.	Adhesion test	Minimum strength adhesion- 4A when tested as per ASTM D 3359 or 4 N/mm <sup>2</sup> when tested with ASTM D-4541	
viii.	Accelerated Corrosion test	IS: 101-88 (Part 6/Sec.1)	No signs corrosion on steel plate upto 500 hrs.
ix.	Moisture Absorption	DIN 53475	<0.1 %
x.	Electrical conductivity	DIN EN 61340-4-1 DIN EN 1081	>5x10 <sup>-13</sup> Ω (Measuring Voltage 100 V)
xi.	Thermal conductivity	DIN 52612	0.3 W/mK +10%
xii.	Flexural Strength	EN 196-1	45-55 N/mm <sup>2</sup>

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#### 5.4 Two part Solvent free Sealer Coat:

##### 5.4.1 Application

Polyurethane two part sealer coat shall be applied over epoxy resin main coat to close the porosity in epoxy resin main coat. The sealer coat imparts aesthetics finish and provides abrasion resistance, anti stain, anti graffiti seamless surface. The sealer should be UV resistance and solvent free. The sealer must prevent any foreign material such as dust, dirt, mud, cleaning chemicals and water to get penetrated in the floor surface. The sealer coat coverage area shall be minimum 100g/m<sup>2</sup> and the adhesion strength shall be >5 N/mm<sup>2</sup>.

##### 5.4.2 Technical Specification of Two part solvent free sealer coat:

Table-III

S.No.	Parameters	Test Method	Values
i.	Density	DIN EN ISO 1183	< 1.2 g/m <sup>3</sup>
ii.	Coverage area		Min. 100g/m <sup>2</sup>
iii.	Moisture absorption	DIN 53475	<0.2%
iv.	Water absorption	DIN 53475	Max 0.1%
v.	Accelerated corrosion test	Appendix IV of NCD 1471 issue 1- part I	No signs of rusting or corrosion on steel plate
vi.	Slip Resistance	DIN 51130	R 10
vii.	Electrical conductivity	DIN EN 61340-4-1 DIN EN 1081	>10 <sup>-12</sup> Ω (Measuring Voltage 100 V)
viii.	Thermal conductivity	DIN 52612	0.25 W/mK
ix.	Flexibility	EN 196-1	40-50N/mm <sup>2</sup>
x.	Compressive Strength	EN 196-1	40 -50N/mm <sup>2</sup>
xi.	Impact resistance	EN ISO 6272-2	45-55 KJ/mm <sup>2</sup>

#### 6. FIRE PROPERTIES

The complete floor coating comprising of Primer, Epoxy coat and sealer coat should confirm to R10, HL2 category when tested by EN 45545 as tabulated below

Table-IV

S.No.	Test Method	Parameter, Unit	Maximum or minimum	Value
i.	EN ISO 9239-1	CHF, kWm <sup>-2</sup>	Minimum	6
ii.	EN ISO 5659-2: 25 kWm <sup>-2</sup>	D <sub>s</sub> max. dimensionless	Maximum	300
iii.	EN ISO 5659-2: 25 kWm <sup>-2</sup>	CH <sub>TG</sub> dimensionless	Maximum	0.9

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## 7. PROTOTYPE APPROVAL

The supplier shall supply a sample along with the following details at the time of prototype approval.

- i. Test certificates from OEM of the Primer, Epoxy resin coating and Sealer coating indicating compliance to specified parameters as above.
- ii. Material and safety data sheets
- iii. 3 nos. of steel sheets of size 300mm x 600mm should be submitted after application of these coatings. The sample must be coated with three layers (primer, epoxy resin and decorative flex with sealer) and all three layers shall be visible to eye to determine the actual process of installation.
- iv. Test certificates for Fire Properties as mentioned in para 6.
- v. Suppliers shall incorporate changes suggested by Railway in the prototype as well as in the bulk supply.
- vi. The bulk manufacturing shall be undertaken only after approval of prototype. This clause of prototype approval is applicable for the first supply from a new supplier.

## 8. WARRANTY:

The Flooring duly installed with Epoxy resin material shall be deemed to bear warranty against defective material and performance for a minimum period of 36 months form date of application. Loss of any of the specified properties would be considered as warranty failure.

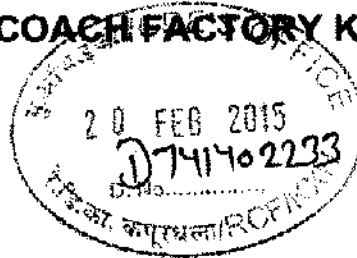
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**RAIL COACH FACTORY KAPURTHALA**

MD22161



Dated : 20.02.2015

**Sub: Issue of specification no. MDTS-133 Rev-'05', Technical Specification for hand lay-up FRP component for all passenger coaches**

Please find enclosed a copy of specification no. MDTS-133 Rev-'05' of Technical Specification for hand lay-up FRP component for all passenger coaches, for information and necessary action at your end.

  
(Suraj Prakash)  
Dy CME/D-1

CQM, CPLE, CWE (FUR), CMM/HSQ, CMM/TKJ, Dy. CMM/Fur/LHB, Dy CCMT,  
DY.CPLE-III

SSE / LIB. DESIGN

✓ SSE / Records




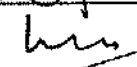
SE / Design / RCF / TKJ

Copy for kind information to:

CDE

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		DATED 02.02.2015

NAME	DESIGNATION	SIGNATURE	DATE	LEVEL
Harish Kumar	SSE/Dev		2/2/15	Prepared
Joginder Singh	SME/D-1		18/2/15	Agreed
Suraj Prakash	Dy.CME/D1		19.02.15	Reviewed
Paramanand Singh	CDE		19.02.15	Approved

Issue/Rev	Details of Changes	Date
Rev. Nil	First Issue	29/03/2003
Rev01	Para 3.1 modified and Warranty's para added	29.03.2003
Rev02	Specification modified. Specification MDTS084 and MDTS-133 clubbed.	06.11.2006
Rev-03	I. Requirement of testing on supplied components/ products added in para 3.2 II. MDTS-03 Rev-1 is withdrawn and MDTS-133 Rev-3 shall be applicable for all practical purposes wherever MDTS-03 Rev-1 has been referred in the past.	26/04/2011
Rev-04	<b>Section -A</b> I. Woven roving, surface mat added in para 2.5 II. Para's 2.6.2 & 4.2.2 added. III Surface mat and woven roving, no of layers deleted and note " two consecutive layers woven roving are not be used " added in para 4.0. IV Para 1.2, 2.2.1, 2.2.2, 2.3.3 & 4.3.2 modified. V Para 1.4 & 1.5 of Rev-03 deleted. VI Styrene content for resin change from 22% to 22-24% <b>Section-B</b> I Smoke density added in Para 4.2 and para 4.22 added.	17-09-2011
Rev-05	i. Para 3.2 modified	02.02.2015

  
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## SECTION 'A' SCHEDULE OF TECHNICAL REQUIREMENTS

### 1.0 FOREWORD & SCOPE: -

- 1.1 This schedule is intended to cover in two parts i.e. A&B. Section – A intends to cover the technical requirements/provisions relating to materials, constructions and tests and does not include all the necessary provisions of the contracts. The section B covers the infrastructural, testing and quality control facilities required to manufacture hand lay-up FRP components.

This schedule draws reference to some of the relevant specification. Latest version of these specifications shall be taken as reference.

- 1.2 Glass fibre reinforced plastic (FRP) panels are to be used for IR passenger coaches. These FRP components are to be produced by hand lay-up process and are required to meet the following objectives.

- Components should be ready to assemble resulting in lower manpower input.
- Reduction in weight of coaches.
- To reduce the extent of corrosion.
- To provide for a clean odourless, hygienic and aesthetically pleasing atmosphere.
- Good impact resistance.
- High specific stiffness.
- Good fire-worthy properties
- Long life with easy maintainability.

- 1.3 The tenderer is permitted to make minor changes in the original design of the system to meet IR's requirements. Prior approval of RCF is must for any change.
- 1.4 Only suppliers with proven credentials who are supplying similar items for Railways/Bus Coach/Automotive/Air Bus shall be considered.
- 1.5 Drawing numbers and number of components required shall be indicated separately at the time of placement of orders.

### 2.0 RAW MATERIAL TO BE USED: –

The materials to be used are plastics (polyester) on the basis of unsaturated polyester resin reinforced by glass fibres. The glass fibres are to be provided with sufficient polyester wetting and the polyester is to be cured completely. The laminates must not show any air pocket (air bubble). Moreover, fibre-free laminate section and bare glass fibres on the surface are not admissible.

The material parameters are to assure a safe functioning of the component under corresponding operating conditions. FRP items shall be manufactured using raw material as indicated below:

- 2.1 FRP items shall be manufactured using unsaturated polyester resin and E-glass Chopped strand mat (CSM), compatible with the polyester resin system.

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2.2 The unsaturated polyester resin used shall be pre-accelerated, high thixotropic laminating of low viscosity and medium reactivity. The resin shall be based on orthophthalic acid and standard glycol, dissolved in styrene and methlmethacrylate. This shall be free from Halogens and shall contain aluminium hydroxide as flame retardant additives. No filler shall be used except those required for obtaining fire retardant property in the resin system.

2.2.1 The resin shall be procured from a reputed manufacturer in sealed containers along with the test certificate. The heat distortion temperature of the resin shall not be less than 100° C and the percentage elongation of the resin shall not be less than 3 %. The properties of the un-cured resin shall be as under:

**TABLE-1**

SN	Properties	Specified Values	Evaluation Standard
1	Density at 20° C	1.5 g/ml	IS-6746-1994
2	Viscosity at 25° C Brookfield DV-II spindle 5 rpm 5	800-1500 MPa.s	IS-6746-1994
3	Styrene content	22-24 %	IS-6746-1994
4	Gel time at 25° C in 100 g cup	20-30 min	IS-6746 Annex-D

2.2.2 **Storage/Handling:** The products are required to be stored in closed container, in a cool place and shielded from sunlight. The gel and curing time of the product, in un-opened original containers, shall not change when stored for at least 03 months in AC temperature controlled storage room.

2.2.3 The manufacturer's recommendation regarding storage must be clearly indicated on the packaging.

2.2.4 The packaging of the individual component should be such that the proper mixing ratio is achieved by using one or more complete packs of resin, hardener & accelerator to avoid wastage of the material.

2.3 **Gel Coats:** Gel coats are applied to the mould surface with a film thickness of approx. 0.6 to 0.8 mm, either by hand with a flat brush or by spraying with spraying equipments. Gel coat shall be pre-accelerated, in spray consistency made from polyester resin. The gel coat shall be based on isophthalic resin dissolved in styrene.

2.3.1 Ready mix granite finish filler system of a reputed brand, resulting in a solid surface of a shade mutually agreed between Railways & Vendor shall be procured from a reputed supplier. This filler system when used with natural colour resin for solid surface (Gel Coating) shall impart necessary fire retardant characteristics to FRP laminate as defined in table-3.

2.3.2 The gel coat shall be procured from a reputed manufacturer in sealed containers along with the test certificate. The properties of the uncured gel coat shall be as under:

**TABLE-2**

  
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SN	Properties	Specified Values	Evaluation Standard
1	Density at 20° C	1.1-1.3 g/ml	IS 6746-1994
2	Viscosity at 25° C Brookfield DV-II spindle 5 rpm 5	25000 to 30000 MPa.s	IS 6746-1994
3	Styrene content	32-34 %	IS 6746-1994
4	Gel time at 25° C in 100 g cup	08-14 min	IS 6746-1994

2.3.3 Storage/Handling: The products are required to be stored in closed container, in a cool place and shielded from sunlight. The gel and curing time of the product, in unopened original containers, shall not change when stored for at least 03 months in AC temperature controlled storage room.

2.3.4 The manufacturer recommendation regarding storage must be clearly indicated on the packaging.

2.3.5 The packaging of the individual component should be such that the proper mixing ratio is achieved by using one or more complete packs of resin, hardener and accelerator to avoid wastage of the material.

2.4 An appropriate pigment compatible with the resin approved by purchaser shall be used.

2.5 E-glass reinforcement: Layers of chopped strand mat of density 450 gm/ sq. meter to IS: 11551 & woven roving of density 360 gm/ sq. meter to IS: 11273 shall be provided in required no's to achieve specified fibre content and overall thickness of the product & panel along with properties specified in para 3.1 & 3.2. Surface mat of density 30 gm/ sq. meter to BS: 3496 shall be provided on finished side of components. Continuous mat shall be used at the corners.

In Lavatory modules (made up by hand lay up process), some of the items are made of sandwich construction (outer portions are of FRP and inner hard cell PVC foam). The hard cell PVC foam shall be as per specification no. MDTS- 096. The details of the inner PVC foam shall be as per drawings indicated by the purchaser. In trough floor, granular corundum particles as per specification no. MDTS 092 shall be used.

In case of sandwiched construction components, 3D mat to specification no: MDTS- 115 shall be used in the middle of the component thickness as mentioned in the drawing.

It should be ensured that two layers of woven roving are not placed one upon each other on both finished product and panel.

### 3.0 PROPERTIES OF FRP PANEL:

3.1 The properties of the 03 mm thick FRP Panel (FRP Panel shall be prepared as per para 4.0 of this specification) shall be as per the values specified in table-3. Gel Coat shall be removed prior to testing of FRP Panels.

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**TABLE-3**

**PROPERTIES REQUIRED OF THE FRP PANEL**

SN	Properties	Specified Value	Evaluation Standard
1	Specific gravity	1.5-1.8	ASTM-D792
2	Tensile strength (N/MM <sup>2</sup> )-min	100	IS: 1998
3	Tensile modulus (N/MM <sup>2</sup> )-min	8000	Do
4	% age elongation at break % min	1.0	Do
5	Inter laminar shear strength- min (N/mm <sup>2</sup> )	7.5	BS:4994
6	Hardness Barcol-min	40	ASTM -D-2583-81
7	Cross breaking strength (N/MM <sup>2</sup> )-min	120	IS: 1998
8	Izod strength (joule/mtr.)	550	IS: 1998
9	Resistance to Impact test	Should not show crack, crazing or pores on the tested surface	ICF/MD/Spec.-107 Annexure A
10	Glass content by weight (w/w)-min(%)	35	IS: 13411 ANNEXURE-A
11	Water absorption-max	0.5 %	ASTM D-570
12	Resistance to spread of flame	Class A or B	UIC 564-2 or Appendix-11
13	Critical oxygen index	28 % min	ASTM -D-2863
14	Toxicity	1.25 max.	NCD-1409
15	Smoke Density	Class A or B	UIC 564-2 or Appendix-15
16	Resistance to stains for (a) Acetone (for solid surface) (b) Black Tea	Should not show any visible change on the surface	IS:2046
17	Crack & Blister test (ink test)	Shall not show any crack in the surface coat.	ICF/MD spec.107 (rev-2) annex B

3.2 In addition above testing as per Table-3, the following tests should also be carried out on the final product made up as per drawing/spec mentioned in the purchase order:

SN	Properties	Required Value
1	Thickness	As per values specified in drawing at various cross-section
2	Glass content by weight on solid (w/w)-min(%)	Values as specified in Table-3
3	Water absorption on solid specimen only	Values as specified in Table-3
4	Critical oxygen index on solid specimen only	Values as specified in Table-3
5	Smoke density on solid specimen only	Values as specified in Table-3

Rest of the inspection shall be carried out as per drawing/spec.

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#### 4.0 FABRICATION: -

The FRP component shall be manufactured by hand lay-up process. For manufacturing of 3mm FRP panel, following minimum reinforcement layers shall be used:

3mm thickness- one finished solid surface (Gel Coat) of 0.6 to 0.8 mm thickness and surface mat, Chopped strand mat and woven roving as per para 2.5 to achieve properties as per Table-3. However two consecutive layers woven roving are not be used i.e. 2 layers of WR are not to be placed upon each other.

**4.1 Workmanship:** The surface shall be smooth and free from visual defects or any other surface defect such as delaminating, cavities and discontinuities etc. The finished surface shall be superior abrasion resistance properties.

**4.2.1** All the layering of the specified glass fibre shall be done in continuous process to avoid undulation. For thicker FRP component (equal to or more than 5 mm thickness), pressure shall be applied on the modules for proper finish of the component.

**4.2.2** Surface mat is to be used as outermost sandwiched layer in all the FRP components irrespective of the construction suggested in the drawing.

#### 4.3 Geometry:

**4.3.1** The dimensions of the FRP components shall be as per relevant drawings.

**4.3.2** The thickness given in the drawing is minimum nominal thickness. However, the reinforcement content specified for each thickness must be provided with fibre layers of specified surface density as per clause 2.5. At Radius, continuous filament to be used. The minimum reinforcement layers for 3mm thick FRP laminate shall be as per Para 4.0 of this specification.

#### 5.0 PAINTING OF THE COMPONENTS: -

The FRP components shall be painted as per MDTS-118 Rev.-01. The items shall be thoroughly cleaned and ground before painting to achieve an excellent painted surface. The gel coat shall be grounded suitably to provide good adhesion. The paint system used, should primarily be suitable for application by spraying. It may also be applied by brush for touching up small areas.

**5.1** Surface preparation: Surface shall be clean, grease free. The surface shall be smoothened with emery paper. Polyester putty shall be applied on the surface wherever required and shall be sanded and smoothened with a proper grade emery paper.

**5.2** Painting System:

**5.2.1** Anti Graffiti paint system with glossy finish (for interior area of lavatories of all AC & Non-AC coaches).

Description	1 <sup>st</sup> coat	2 <sup>nd</sup> coat
Type of coating material	2-component polyurethane based primer (Table-I of	2-component polyurethane based direct gloss Anti-graffiti paint (Table 3 of

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	MDTS-118 Rev. 01)	MDTS-118 Rev. 01)
DFT	30-35 $\mu$ m	50-70 $\mu$ m

- 5.2.2 Anti Graffiti paint system with Matt finish (All areas of AC & Non-AC coaches except interior area of lavatories.)

Description	1 <sup>st</sup> coat	2 <sup>nd</sup> coat
Type of coating material	2-component polyurethane based primer (Table-I of MDTS-118 Rev. 01)	2-component polyurethane based matt Anti-graffiti paint (Table 5 of MDTS-118 Rev. 01)
DFT	30-35 $\mu$ m	50-70 $\mu$ m

- 6.0 There should no damage to the surface in terms of cracks or deep scratches on the surface in course of assembly.

- 7.0 **Marking:** Before dispatch, each assembly shall be legibly marked with indelible marking ink/paint showing the following details:

Manufacturer's name  
Nomenclature of the store  
Month and year of manufacturing

#### 8.0 PACKING: -

The FRP panels shall be packed in properly designed pallet to avoid damage to FRP panels. Suitable rubber packing/spacers shall be used for packing. The pallet shall be so designed that one complete coach material comes in one pallet and it shall be possible to check the quantity per coach. Complete detail of the packing shall be furnished on the pallet. The pallet shall be of disposal type.

#### 9 Warranty:

The store supplied against an order shall be deemed to bear a warranty of 6 years from the date of fitment against defective materials/ workmanship and performance. If the stores supplied are found by the consignee to be so defective during warranty period, the same shall be replaced immediately with serviceable stores without any charges or cost.

#### 10. Training:

The firm shall conduct training for user railways staff for repairs and preventive maintenance.

  
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## SECTION-'B'

### Requirements of infrastructure facilities to manufacture FRP components

#### 1. SCOPE

This section covers the infrastructural requirements for manufacture of FRP components of passenger coaches to be manufactured at RCF.

#### 2. REQUIREMENTS

All vendors seeking registration with RCF must fulfill the requirements of this schedule.

#### 3. PLANT, MACHINERY & INFRASTRUCTURE REQUIREMENTS

- 3.1 The manufacturer's shall have adequate space and covered area with Cemented floor to accommodate the following:
- a) Damp free place for storage of powder, chemicals reinforcement and other raw materials including bought out items.
  - b) Independent manufacturing areas for FRP components.
  - c) Finishing, Assembly and Inspection area with proper ventilation system and dust free area.
- 3.2 The firm shall have separate pattern making shop with all modern facilities for making the patterns of mirror finish surface. The firm shall have adequate facility of buffing and polishing of the pattern.
- 3.3 The firm shall have at least one ITI holder pattern maker with minimum of 5 years experience in the relevant field.
- 3.4 The mould/pattern up-keep shall be proper and the mould/pattern shall be cleaned after every production cycle.
- 3.5 The firm shall have adequate no's. of suitable tools, brushes, roller of different type, cutters required for manufacturing of FRP components, polishing files and buffing machine for de-flushing the moulded products.
- 3.6 The firm shall have at least one drilling machine with provision for drilling, different dia. holes and at least two portable hand grinders for finish grinding of components.
- 3.7 The firm shall have one number air compressor of suitable capacity with air dryer attachment.
- 3.8 The firm shall have system to ensure that moulds are checked at regular intervals. The firm shall have adequate mould handling facilities like chain pulleys or electric hoist or any other suitable method for movement of heavy moulds.

  
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- 3.9 Prior to release of patterns/moulds for production, it should be ensured that these are checked dimensionally in all respects. Proper records of patterns/moulds inspection checking showing the date of checking should be available.
- 3.10 The firm shall have at least one number patterns/moulds for each item along with minimum one number die for test laminates.
- 3.11 The firm shall have proper cutting facility for the FRP components with proper ventilation area. The cutting shop shall be clean and dust free.
- 3.12 The firm shall have one number oven (0 to 200 deg C) with digital temperature indicators fitted with control panel for post or pre-heating of moulds and spraying of moulds.
- 3.13 The firm shall have one no. Gel Coat System with AAC (air assist containment) gun gel coat pump.
- 3.14 The firm shall have separate paint booth with proper ventilation system and dust free environment for spraying of gel coat and painting of the components.
- 3.15 The painter shall have minimum 05 year experience and necessary training shall be imparted to technicians at different stage to update their skills.
- 3.16 Proper weighing facilities for measuring various raw material constituents should be available. One electronic weighing balance of minimum 10- mg accuracy and one mechanical weighing balance of 100 kg capacity with 0.2 % accuracy shall be available.
- 3.17 It must be ensured that the weighing machines are calibrated regularly and frequency of calibration should be specified.

#### 4. TESTING FACILITIES

- 4.1 The firm shall have tensile testing machine of 2.5 MT capacity having a least count of 2 kg with adequate speed of testing required for FRP components.
- 4.2 The firm shall have test facilities for critical oxygen index, smoke density and toxicity index in house.
- 4.3 The firm shall have tie up with a reputed test house for conducting the resistance to spread of flame test.
- 4.4 The firm shall have hot plate for boiling water test of FRP.
- 4.5 The firm shall have one muffle furnace (800 °C) with digital temperature controller and indicator for glass content determination.
- 4.6 The firm shall have Barcol hardness tester (portable) range (0-100)
- 4.7 The firm shall have Izod impact testing machine for testing of FRP products.
- 4.8 The firm shall have electronic balance (least count – 0.001 gm) with density determination kit.
- 4.9 The firm shall have testing facility for resistance to impact test.
- 4.10 The firm shall have testing facility for water absorption percentage.
- 4.11 The firm shall have all measuring instruments like steel scales (300, 600 & 1000 mm) and vernier calipers (0-300 mm)

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SPECIFICATION	TECHNICAL SPECIFICATION FOR HAND LAY-UP FRP COMPONENTS FOR ALL PASSENGER COACHES	MDTS: 133 REV 05 Page 10 of 11  DATED 02.02.2015
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- 4.12 The firm shall have all measuring and checking gauges for different components of the FRP components to ensure the dimensions as per drawings.
- 4.13 The firm shall have Digital Gloss Meter with 45° and 60° to measure gloss value of the surface of the FRP product.
- 4.14 The firm shall have at least one number of DFT meter.
- 4.15 The firm shall have at least one number flow cup B-4 (ford) for measuring the viscosity of resin.
- 4.16 The firm shall have at least 03 nos. of Silica Crucible of 4" size for glass content test and two numbers of glass desecrators. Other glassware like beakers, watch plate, funnel etc. should also be available.
- 4.17 The firm shall have necessary arrangement for measuring the gel time for resin like beakers, pipette, conical flask etc.
- 4.18 The firm shall have one number stopwatch.
- 4.19 The firm shall have one number lab stirrer for mixing the different chemical and fillers.
- 4.20 The firm shall have Test sample preparation facilities like vice, cutter, polishing files etc. for preparation of various samples for test for tensile strength, hardness, specific gravity etc.
- 4.21 Jigs & Fixtures for conducting load test, tensile test etc. should be available with the firm.
- 4.22 The firm shall have one digital oven (200°C) with digital temperature controller and indicator.

## 5. QUALITY CONTROL REQUIREMENTS

- 5.1 The firm shall have their own valid ISO: 9000 series certification for the product for which the approval is sought.
- 5.2 There should be the system to ensure the traceability of the product beginning with raw material stage to finish product stage.
- 5.3 There should be the system to ensure 'first-in first-out' for all raw materials and intermediate stages to finish products.
- 5.4 It should be ensured that there is a Quality Assurance Plan for the product detailing the following various aspects: --
  - Organisation chart.
  - Process flow chart.
  - Stage inspection details from raw materials stage to finish product stage.
  - Various parameters to be checked and level of acceptance of such parameters indicated and method to ensure control over them.
  - Disposal system of rejected raw material and components.
- 5.5 The quality manual of the firm for ISO: 9000 should clearly indicate the control over manufacturing at every stage and testing of the said Railway Product.
- 5.6 There shall be at least one graduate degree holder person in relevant technology with field experience of at least 5 years or a diploma holder with experience of 10 years on thermosetting polymers for regular production and quality control.

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- 5.7 It should be ensured that proper analysis is being done on monthly basis to study the rejection at various stages of production and is documented.
- 5.8 Latest version of all the relevant specification IS, ASTM & RDSO standards and drawings with latest alterations should be available with the firm.

## 6. DOCUMENTATION

Firm shall maintain following documents/records:

- 6.1 A well documented Quality Plan.
- 6.2 Incoming raw material register with TC reference of supplier as well as internal test results.
- 6.3 Maintenances of stock register for use and balance of raw materials, bought out items.
- 6.4 Stage inspection results including finished product results.
- 6.5 Records of internal rejection and its analysis vis-à-vis action plan.
- 6.6 Records of final products inspection by external agencies (like RCF) NCR and case analysis as well as action taken thereof.
- 6.7 Records for maintenance of dies/moulds.
- 6.8 The firm shall ensure that proper systems are available for dealing with customer complaint.

## 7. TRAINING

- 7.1 Training needs should be identified for all concerned officials and regular training shall be organized and imparted on maintenance of machines, quality assurance, safety parameters etc.

  
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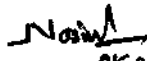
अनुसंधान अभिकल्प एवं मानक संगठन  
RESEARCH DESIGNS AND STANDARDS ORGANISATION

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	No. of Pages	Remarks
1.	05.07.2016	Rev.1	21	Incorporating all Amendments to Specification No. RDSO/PE/SPEC/TL/D/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

कार्यकारी निदेशक/विद्युत आपूर्ति एवं ई.एम.यू.  
Executive Director (PS & EMU)

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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
<b>General</b>			
1.	Type -A	18 Watt	Passenger area (Cabin) for conventional AC coaches
2.	Type -B1	9 Watt	<ul style="list-style-type: none"> <li>Corridor, Doorway &amp; Gangway of all conventional coaches (except ICF built AC) and Non AC LHB Coaches.</li> <li>Passenger area (Cabin) of conventional Non-AC and LHB Non-AC coaches.</li> <li>Conventional Non AC Chair car (Day coach)</li> </ul>
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
<b>For LHB AC Coaches</b>			
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
<b>For chair car/EMU/MEMU Coaches:</b>			
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:**

- i) 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.
- 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. LED array shall be designed in MS/Aluminium enclosure (irrespective of materials given in the drawings) for thermal management and to maintain  $T_j < 85^\circ\text{C}$ .
- iii) 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-fitment 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.0)	Specification of Electronics used in Rolling Stock Application.
IEC 61373	Shock and Vibration Tests for rolling stock application
IEC 61000	Electromagnetic compatibility (EMC)
IS16106	Electrical and photometric measurement of solid state lighting (LED) products
LM-80 / IS16105	Method of measurement of lumen maintenance of solid state lighting (LED) sources
TM-21-11	Projecting long term lumen maintenance of LED light.
UIC-555	Electric lighting in passenger rolling stock.

#### 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 $1.6 \text{ mg/m}^3$
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"> <li>• 110 V AC/DC (conventional/LHB / 3-phase EMU, DEMU/ Kolkata Metro coaches)</li> <li>• 127V AC (Conventional EMU/MEMU coaches)</li> </ul>
Voltage range	<ul style="list-style-type: none"> <li>• 90 V-140 V AC/ DC (conventional/LHB/3-phase EMU, DEMU/ Kolkata Metro coaches)</li> <li>• 90 V-170 V AC (Conventional EMU/MEMU coaches)</li> </ul>
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 UIC 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 UL94-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/65mA 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 e-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 & Kolketa 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:**


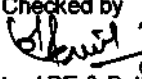
Sl. No.	Description of test	Clause no.	Prototype Test	Type Test	Acceptance Test	Routine Test
1.	Visual and Dimensional check	8 (i)	Y	Y	Y	Y
2.	Checking of Purchase documents of LED	8 (ii)	Y	Y	Y	Y
3.	Resistance to humidity	8 (iii)	Y	Y	-	-
4.	Insulation resistance test	8 (iv)	Y	Y	Y	Y
5.	HV test	8 (v)	Y	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  $10^{\circ}\text{C}$ .

Temperature at junction shall not exceed  $125^{\circ}\text{C}$  when corrected to  $55^{\circ}\text{C}$ . 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  $20^{\circ}\text{C}$ .

**xii) 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  $105^{\circ}\text{C}$  and ensure testing is done at minimum 80% of its absolute maximum forward current ( $I_f$ ). 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.


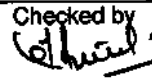
#### xxi) Safety:

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 indeiibly marked on the lamps for retro fitment:

- 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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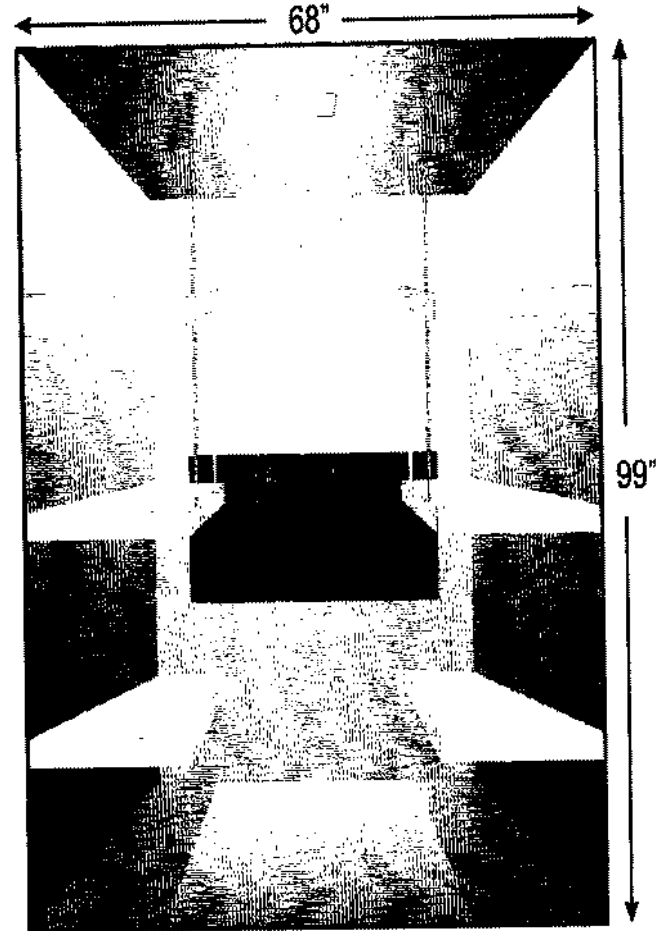
- Megger (500Volt)
- Measuring Gauges such as Vernier caliper, micrometers, dial gauge,
- Non-contact digital thermometer, contact less thermometer and room thermometer.
- Digital multimeter.
- Digital Weighing machine.
- Complete test bench for measuring the different parameters as mentioned in the 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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### 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 &amp; 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)
<b>PART DRAWING</b>				
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

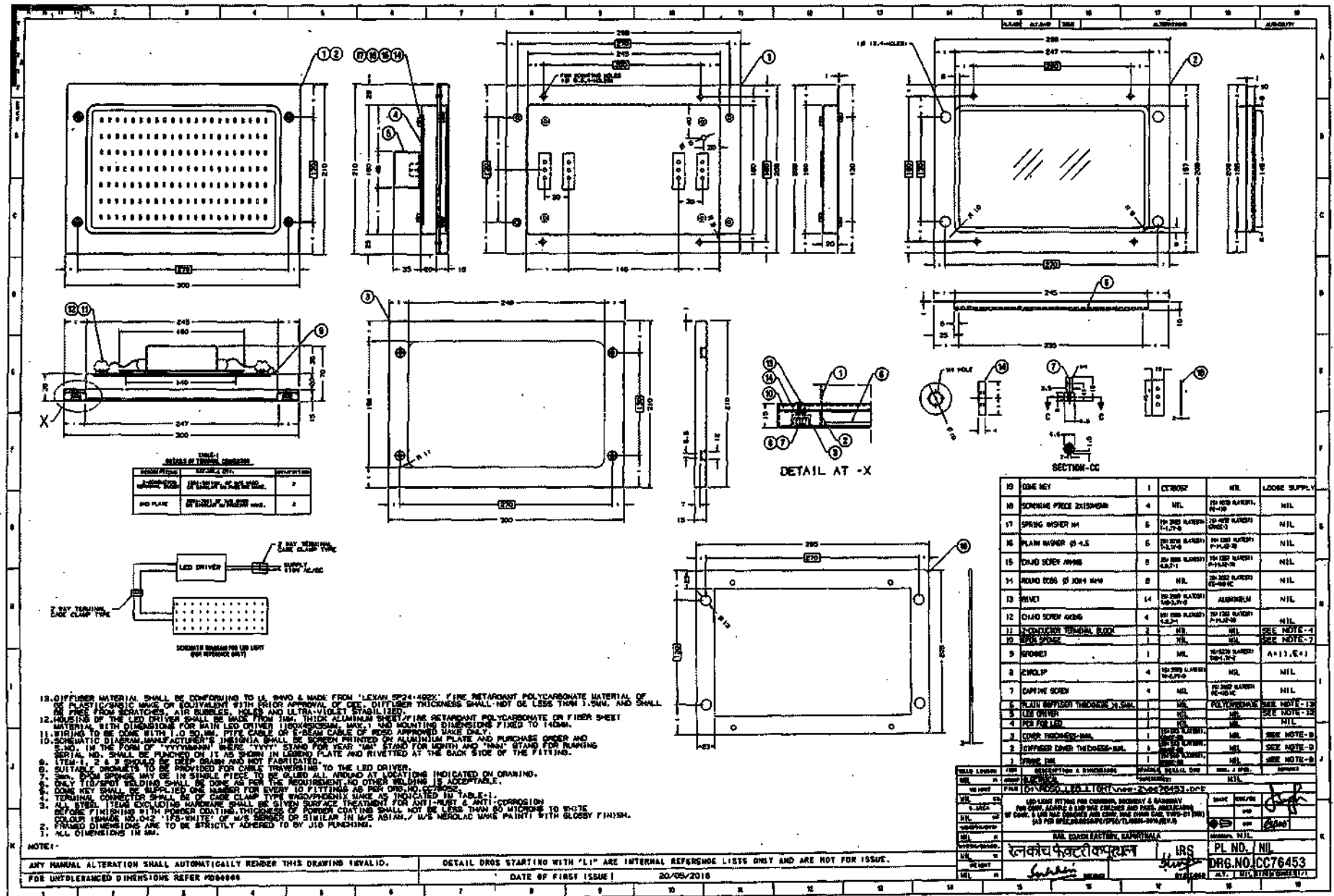
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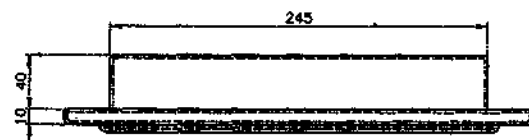
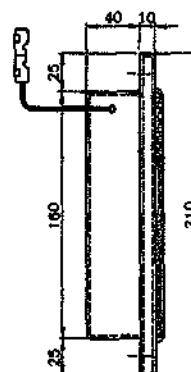
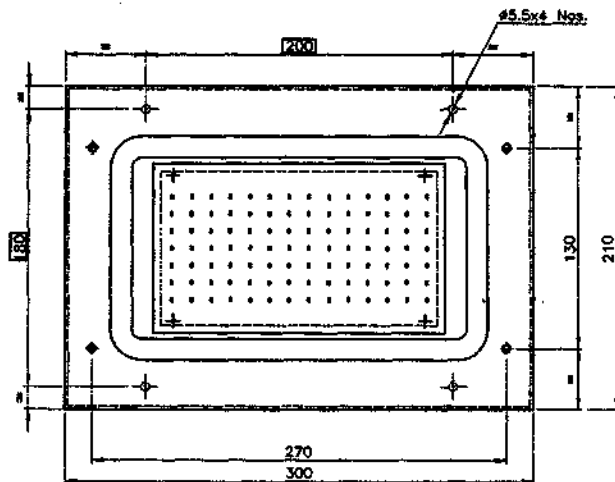
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ICF/STD-7-6-050



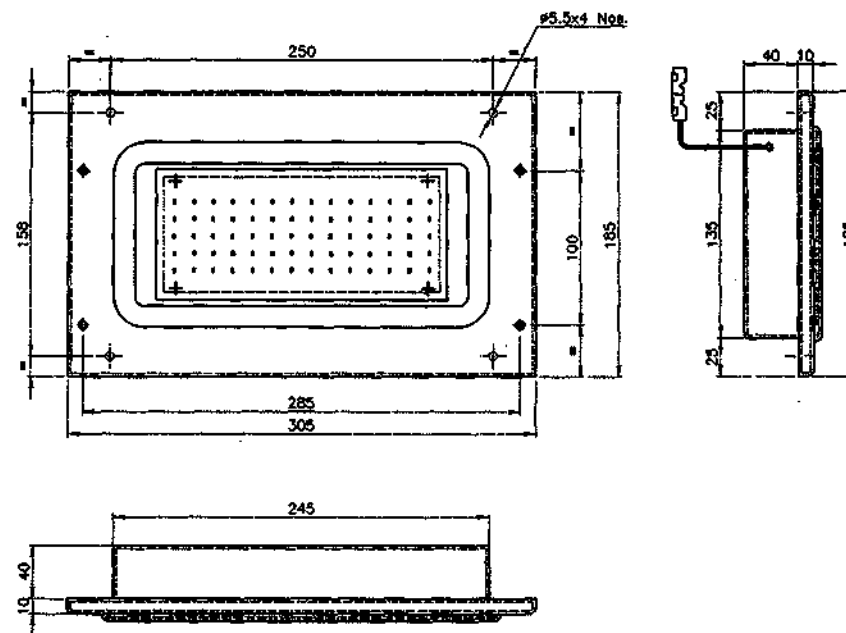
ALTERATIONS

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						ALT.			
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<p>DATA CODE NO. 140</p>						<p>SHEET 1 OF 1</p>			
<p>ICF/STD-7-6-050</p>						<p>FORM 12-A3 -20x300</p>			

ASSEMBLY DRAWINGS			
20-05-2016	DATE OF FIRST ISSUE		
ALT.	DATE OF LATEST ALT.	DATE OF FIRST ISSUE	DY.CEE/D

ICF/STD-7-6-046

ALTERATIONS

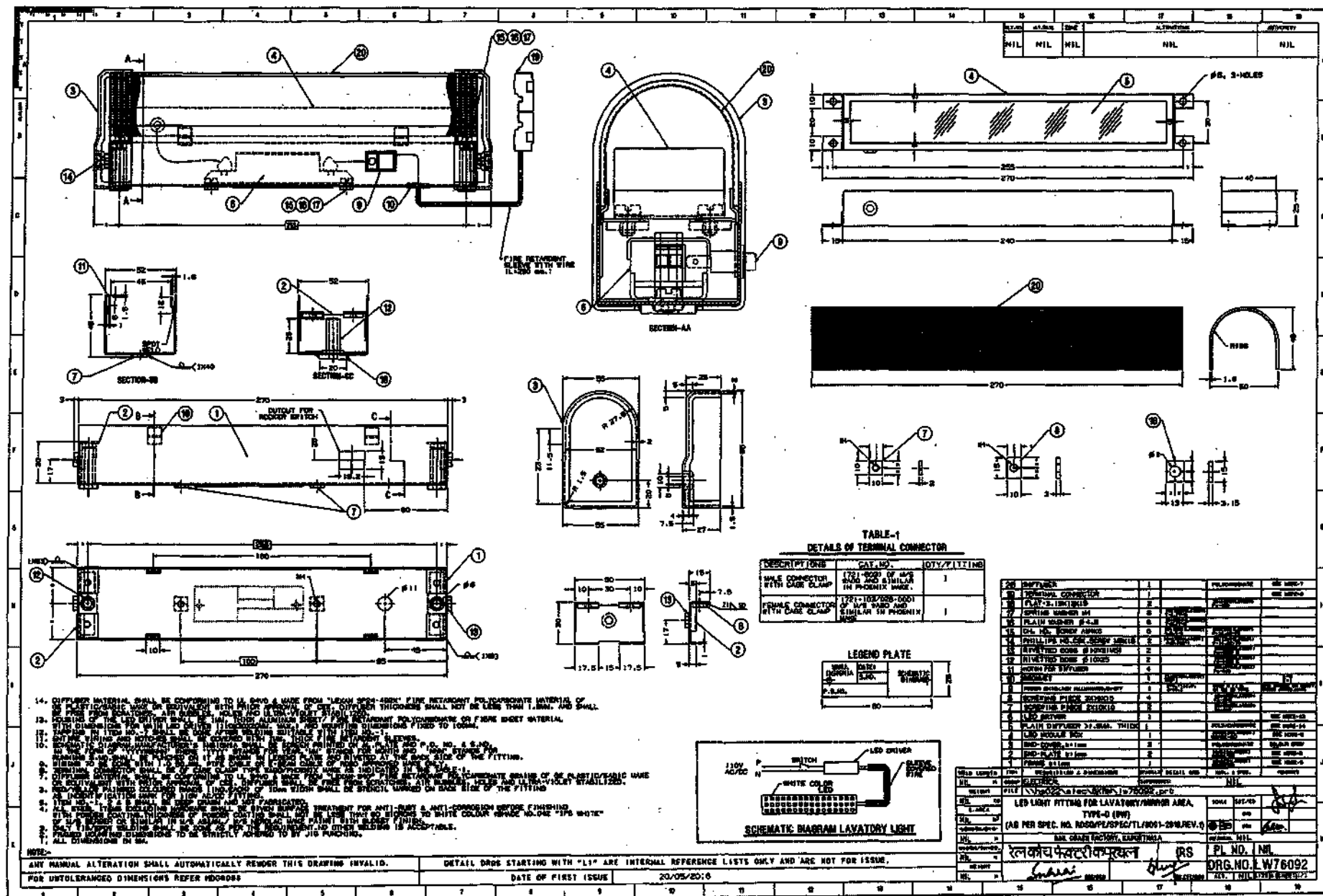


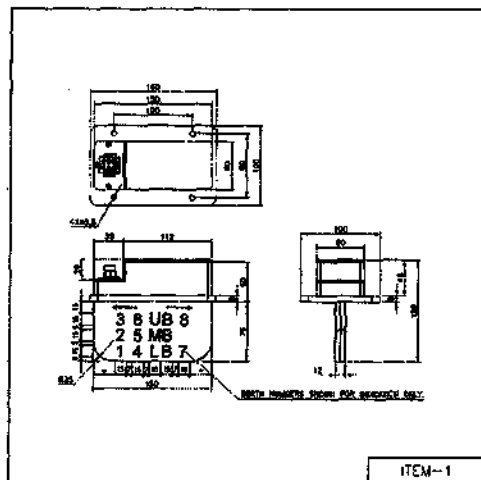
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<b>LED LIGHT FITTING, TYPE-C (9W)</b> FOR CABIN & CORRIDOR AREA OF ICF BUILT SCN COACHES (AS PER SPEC. NO. RDSO/PE/SPEC/TL/0091-2016, REV.1)				SUPERSEDES:			
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				ALT.			
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SHEET 1 OF 1				ICF/STD-7-6-046			

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ALT.	DATE OF LATEST ALT.	DATE OF FIRST ISSUE	DY.CEE/D
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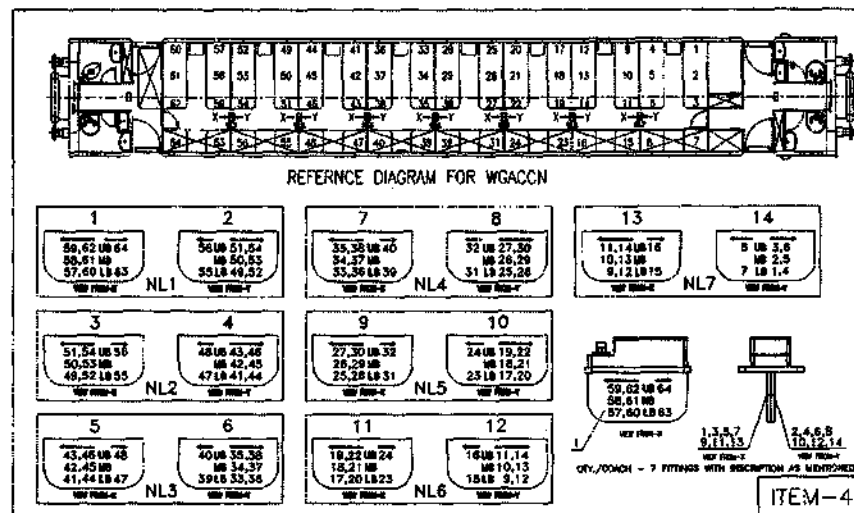
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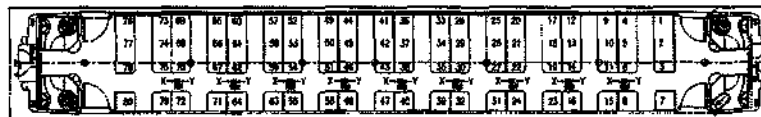




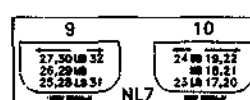


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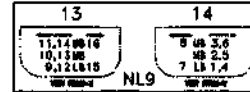
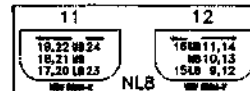




REFERENCE DIAGRAM FOR LSON



207. ADAM - 9 AIRBORN WITH RESERVATION AS MENTIONED.

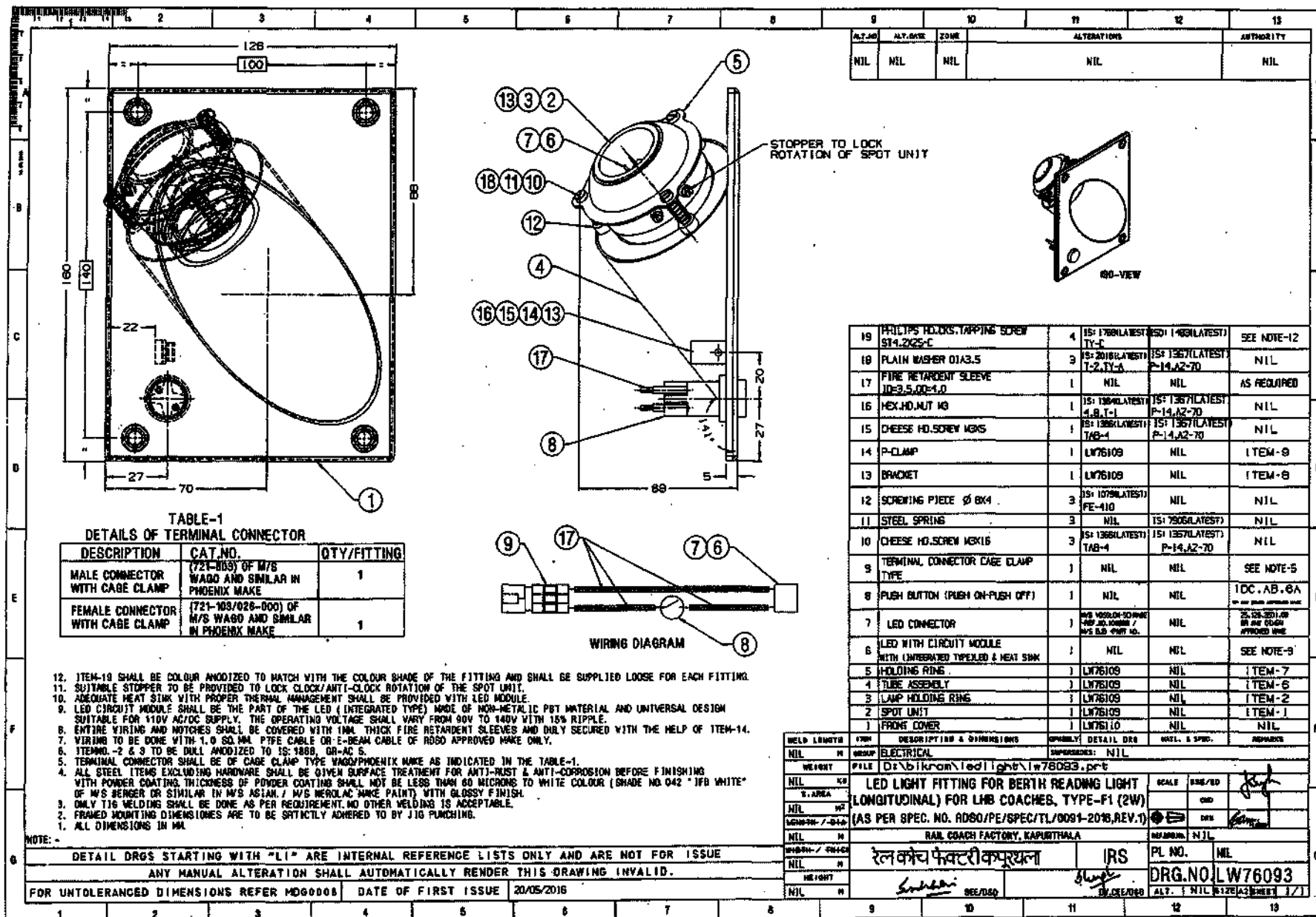


COL-31

ITEM-5

ITEM-7

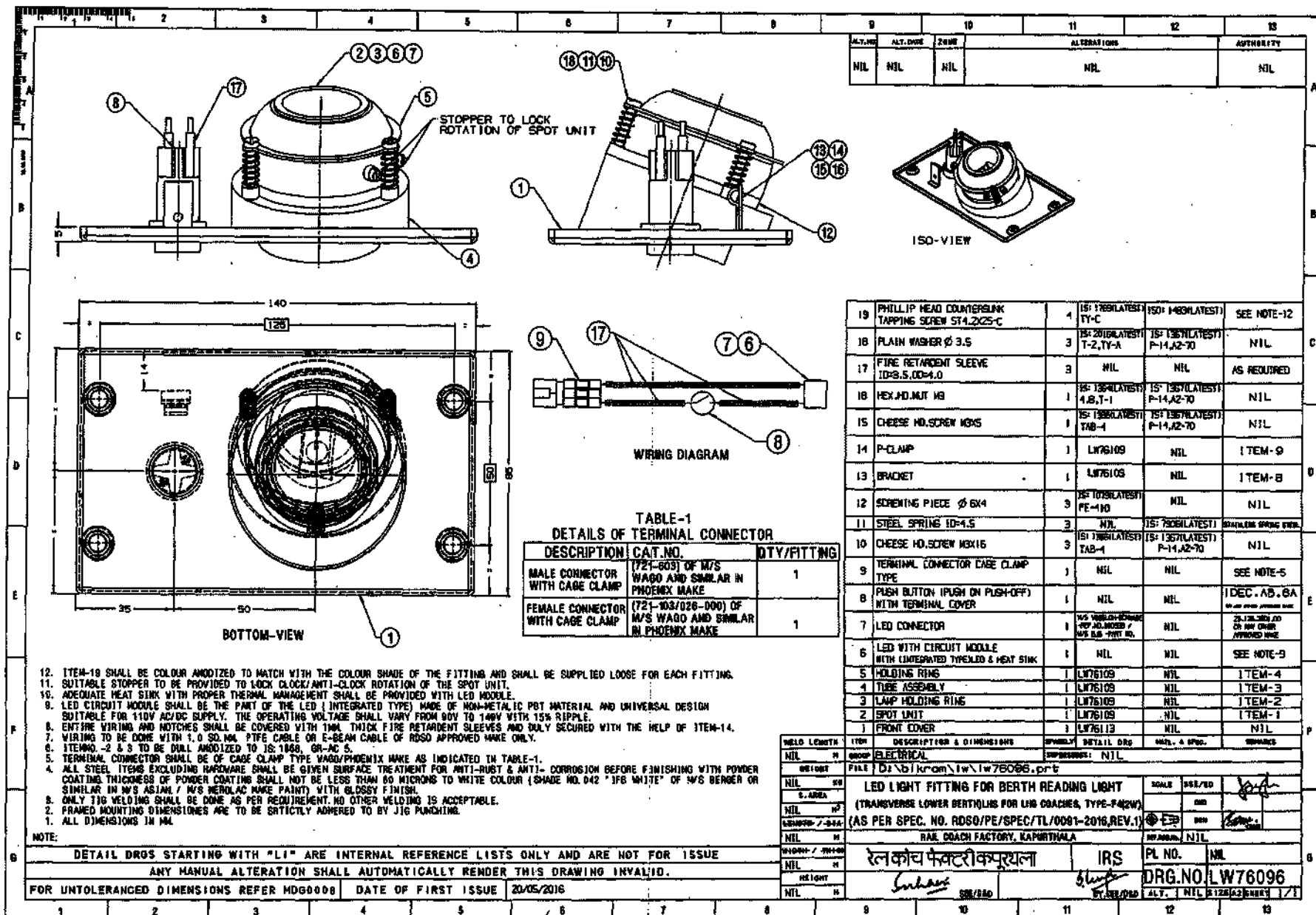
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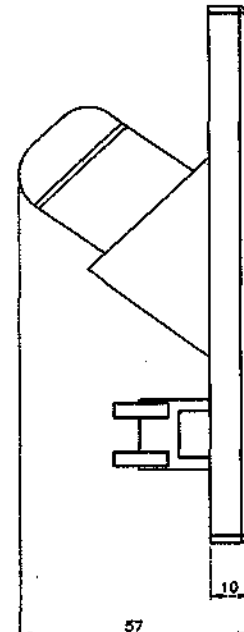
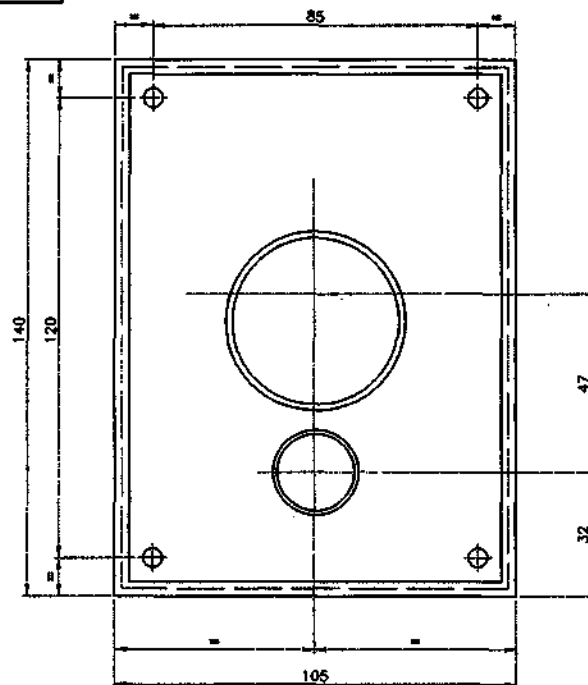








ICF/STD-7-6-051

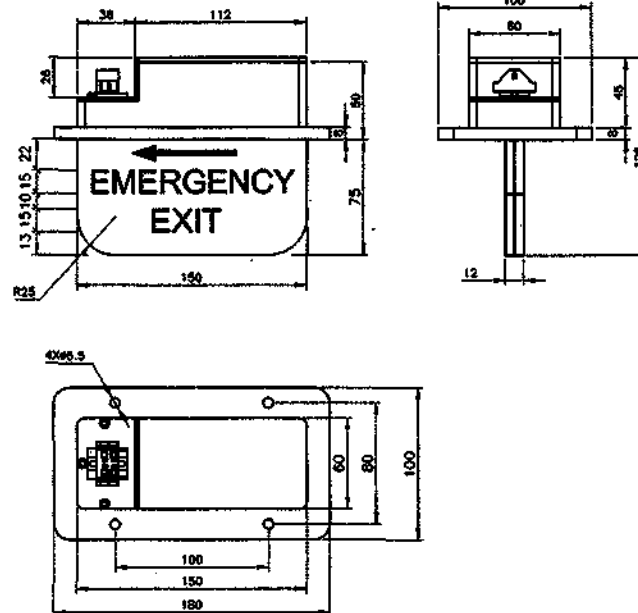


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LED LIGHT FITTING, TYPE-F5 (2W)		SUPERSEDES:	
FOR BERTH READING LIGHT FOR CONVENTIONAL AC COACH		SCALE	SSE/D
(AS PER SPEC. NO. RDSO/PE/SPEC/TL/0081-2016, REV.1)		1:2.5	CHD.
			ALT.
			DRN
			RATHARAJA
		ALT	
ASSEMBLY DRAWINGS		INTEGRAL COACH FACTORY	
20-05-2016		CHENNAI - 38	
DATE OF FIRST ISSUE			
DY.CEE/D			
CAD FILE: ED-CAD\140 7-6 051---03.DWG			
DATA CODE NO.		SHEET	
140		1 OF 1	
INDIAN RAILWAY STANDARDS		ICF/STD-7-6-051	

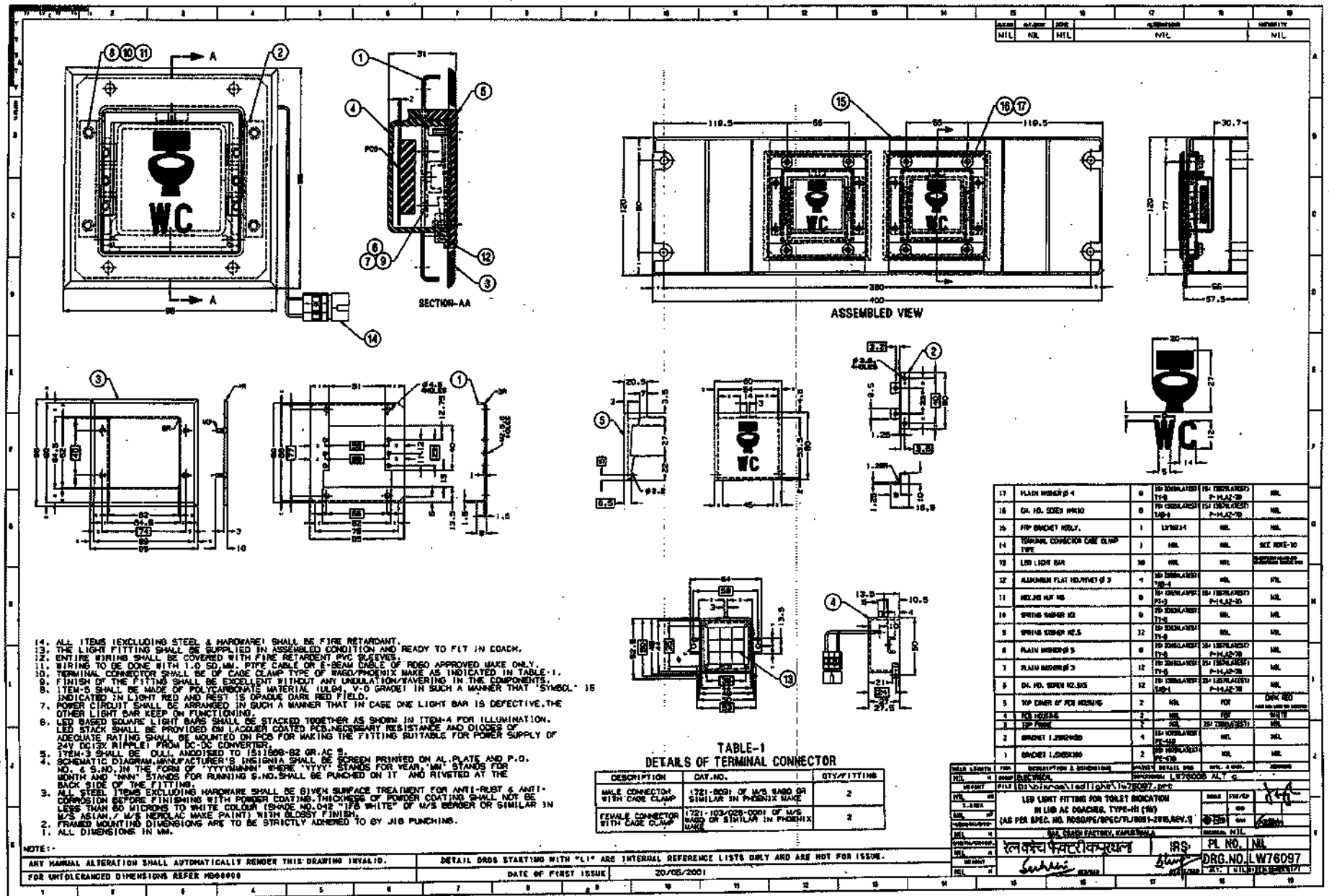
FORM IR A3 420-300

ICF/STD-7-6-049

ALTERATIONS

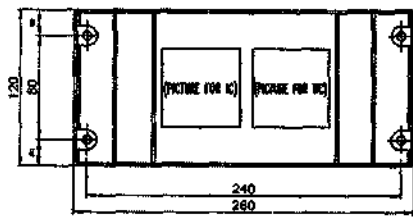
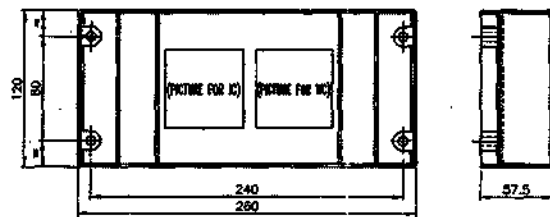


GROUP: 7-6				SUPERSEDED BY:	
LED LIGHT FITTING, TYPE-G (1W)				SCALE	
FOR EMERGENCY EXIT INDICATION				1:2.5	
(AS PER SPEC. NO. RDSO/PE/SPEC/TL/0081-2016, REV.1)				SSE/D	
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INDIAN RAILWAY STANDARDS				DRN	
SHEET 1 OF 1				RAITHARAJA	
ICF/STD-7-6-049				INTEGRAL COACH FACTORY	
FORM IR-AS 420a/300				CHENNAI - 38	

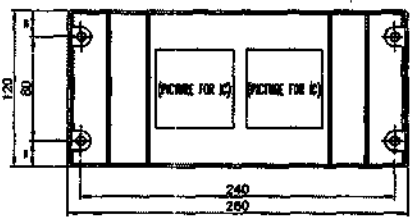


ICF/STD-7-6-052

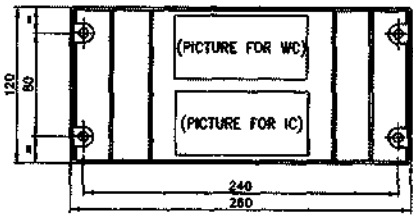
ALTERATIONS  
 07/2016  
 TOILET INDICATION LIGHT  
 FOR WAGCON, WGSWAC, WGSZAC  
 AND WGSWAC COACHES  
 ADDED.  
 SSE/D  
 DY.CEE/D



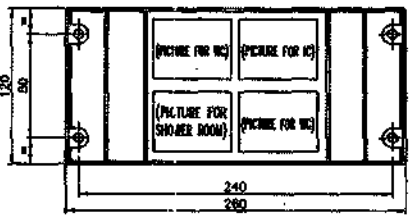
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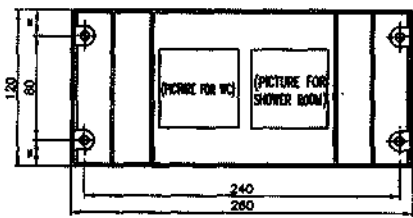
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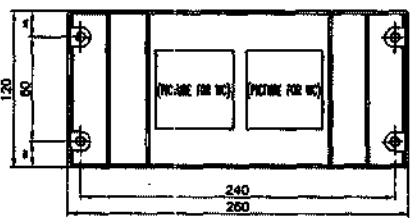
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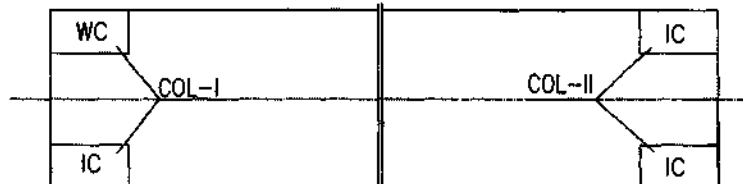
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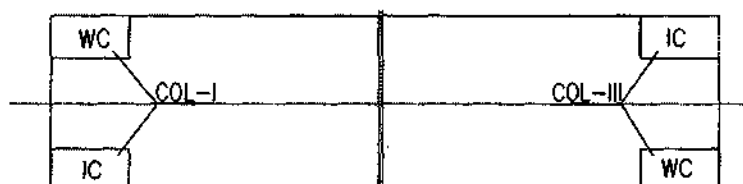
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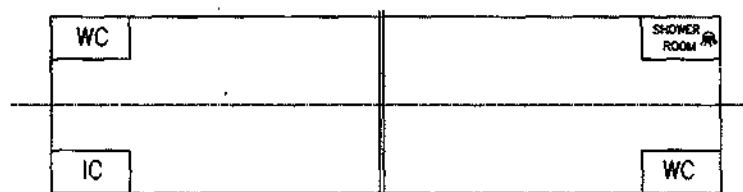
COL-VI



REF. DIAGRAM FOR WAGCON, WGSWAC, & WGSZAC



REF. DIAGRAM FOR WGSWAC



REF. DIAGRAM FOR WGFAC

COL-IV

ASSEMBLY DRAWINGS			
07-2016	20-05-2016	2	DY.CEE/D
ALT.	DATE OF LATEST ALT.	DATE OF FIRST ISSUE	DY.CEE/D

GROUP: 7-6				SUPERSEDED BY:			
LED LIGHT FITTING, TYPE - H2 (1W)				SUPERSEDED BY: 17/2016-7-6-052-AT-07			
FOR TOILET INDICATION IN CONV. AC COACHES				SCALE	SSE/D	CRD.	
(AS PER SPEC. NO. RDSO/PE/SPEC/TL/0091-2016, REV.1)				1:2.5			
CAD FILE: ED-CAD\140 7-6 052-SAO.DWG				ALT.	H.SASIRUJAN	DRN	RATHARAJA
DATA CODE NO. 140				ALJ			
INDIAN RAILWAY STANDARDS				INTEGRAL COACH FACTORY, CHENNAI - 38			
SHEET 1 OF 1				ICF/STD-7-6-052			

FORM SIZE: A2 (800x420)

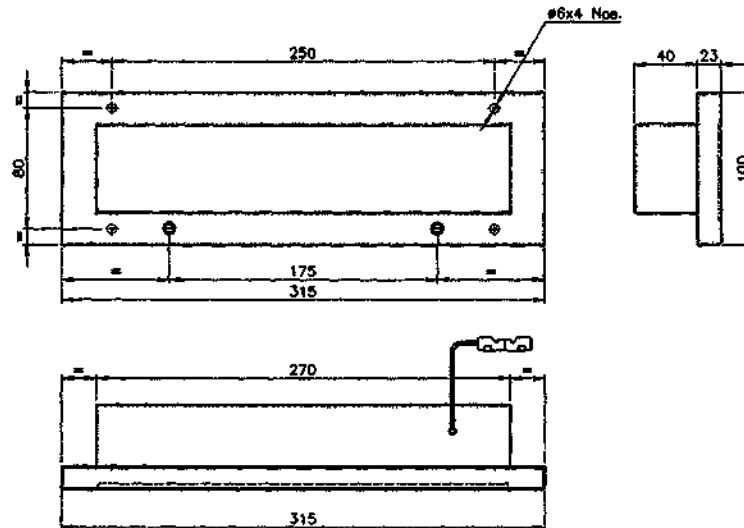






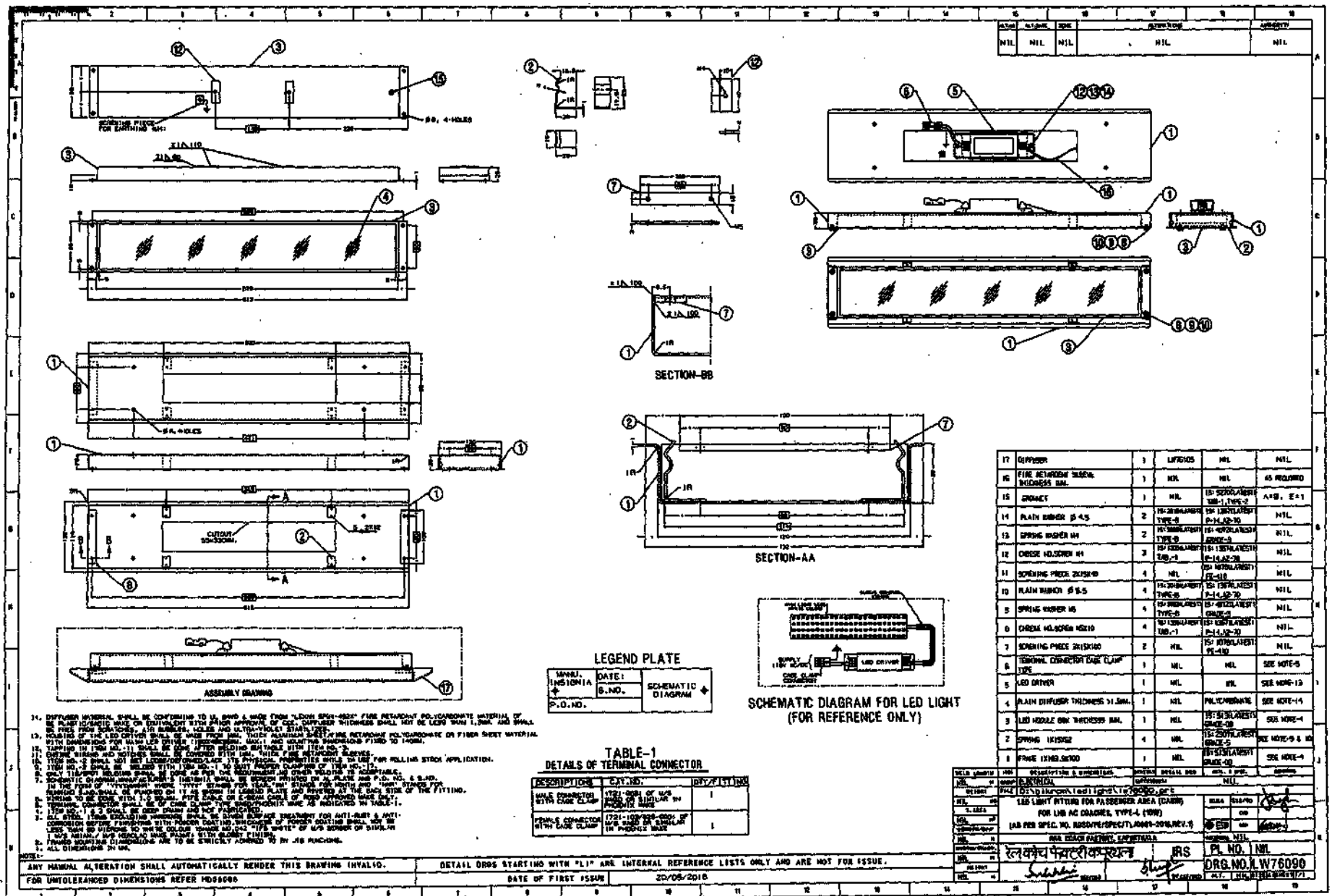
ICF/STD-7-6-048

ALTERATIONS

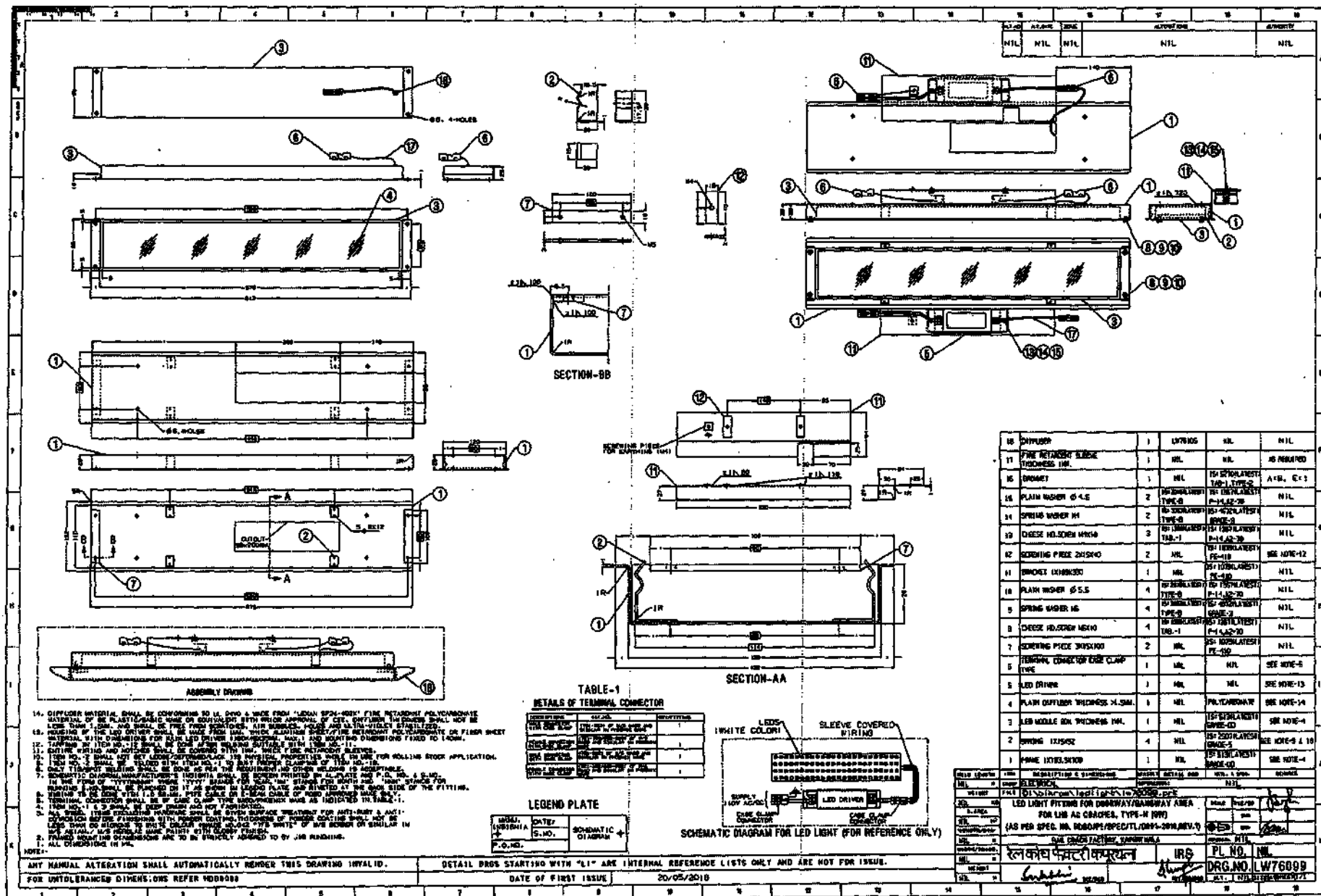


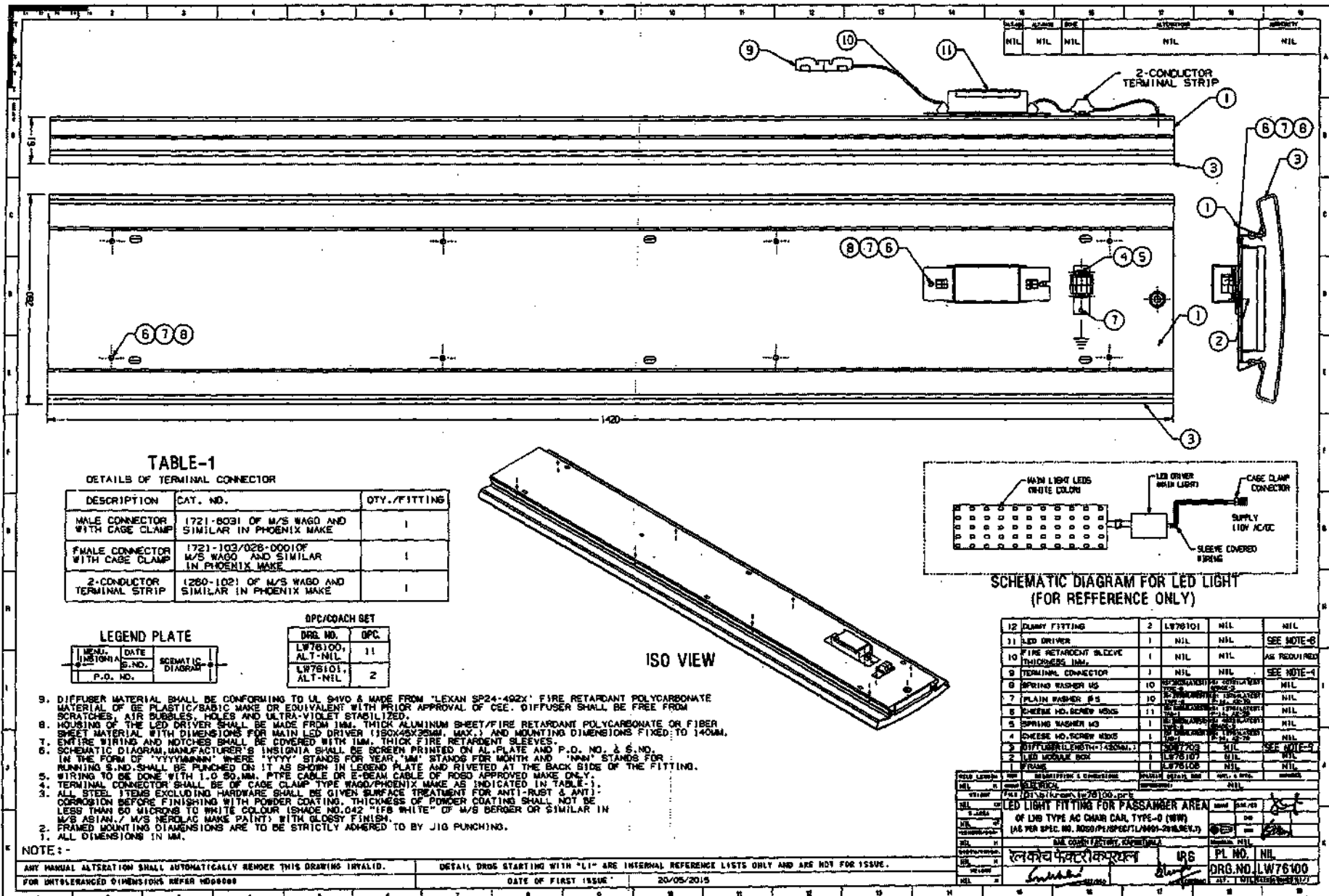
GROUP: 7-6		SUPERSEDED BY:	
LED LIGHT FITTING, TYPE-K (9W)		SUPERSEDES:	
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(AS PER SPEC. NO. RDSO/PE/SPEC/TL/0091-2016, REV.1)		1:2.5	CHD.
		ALT.	DRN
		ALT	RATHARAJA
ASSEMBLY DRAWINGS		INTEGRAL COACH FACTORY	
20-05-2018		CHENNAI - 38	
ALT.	DATE OF LATEST ALT.	DATE OF FIRST ISSUE	DY.CEE/D
CAD FILE: ED-CAD\140 7-6 048--00.DWG		SHEET	
DATA CODE NO.		1 OF 1	
140		ICF/STD-7-6-048	

FORM R A3 420x300

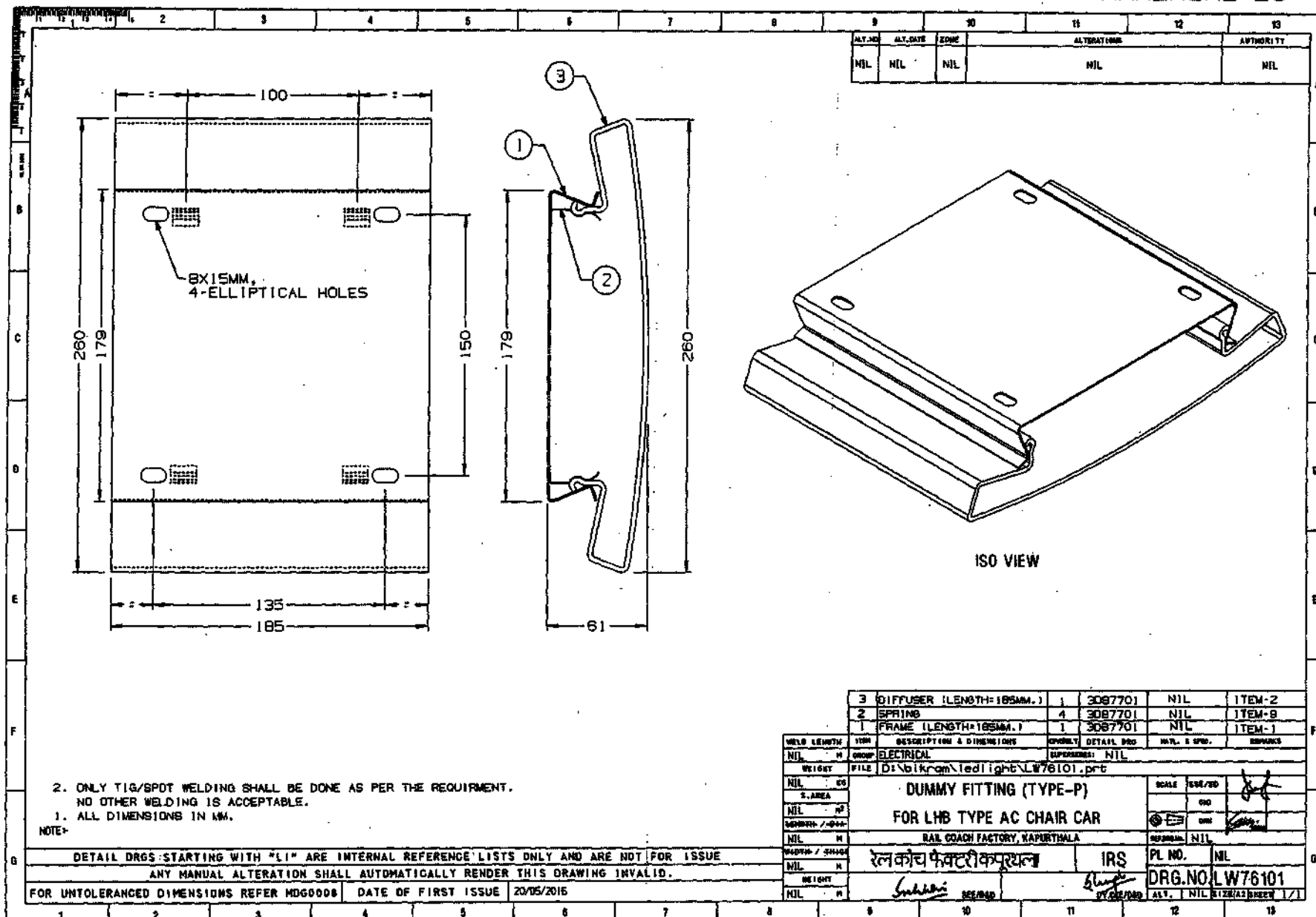








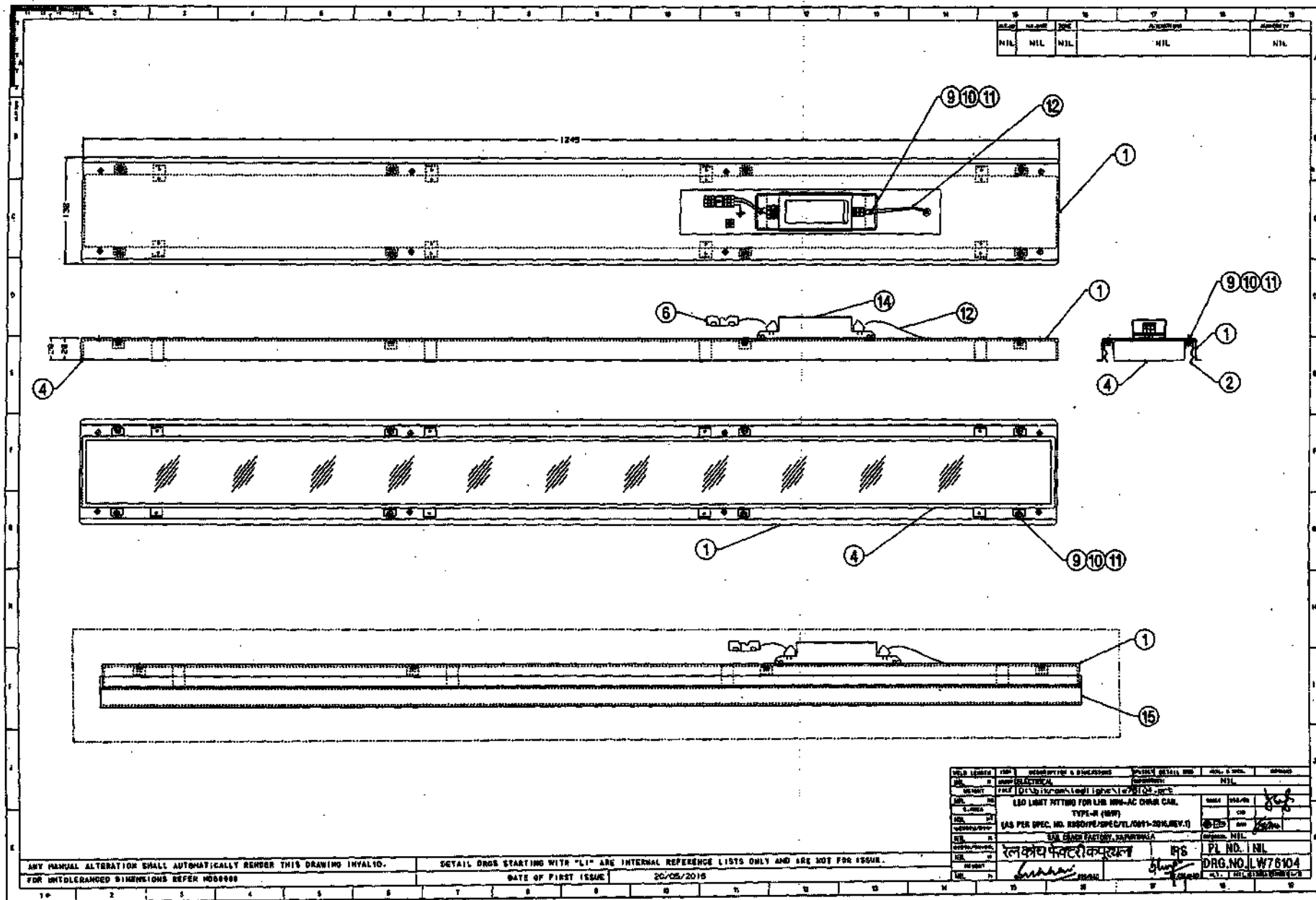
# ANNEXURE-20

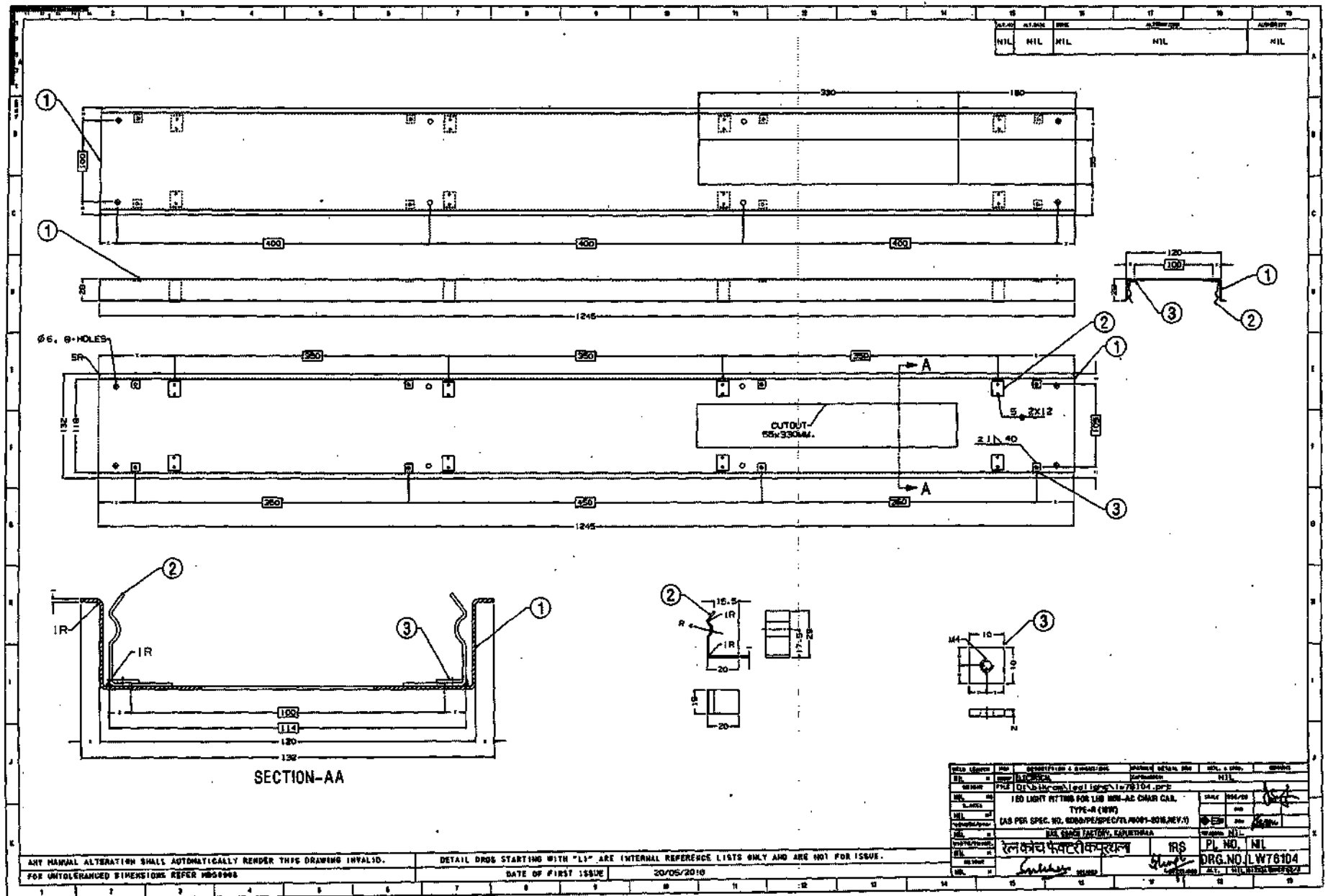






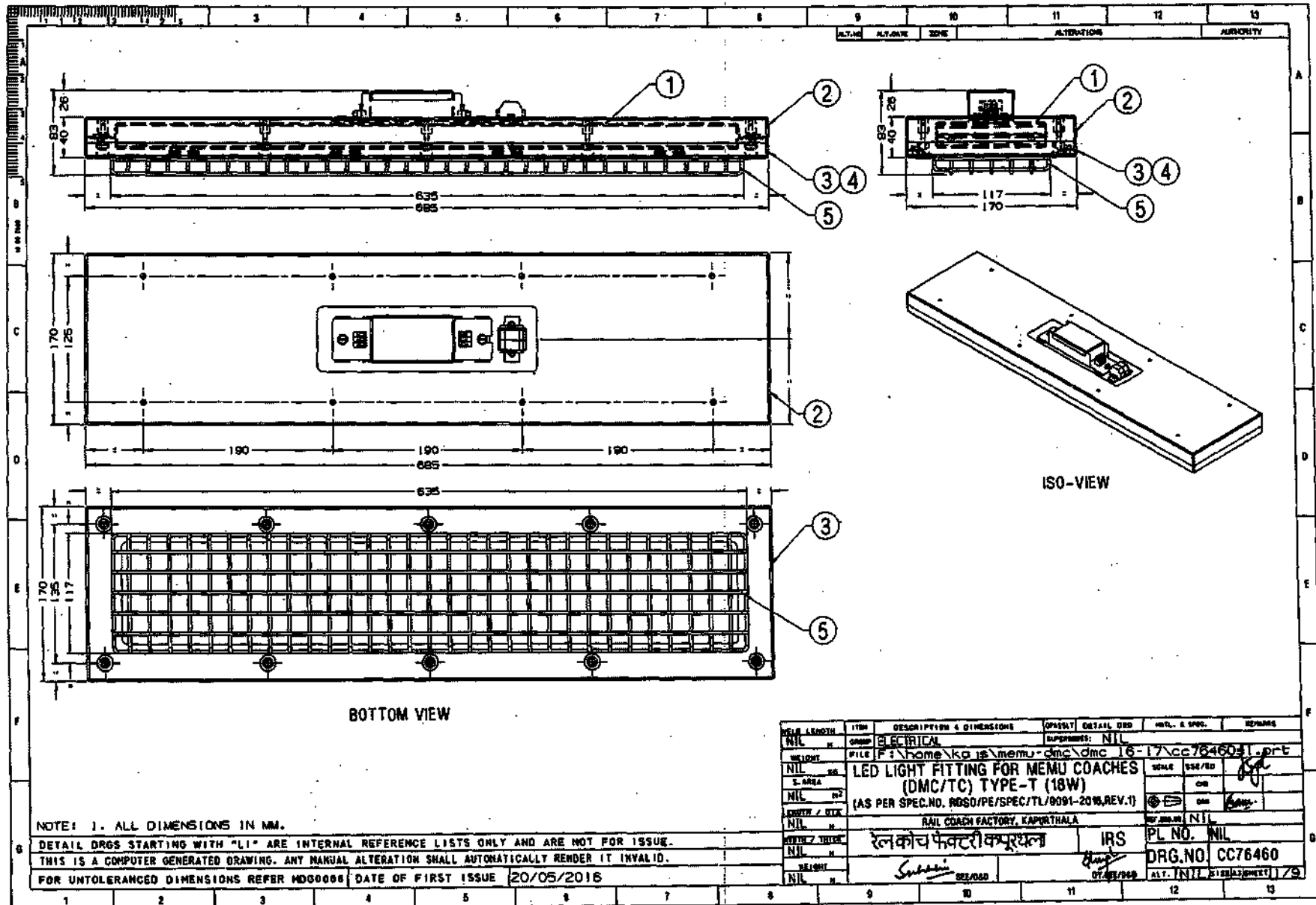


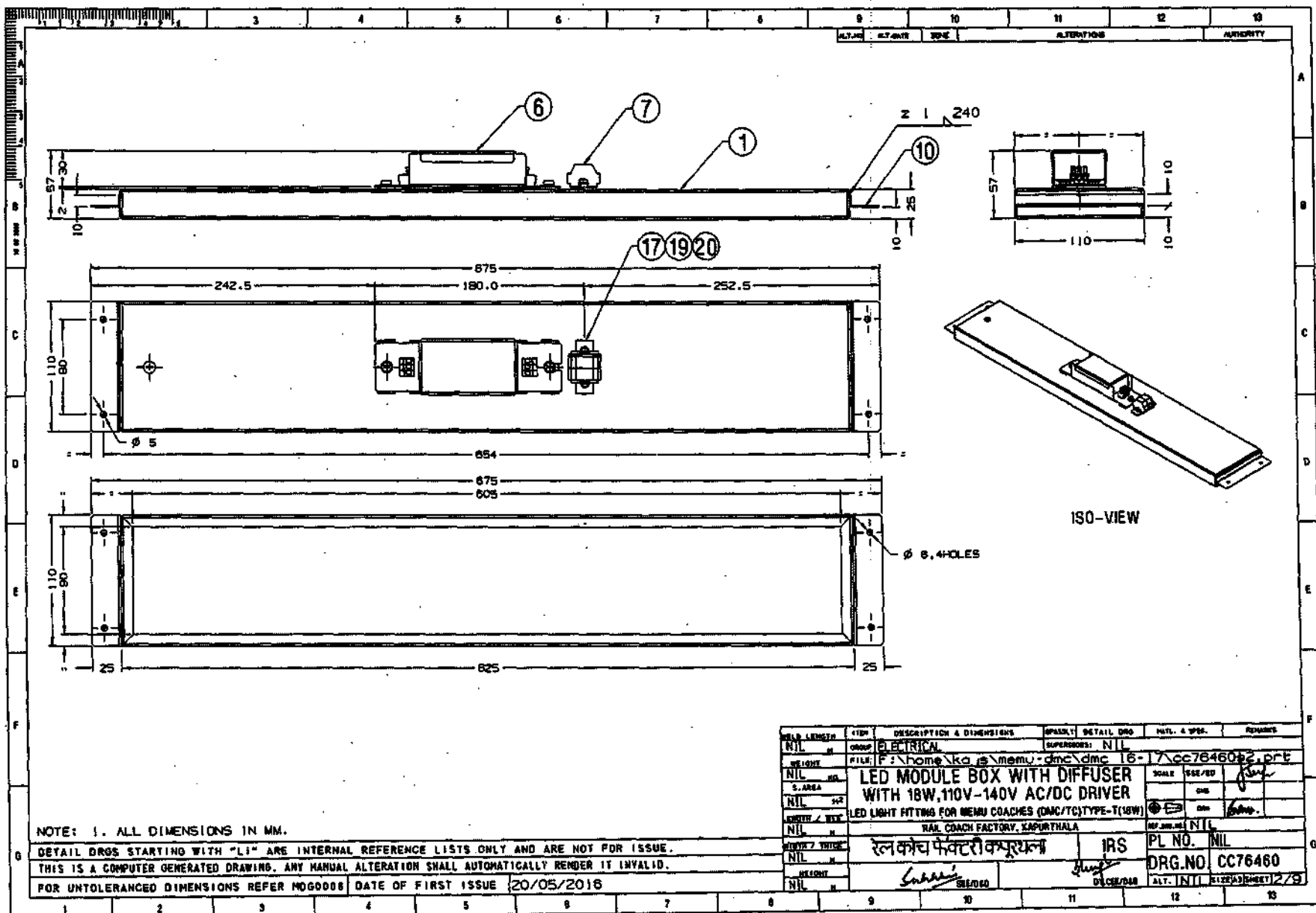




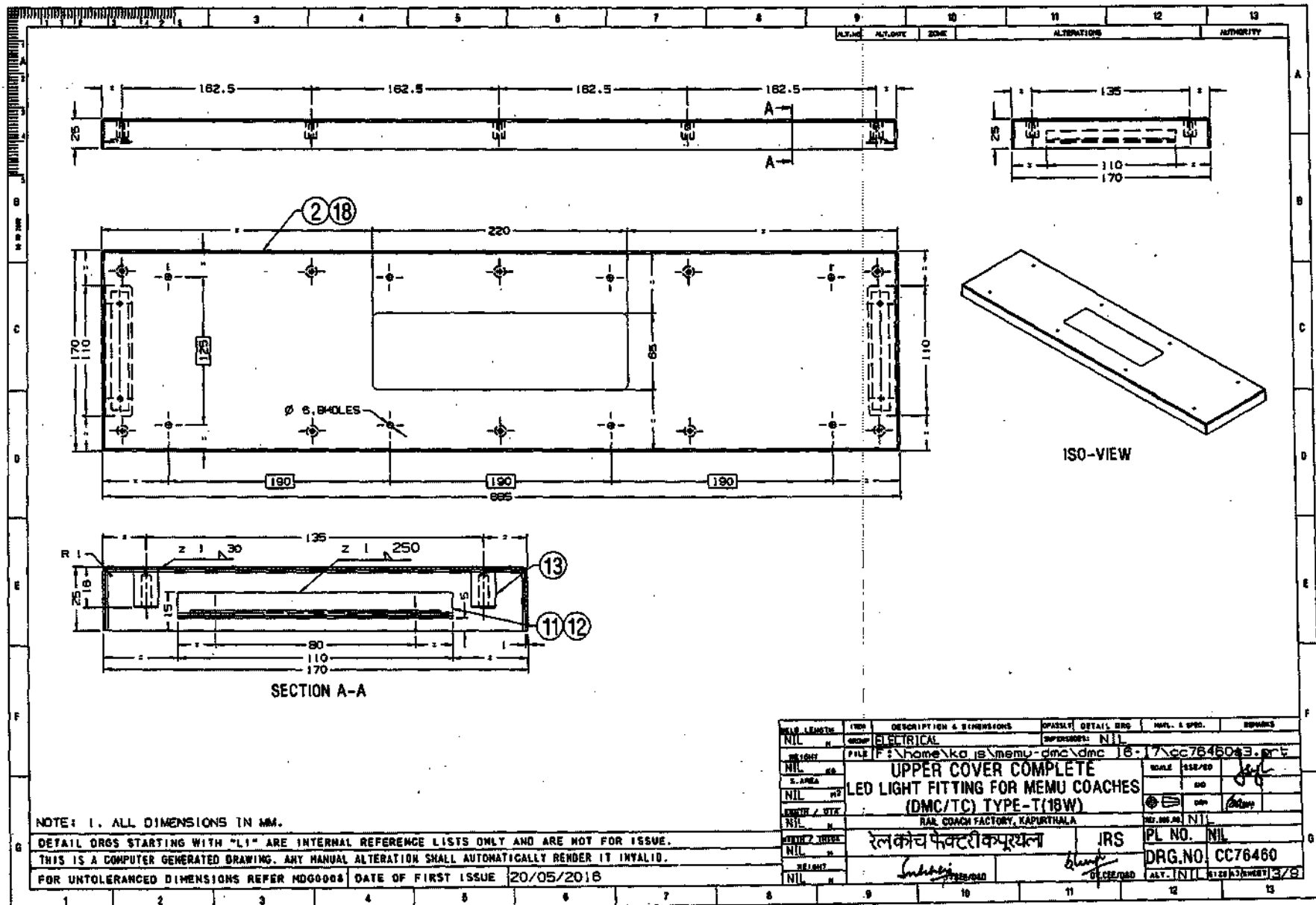


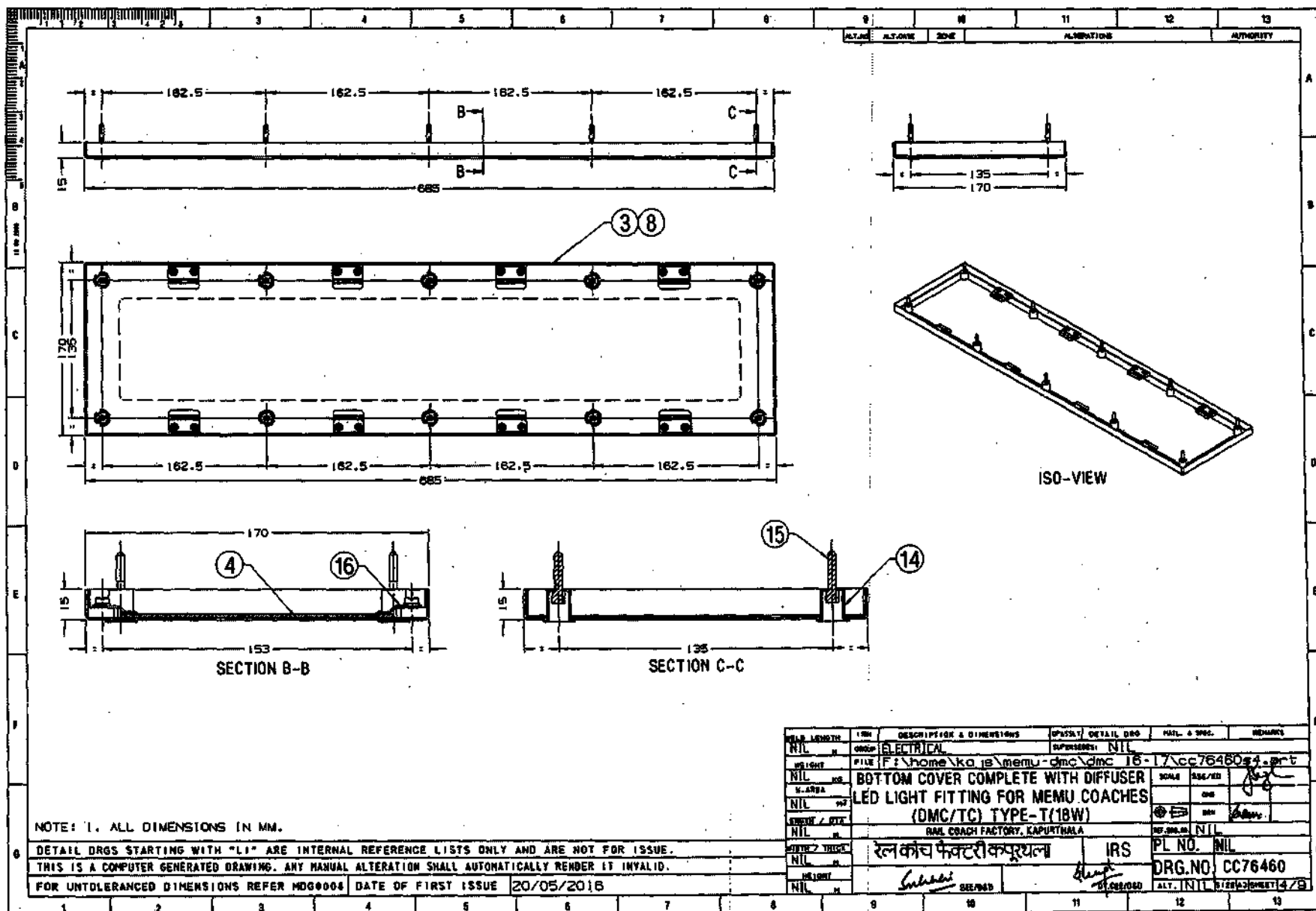


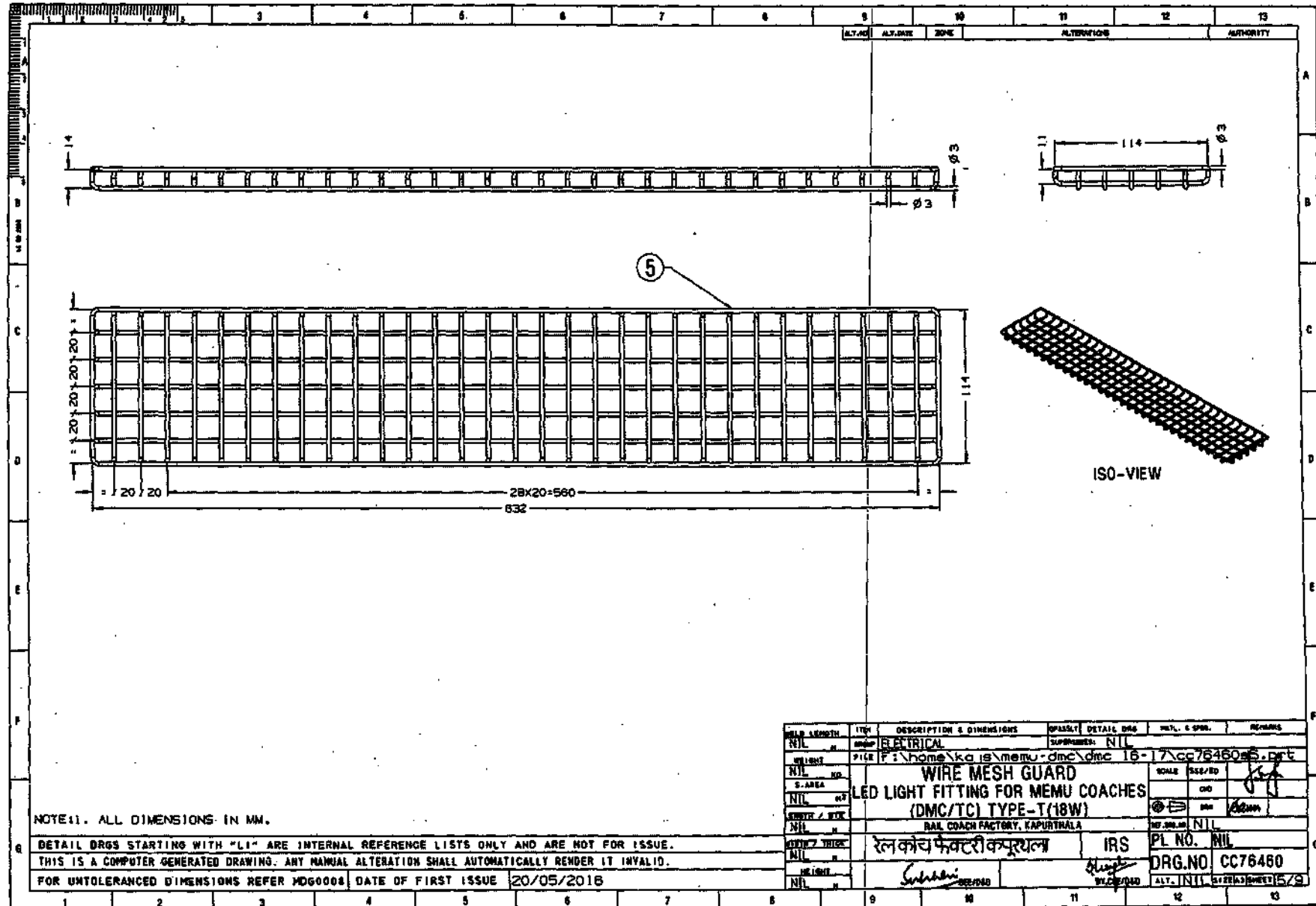


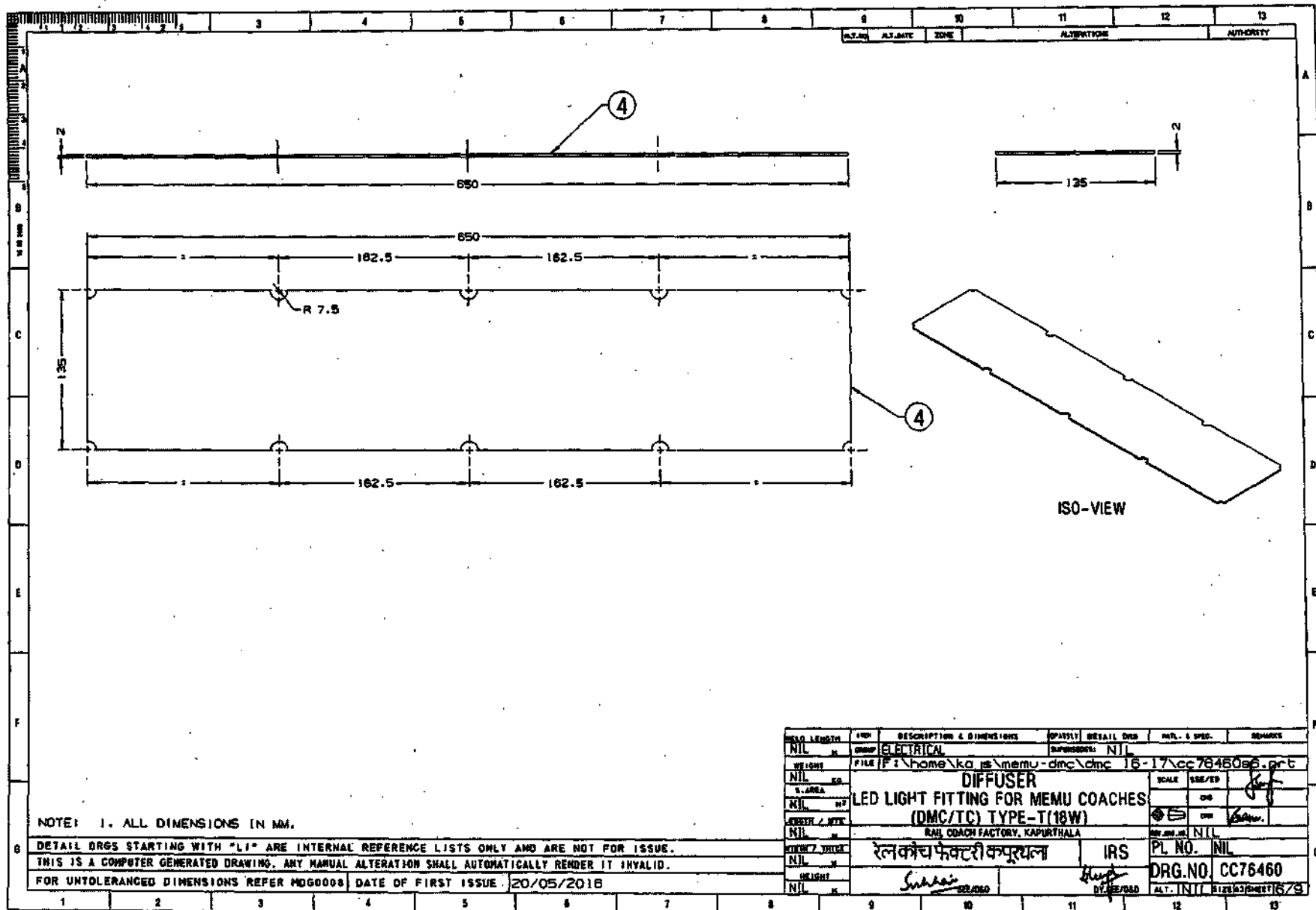


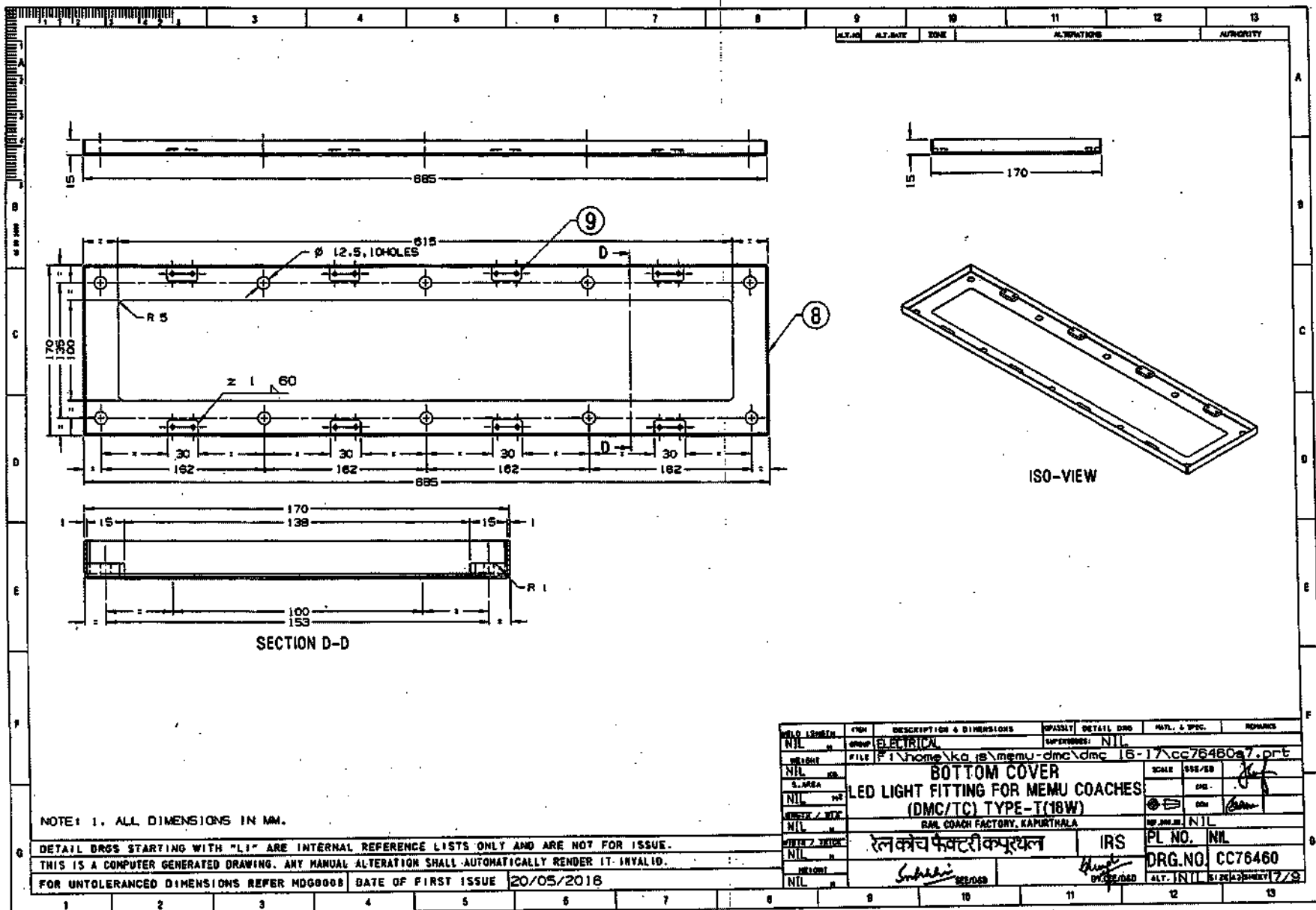




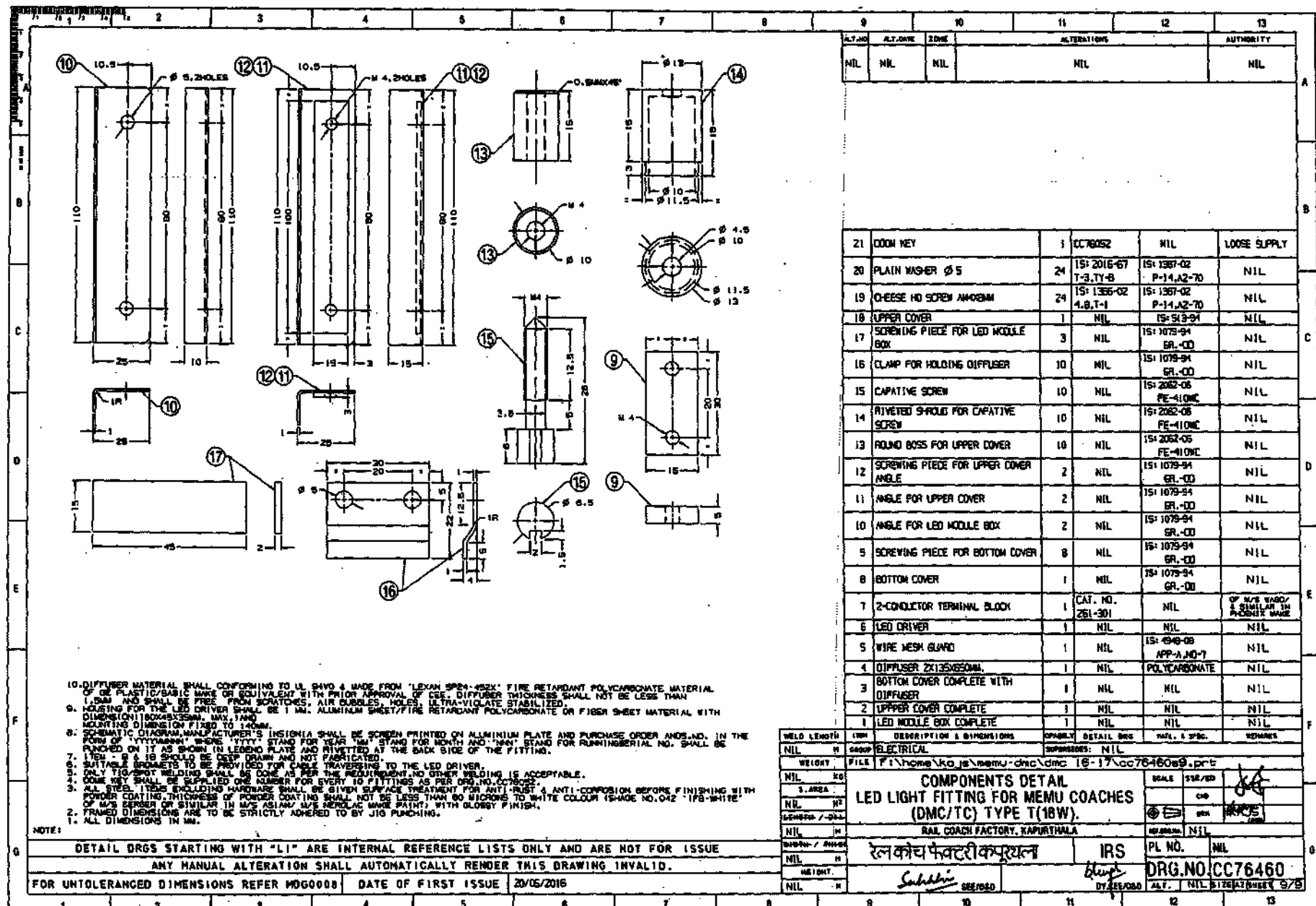






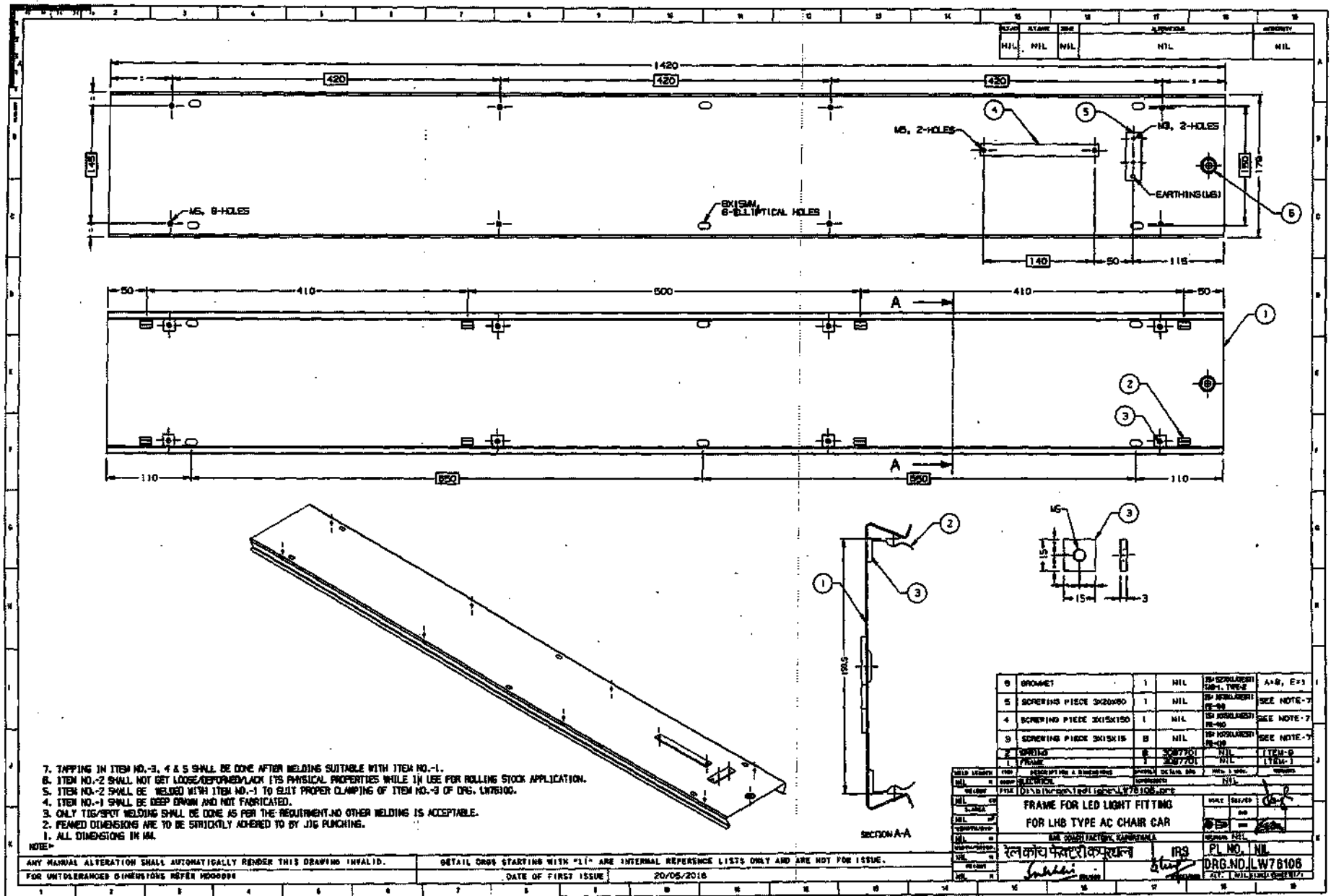


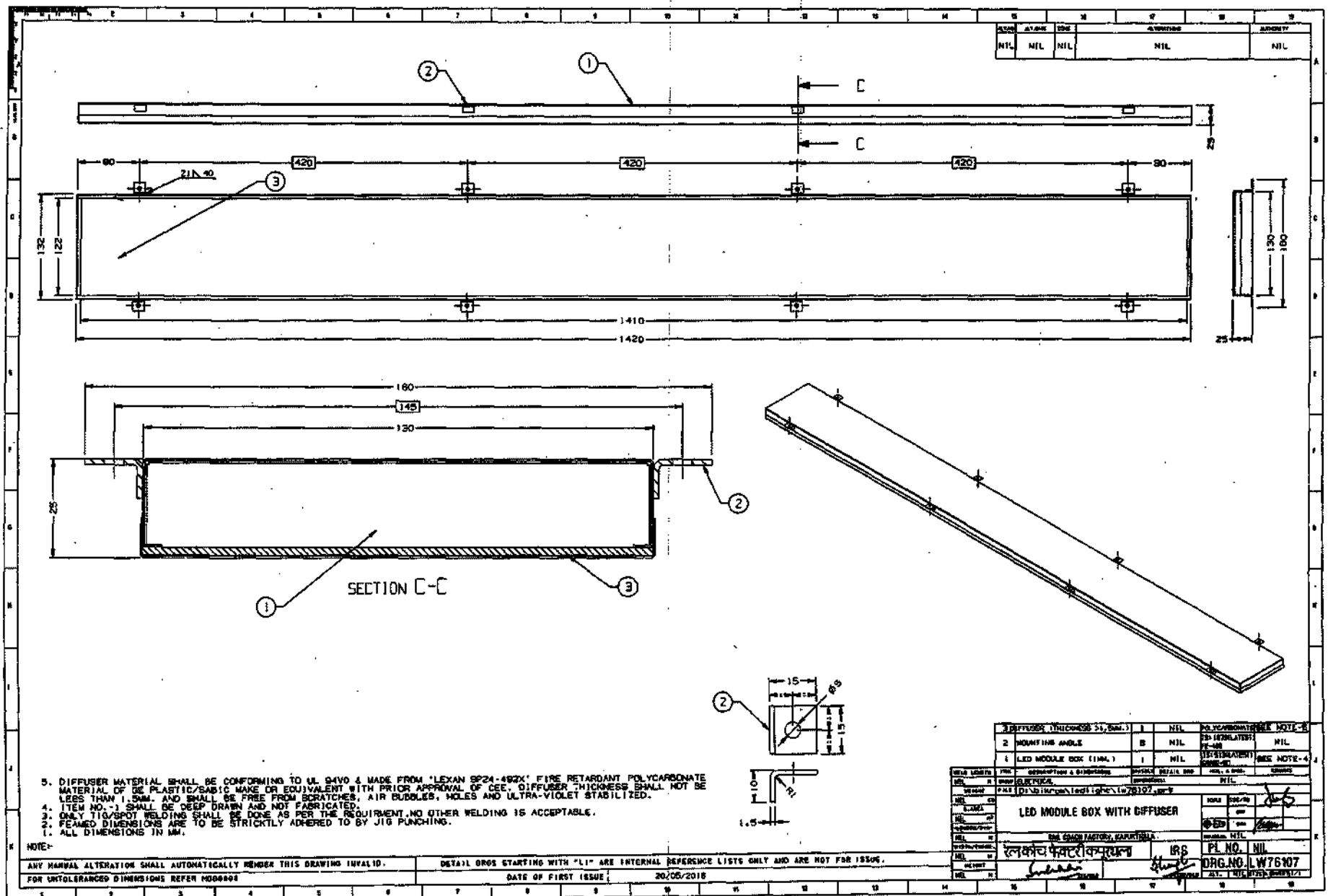


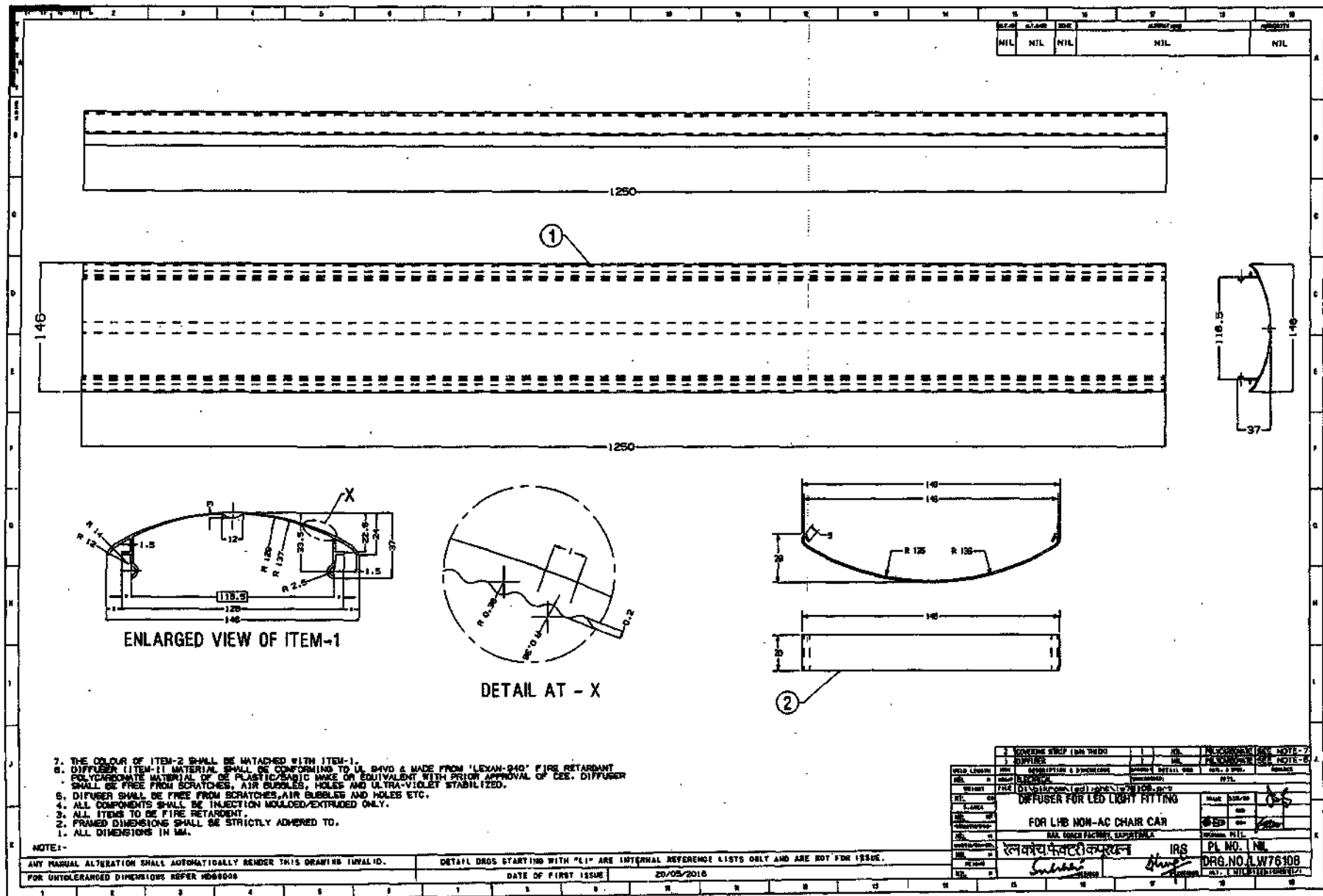


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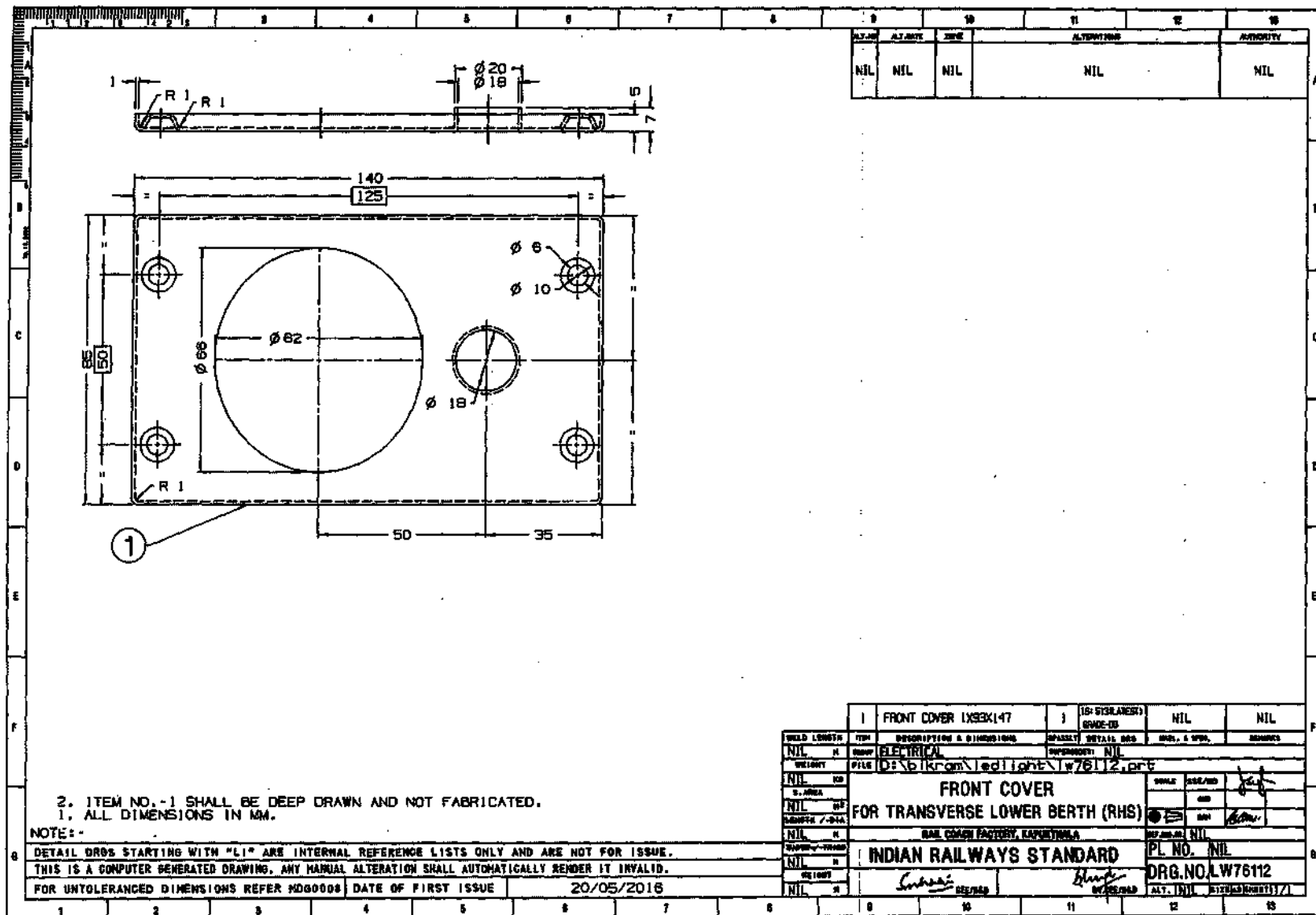


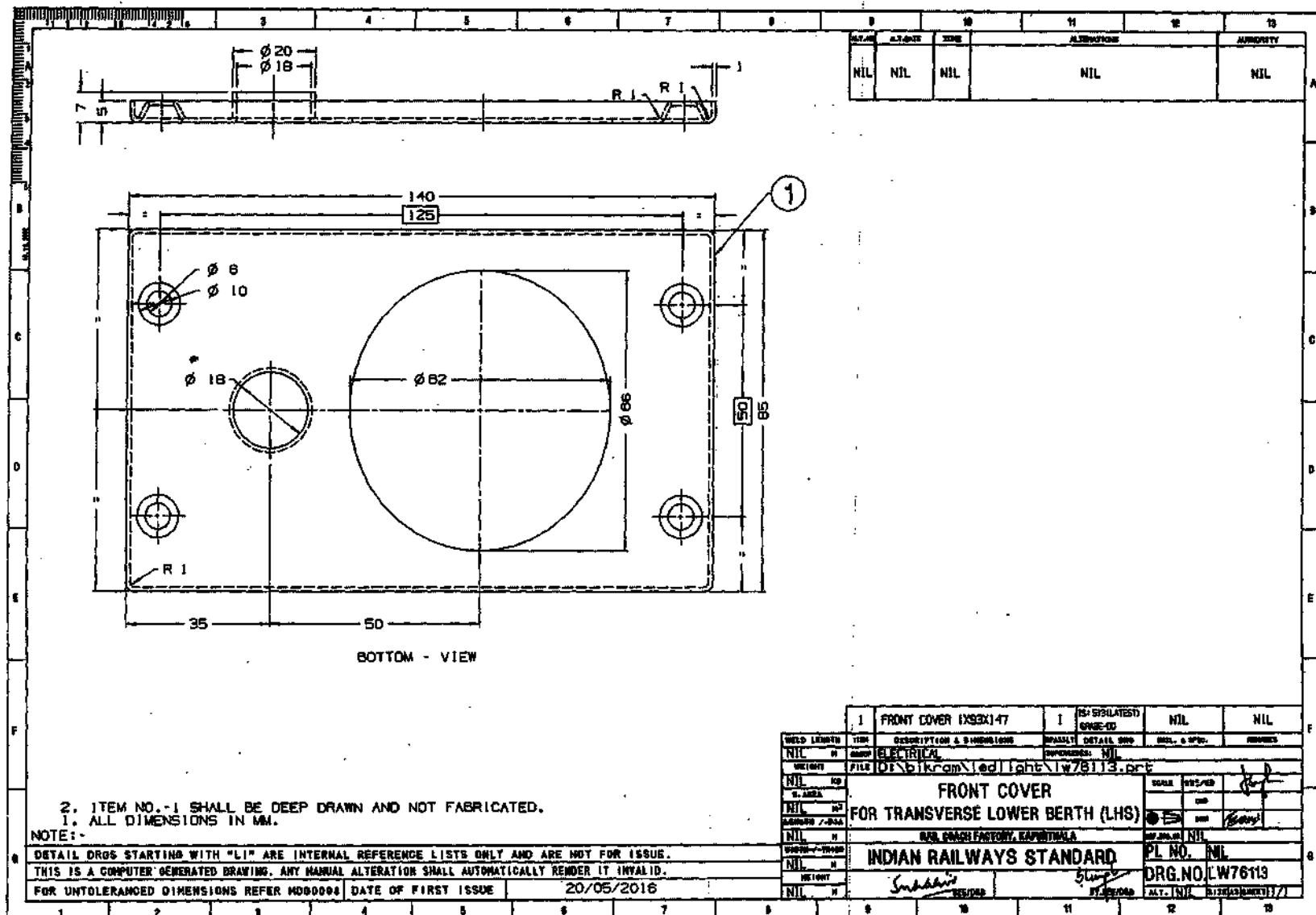




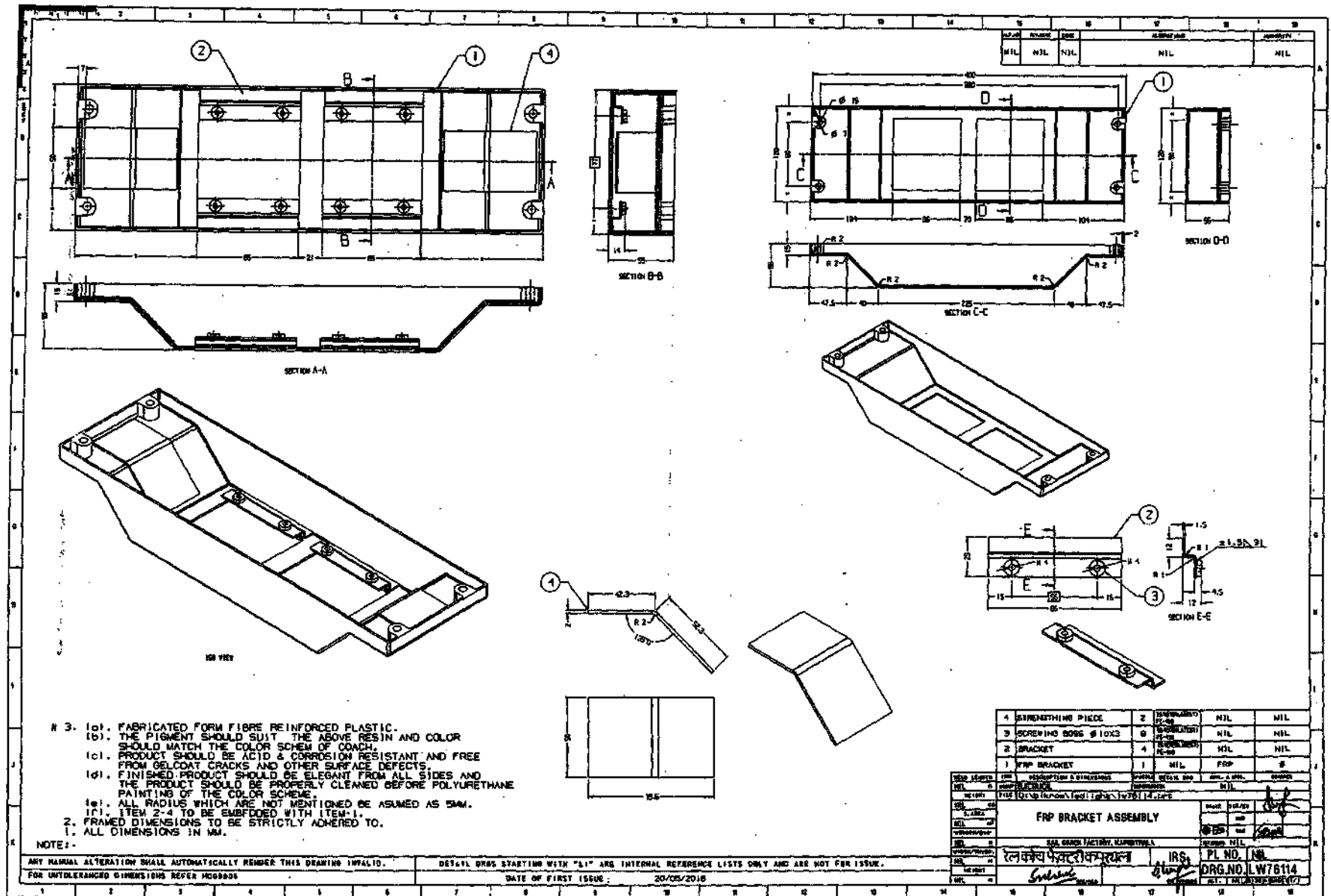




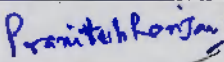
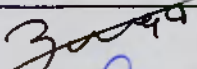










SPECIFICATION	Schedule of Technical Requirements for Aluminium-Polymer Composite, Solid Surface Sheets for interior furnishing of Railway Coach Toilets	MMDTS 18008, Rev.-2 PAGE 1 of 7 Date: 10.11.2022
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Name	Designation	Signature	Date	Level
Pranitesh S. Ranjan	SSE / Design		10.11.2022	Prepared
Abhinav Yadav	SME / Design-III		10.11.2022	Agreed
Lalit Kishore	Dy. CME / Design		10.11.2022	Reviewed
D.K.Singh	CDE		10.11.2022	Approved

**Amendment History:**

Rev.	Date	Change in Brief
1.	26.06.2019	The warranty period in clause no. 8 has been modified from existing 3 years to 6 years from the date of supply.
2.	10.11.2022	1. Eligibility criteria (Clause no. 5) deleted.

  
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## 1. SCOPE:

- The schedule of requirements lays down the technical requirements about construction of material/composition, physical properties, test parameters and required compliance to fire safety standards.
- In this schedule, due consideration had been given to the development in the field of composite materials in developed countries and make in India concept as well.
- The schedule of requirements for Aluminium Polymer Composites (APC) Solid Surface Materials for Modular Toilets and their accessories consists of technical requirements, methods of sampling and testing of Solid Surfaces.
- Being a new material, the tenderer shall be required to submit separate cost for supply and installation of the material along with instructions for maintenance of the articles/ items, recommended cleaning agents etc. for APC items.

## 2. Construction/Composition :

Aluminium: 60-65 %

Polymer : 33 % max.

Additives : 3-5 %.

### Requirements:

The Solid Surface sheets shall be made of Aluminium Polymer Composite (APC) with compatible decorative fillers only to strengthen physical and mechanical properties of the solid surface sheets. No other material shall be used for this purpose. These sheets should conform to following requirements:

- The APC solid surface (SS) sheets shall be thermo-formable as per ISO: 19712-2 with the minimum radius of 75mm without deforming/fading of colour/texture of surface. No discoloration or distortion should take place during the thermoforming procedure as specified above.
- The surface of the sheets shall not show any blisters, cracks etc. during its entire service life.
- The tenderer should submit QAP (Quality Assurance Plan) and test reports for tests parameters of APC solid surfaces materials from OEM, along with the offer.
- The APC Solid Surface sheets are required to be boiling water-proof and should not warp, delaminate, loose shape, straightness and profile after testing and throughout their entire service life. The sheets should also resist and withstand the attacks from termite and rodents etc.
- Unless specified otherwise, the thickness of sheets for Toilet interiors shall be 12mm  $\pm$  0.8.

*Pranish Kumar*  
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*[Signature]*  
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SPECIFICATION	Schedule of Technical Requirements for Aluminium-Polymer Composite, Solid Surface Sheets for interior furnishing of Railway Coach Toilets	MMDTS 18008, Rev.-2 PAGE 3 of 7 Date: 10.11.2022
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2.6 The sheets should not exhibit expansion or contraction under varying temperature conditions, beyond max.  $\pm 3\text{mm}$  / per meter / from  $05^{\circ}\text{C}$  to  $80^{\circ}\text{C}$ , defined as per ISO 19712.

### 3. Physical Properties:

TABLE-01

Property	Result	Test Standard
Tensile Strength	40 to 48 MPa	UNE-EN ISO: 527-2
Tensile Elongation	0.06 to 0.95%	UNE-EN ISO:527-2
Flexural Strength	61 to 72 MPa	EN ISO:178
Flexural Modulus	7350 to 8860 MPa	EN ISO:178
Hardness	>85 Rockwell Scale	ISO:2039-2
Ball Indentation hardness	260 $\pm$ 20 mm	ISO:2039-1
Thermal Expansion	3.02 X 10 <sup>-5</sup> in/in/ $^{\circ}\text{C}$	ASTM D 696
Light Resistance (Xenon arc)	No effect	Light Resistance (Xenon arc) NEMA LD 3-2000(3.3) or ISO: 4892
Wear and Cleanability	Passes	ISO:19712-2
Stain Resistance sheets	Passes Rating>4	EN 438-2
Fungus and Bacteria Resistance	Does not support microbial growth	ISO: 846
Resistance to wet heat	No visible change	ISO:19712-2, clause-13
Impact Resistance:	No Break	EN438-2, clause-21 or ISO:1872, clause-8
Density	1.66 to 1.75	ISO: 1183
Water Absorption	0.02 TO 0.03 %	ISO R62-80 3L

S.N	PARAMETER	STANDARD
1	Critical flux at Extinguishing T-02 Lateral Spread Of flame	ISO: 5658-2
2	MARHE (Maximum average rate of heat emission) T-03.01 (Heat Release Rate)	ISO: 5660-1
3	Ignition when subject to direct impingement to Fire T-05	ISO: 11925-2
4	Smoke generation (Optical density by Single chamber method) T-10.01	ISO: 5659-2
5	Smoke generation (Optical density by Single chamber method) T-10.02	ISO: 5659-2
6	Smoke Toxicity (Gas Analysis in a smoke Box)	DD CEN/TS 45545-2-2009

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#### 4. Technical Requirements:

The APC solid surface sheets shall be manufactured in accordance with ISO: 19712-2. The APC solid surface sheets shall be thermo-formable at a temperature around 165° C and convertible to different shapes and sizes as per designs, applicable for coach toilet interiors such as wash basins, bowls, wall panels, Mirror Frames, WC covering, Baby nappy changing stations, and other accessories such as Snack Tables, Pantry/ kitchen counter tops, Control Panel counter etc. The tenderer should suggest better designs in view of their experience, command and competence in the field of solid surfaces sheets.

#### 5. Eligibility Criteria for the tenderer: Deleted.

#### 6. SAMPLING CRITERIA:

Three identical test specimens of 300mm x 300mm size (or of size as asked by the testing authority), per each supplied lot of sheets shall be submitted along with the supply for testing as per table 01 and Table 02.

6.1 Test results/values indicated in table 01 and table 02 shall be tested on APC solid surface sample sheets.

6.2 However, MCF/RBL reserves the right to take any finished product under audit if considered necessary.

To establish the genuineness of the finished product, OEM's tender specific certificate for the finished product, confirming that the material has been processed and fabricated in accordance to the OEM's manufacturing guidelines, shall be provided at the time of inspection and along with bulk supplies without which the respective lot shall not be accepted.

6.3 Test Reports mentioned at table 01 and table 02 of the physical properties shall be submitted in the form of WTC from OEM only.

6.4 Testing shall be got done either from NABL accredited test labs or in OEM's test labs producing WTC for this. PO and Lot specific OEM's Work test certificate is acceptable.

6.5 Prototype / Sampling.

6.5.1 Three Nos. of 300mm x 300mm sample for colour shade and pattern approval shall be submitted for approval by office of the CDE/MCF.

6.5.2 Bulk production of PO items shall be carried out after prototype approval.


#### 7. MARKING AND PACKING


7.1 **Marking:** The following shall be marked on all raw sheets as under

7.1.1 Manufacturers name or recognized trademark if any.

7.1.2 Lot Number.

7.1.3 Country of Origin.

  
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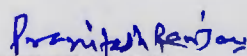
  
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**7.2 Packing:** The Finished products shall be suitably packed in accordance to the given guidelines from the manufacturer as to prevent damages during transportation.

**8. Warranty:**

The general warranty of the product and workmanship shall be for 6 years. However the tenderer shall submit warranty certificate of raw material from OEM against compliance to specification, material composition, absence of any manufacturing defects, discoloration, fading, cracking, bubble formation, signs of deteriorations/disintegration etc for period of six years from the date of supply. In case of any manufacturing defect is noticed during the warranty period, the same shall be brought to notice of the supplier and same shall be attended by the supplier as per nature of urgency and requirement of the user railway, at the earliest.

  
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## SECTION B

This section covers the infrastructure requirement for OEM or Fabricator of Aluminium Polymer Composite Solid Surface components.

### 1. Technical Eligibility Criteria:

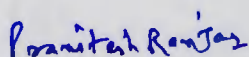
- 1.1. The tenderer shall be either OEM or its authorized Fabricator. Documentary proof of being OEM or their authorized dealer to be submitted by the tenderer along with the offer.
- 1.2. All vendors seeking registration with MCF and or participating in the tender for supply of the subject items shall comply all the requirements mentioned below, necessary documents shall be submitted by the tenderer along with the offer

### 2. Plant Machinery and Infrastructure requirement :

- 4.1 The Fabricator shall have adequate space and covered area with proper floor to accommodate the following.
  - 4.1.1 Damp Free Space for storage of Raw Sheets, Adhesives and other consumables.
  - 4.1.2 Separately identified covered area for converting the sheets in to desired item.
  - 4.1.3 Inspection and Quality Control Area.
- 4.2 The Firm should have the following Equipment's to fabricate the desired items from APC Solid surface
  - i. Panel Saw,
  - ii. Heating Oven of relevant Size,
  - iii. Hydraulic Press ( 20 Ton),
  - iv. Pneumatic system for working tables,
  - v. Heavy Duty Hand held Routers,
  - vi. Heavy Duty electrical and Pneumatic Sanders,
  - vii. Clamps of different sizes,
  - viii. Wood working tools and other necessary tools and machinery.

### 3. Fabrication Process and Quality Control:

- 4.3 The substructure supplier has to check the substrate for proper support to APC solid surface top, according to official construction recommendations.
- 4.4 Fabrication to be performed by APC Solid Surface manufacturer Certified fabricator/installer.
- 4.5 Fabricate components in fabrication unit to the greatest extent practical to sizes and shapes.
- 4.6 APC Solid surface to APC Solid Surface joints should be done using APC Solid Surface joint Chemical provided by the OEM. Joints shall be inconspicuous in appearance and without voids.
- 4.7 Necessary accessories and joining compounds, Silicon sealants, Screws, rivets, nut bolts, installation brackets etc., shall be used wherever required.
- 4.8 APC Solid Surface Care and Maintenance instructions, review maintenance procedures upon completion of installation shall be provided to the railway.

  
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#### 4. TESTING FACILITY:

- 4.1. The firm should have facility for temperature and humidity control.
- 4.2. The Firm should have the facility for measuring
  - 4.2.1 Density.
  - 4.2.2 Thickness (Vernier Callipers).
  - 4.2.3 Tables appropriately designed for visual inspection of Sheets/Items.

#### 5. Quality Control Requirement:

- 5.1 There should be proper system to ensure the traceability of the product from the raw material stage to finished product stage. The system should also facilitate to identify the raw material composition from the finish product stage.
- 5.2 The company to maintain Lot numbers, for all the inputs through the use of Job Cards during processing of the sheets.
- 5.3 A Quality assurance plan for the product detailing the following various aspects:
  - 5.3.1 Organizational Chart.
  - 5.3.2 Process flow chart.
  - 5.3.3 Stage inspection details from raw materials to finish product stage.
  - 5.3.4 Various parameters to be checked and level of acceptance of such parameters indicated and method to control over them.
  - 5.3.5 Disposal system of rejected raw material and components.

#### 6. Documentation Requirements:

- 6.1 Required in place a well-maintained Quality Plan.
- 6.2 Maintain records of incoming raw material with test certificates / certificate of Analysis.
- 6.3 Records of Commercial challans, Invoices, Eway bills etc.
- 6.4 A proper system / process to deal with Customer complaints.




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<i>Designation</i>	<i>Name</i>	<i>Signature</i>	<i>Date</i>	<i>Level</i>
SSE/Fur	A.Felix		16.11.16	Prepared
Dy.CME/D-II	Suraj Prakash		16.11.16	Agreed & Reviewed
CDE	A. K. Kathpal		16.11.16	Approved

Issue/Rev	Details of Changes	Date

  
Prepared by  
Agreed by 16.11.16


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Prepared by

  
Agreed by 16.11.16

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**Schedule of requirements for Composite Decorative Glass Fibre Reinforced Plastic  
(DGFRP) sheets for paneling of IR passenger coaches**

**SECTION - A**

**Foreword:**

This schedule is intended to cover the technical requirements/provisions relating to materials construction, parameters and testing requirements. It does not include all the necessary provisions of the contracts.

For the purpose of deciding whether a particular requirement of the schedule is complied with the final value observed or calculated expressing the results of a test or analysis shall be rounded off in accordance with IS: 2 with latest revision. The number of significant places retained in the rounded off value should be the same as that of the specified value in this schedule.

In this schedule due consideration has been given to the developments in the field of polymerized materials, process technologies and serviceability requirements of the Indian Railways and the practices followed in advanced countries in the field.

**1. Scope**

This specification for Composite Decorative Glass Fibre Reinforced Plastic (DGFRP) for paneling of Railway Passenger Coaches consists of two sections i.e. Section-A and Section-B. Section-A covers the technical requirements, methods of sampling and tests of Composite Decorative Glass Fibre Reinforced Plastic (DGFRP) and Section-B covers infrastructure requirements of manufacture, testing and quality control. The supplier shall provide necessary supervision to RCF employee in fitment of DGFRP Sheets in coaches.

**2. Method of Manufacture**


The DGFRP sheets shall be manufactured by compression moulding.

**3. Requirements**

**3.1 General**

- 3.1.1 These sheets shall be made from E-Glass fabric with or without fillers. The sheets may also contain inorganic materials, printed or plain decorative layer and colouring agents.
- 3.1.2 The resin shall be fire retardant melamine / phenolic resin. The raw material for resin manufacturing shall be procured by reputed manufacturer along with the test certificate.
- 3.1.2 The surface of the sheets shall not show blisters, porosity or cracks. The surface shall be reasonably smooth and even.

  
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- 3.1.3 The parameter and tests on raw material i.e. E-Glass fabric and resin should be mentioned in firm's QAP. Firm should keep records of test results to show the inspecting authority wherever asked for.
- 3.1.4 The sheets shall be sufficiently robust to withstand the normal handling during assembly on coaches. The sheets shall not crack or fracture when worked on by ordinary wood working tools or machinery.
- 3.1.5 The sheets shall be weatherproof and shall not loose shape or rot in service. They shall also withstand attack by vermin. The sheets shall not warp, split, delaminate or blister. Expansion or contraction due to thermal changes shall be negligible.
- 3.1.6 The sheets shall be available in different colors, design and pattern as per the requirement of Railway. The colour, pattern & texture of the sheet shall be got approved from CDE/RCF before undertaking bulk manufacture
- 3.1.7 Unless otherwise specified the thickness of sheets shall be  $2\text{mm} \pm 0.2 \text{ mm}$ . The length and width of the sheets shall be as agreed to between the purchaser and the manufacturer. The tolerances shall be  $\pm 10\text{mm}$  for length and width. The out of squareness of the sheets shall not exceed  $10\text{mm}/1500\text{mm}$  length.
- 3.1.8 Material shall be supplied with surface/ self protective film to avoid scratches at the time of transit and fitment.

### **3.2 Physical properties**

- 3.2.1 The physical properties of sheets shall conform to the requirements indicated in Table 1.

**TABLE-1**

S. No	Property	Required value	Method of test
1.	Density ( $\text{gm}/\text{cm}^3$ )	$1.7 \pm 0.3$	Appendix A
2.	Tensile strength (MPa) Min. both along the length and width	100	Appendix B
3.	Breaking strength (Kg) Min. both along the length and width	25	Appendix C
4.	Drop impact test	1.5Kg	Appendix D
5.	Water absorption (%) Max.	1%	Buoyancy method or Appendix E
6.	Resistance to staining rating scale as per IS:2046-95 Annexure -M	Not worse than 5	IS 2046-95 Annexure -M

  
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7.	Resistance to colour change in xenon arch light minimum as per IS 2046-95 annexure –M	Not worse than 5	IS 2046-95 annexure –M
8.	Resistance to surface wear	Index 3 IP >150 FP >350	IS 2046 -95 appendix C
9.	<i>Resistance to immersion in boiling water</i>		
9.a	Appearance	Degree 5	
9.b	Increase in thickness	Curve 2 of Annexure A	
9.c	De-lamination	Shall not be visible	
10.	Resistance to surface wear	Index 3 IP >150 FP >350	IS 2046 -95 appendix C

**3.2.2** The physical properties of sheets shall conform to the requirements indicated in Table 2.


**TABLE-2**

<b>Fire Worthiness Properties as per EN45545-2</b>			
1	Reaction to fire test- Spread of Flame (kW/m <sup>2</sup> )	CFE: Critical Flux at Extinguishment: HL3	ISO 5658-2 specified in EN 45545-2:2013 (R1)
2	Smoke Generation: Determination of Optical Density by a single chamber test.(Ds4 Maximum dimensionless)	HL3	ISO 5659-2 (T10.01): specified in EN 45545-2:2013 (R1)
3	Smoke Generation: Determination of Optical Density by a single chamber test.(VOF4)	HL3	ISO 5659-2 (T10.02): specified in EN 45545-2:2013 (R1)
4	Gas analysis in the smoke chamber EN ISO 5659-2, using FTIR technique (CITG at 4 min. & CITG at 8 min.)	HL3	ISO 5659-2: specified in EN 45545-2:2013 (R1)
5	HEAT RELEASE RATE (kW/m <sup>2</sup> )	HL3	ISO 5660-1

**3.2.2** Number of Test:

All the tests given in Table – 1 & 2 shall be carried out on each lot except test mentioned at Serial Number 4 of Table 2, shall be carried out once in a year in outside laboratory only.

  
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#### 4. Sampling and Criteria for Conformity:

##### 4.1 Test specimen

The number of samples for various tests shall be drawn as per Table-3. The specimens for individual tests shall be as per the test procedure:

**TABLE -3**

Lot size	For appearance and dimensions.		For properties as given in Table 1 & 2
	No. of sheets to be selected	Permissible No. of defects	
Up to 100	2	0	1
101 - 200	3	0	1
201 - 300	5	1	2
301 - 500	8	1	3
501 & above	10	2	4

- 4.2 For each test specified in the specification the scale of samples to be drawn and tested shall be as above. In case any sample drawn fails to satisfy the requirements, twice the number of samples shall be drawn and tested. If any of the retested samples fail to satisfy the requirements of the specification, the entire lot shall be considered rejected.

#### 5. Marking and Packing

##### 5.1 Marking:

The following shall be marked on all sheets as under:

- Manufacturers name and recognized trademark if any.
- Date of manufacture.
- Lot or batch number.

##### 5.2 Packing:

After inspection and approval, sheets shall be suitably packed to prevent damage in transit. The method of packing used shall be as agreed to between the purchaser/inspector and the supplier.

#### 6. Warranty:

48 months from the date of supply and 36 months from the date of fitment whichever is earlier, the product shall be warranted against natural cracking due to manufacturing defect. Cracking due to mishandling, deliberately damage shall not be considered as manufacturing defect. Warranty Certificate is required to be submitted through OEM.

App.  
Prepared by

Agreed by  15/11/16



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#### APPENDIX - A

##### DENSITY: -

The test specification of about 100 cm<sup>2</sup> shall be weighed correctly to 0.1 gm. and its dimensions measured. The length and width shall be measured to an accuracy of  $\pm 0.5$  mm and thickness shall be measured at 6 random places widely spaced on the test specimen and average value shall be considered for calculation of volume. The weight of the test piece in grams divided by its volume in cm<sup>3</sup> gives the density.

Three test specimens shall be subjected to this test and average value taken for consideration as given in table-I

#### APPENDIX - B

##### TENSILE STRENGTH: -

The tensile strength test shall be carried out on test specimen of 25mm wide of 200 mm long and of the actual thickness of the sheet. These specimens shall be cut along the length and width of the sheet. Specimens with clear-cut edges only shall be used. Specimen with irregularities in the cut edges shall be rejected. The rate of traverse of the moving jaw of the tensile testing machine shall be  $20 \pm 5$  mm /minute.

Three test specimen shall be tested and mid value taken for consideration as given, in table -I for each directions

#### APPENDIX - C

##### BREAKING LOAD TEST: -

Breaking load test shall be carried out on a universal testing machine on a specimen of 200mm Long x 75mm wide. The distance between supports shall be 100mm with a bedding shank of 25mm Dia. The loading shall be completed between 30 to 60 seconds and the load at which fracture occurs shall be recorded.

Three test specimens shall be tested and mid value taken for consideration as given in table-1 for each direction.

#### APPENDIX - D

##### DROP IMPACT TEST: -

The drop impact test shall be carried out with a falling weight type of impact tester, which shall essentially consist of the following,

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- i) A rigid metallic base preferably with leveling screws. The base shall have a hole or a ring of 25mm inside diameter attached to it for supporting the test specimen on it. The ring/hole should be so situated that its axis coincides with the line of fall of the striker. A device for clamping the test specimen to hold it in position while under impact shall also be provided.
- ii) A striker consisting of a 19mm diameter hardened steel ball ended plummet capable of being clamped released and falling freely in the guides. The spherical striking surface of the plummet shall be free from faults or any other imperfections. The entire striker assembly shall weigh 1.5 Kg. The line of fall of the plummet shall be perpendicular to the specimen surface and shall be concentric to the axis of the ring.
- iii) Superstructure shall consist of rigid frame with guides to adjust the height of the striker. The height of the frame shall be such that the maximum height of fall of the striker is not less than 300 mm. and the frame shall be calibrated from 0 to the maximum of the fall.
- iv) The test specimen supported on the ring shall be subjected to drop impact. The material shall not fracture in drop impact test with a drop height of 200 mm. Minor cracks on the reverse side, if any should confine to the point of indentation only and shall not propagate beyond an area with 20 mm diameter.
- v) Sample Size: Five test specimens of size 70mm X 70mm shall be subjected to test and each of the test specimens shall confirm to the requirements. Four test specimens should be drawn from each corner at the distance of 100mm from the edges of the sheet and one test specimen should be drawn from the middle of the sheet.

#### **APPENDIX - E**

##### **WATER ABSORPTION: -**

Three-test specimens each of 100mm x 100mm shall be cut from a sheet. These specimens shall be cut leaving 150mm smoothed with sand paper but not sealed. The specimens shall be conditioned in an atmosphere maintained at a relative humidity of  $65 \pm 5\%$  and at a temperature of  $27 \pm 2^{\circ}\text{C}$  until the weight is substantially constant. After this each of the test specimens shall be weighed to an accuracy of  $\pm 0.1\text{gm}$ . They shall then be kept fully submerged in water clear of the bottom of the container, maintained at  $27 \pm 2^{\circ}\text{C}$  for 24 hrs. At the conclusion of 24 hours immersion period, the test specimens shall be withdrawn from water and all excess water shall be wiped with a damp cloth and finally with dry tissue paper. Each of the specimens shall be weighed to an accuracy of  $\pm 0.1\text{gm}$ . For each of the specimens the increase in weight, expressed as percentage of the weight before immersion shall be calculated.

Three-test specimen shall be subjected to this test and average value shall be taken for consideration as given in table-I. The test specimen should also not show sign of warping, deformation and de-lamination.

  
Prepared by

  
Agreed by



<b>SPECIFICATION</b> <b>No.</b> <b>MDTS 46303</b>	<b>Schedule of Technical Requirements for</b> <b>Composite Decorative Glass Fabric Reinforced</b> <b>Plastic (DGFRP) Sheets</b>	<b>DATED 15.11.2016</b> <b>PAGE 9 OF 11</b>
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### **SECTION-B**

#### **1. Scope**

This section covers the infrastructural requirements for manufacture Composite Decorative Glass Fibre Reinforced Plastic (DGFRP) Sheets for Panelling of IR Passenger Coaches.

#### **2. Technical Eligibility Criteria**

- 2.1 The tenderer shall be either OEM or its authorised dealer. Documentary proof of being OEM or their authorised dealer to be submitted by the tenderer along with the offer.
- 2.2 All vendors seeking registration with RCF and/or participating in tender for supply of subject item shall comply all the requirements mentioned below. Necessary documents shall be submitted by the tenderer along with the offer.

#### **3. Plant, Machinery and Infrastructure Requirements**

- 3.1 The manufacturers shall have adequate space and a covered area with cemented floor to accommodate the following:
  - a) Damp free place for storage of raw materials i.e. E-Glass Fabric, resin, chemicals etc.
  - b) Independent manufacturing area for composite DGFRP sheet.
  - c) Inspection & quality control area.
- 3.2 The firm should have resin coating arrangement on Glass Fabric etc.
- 3.3 The firm should have at least one number heavy-duty hydraulic press with die arrangement to manufacture Composite DGFRP sheet of adequate size for paneling with adequate margin of trimming.
- 3.4 The firm should have at least one No. of trimming machine.

#### **4. Testing Facilities:**

- 4.1 The testing lab should have facility for temperature and humidity control.
- 4.2 The firm should have an electronic balance.
- 4.3 The firm should have one universal testing machine of adequate capacity.
- 4.4 The firm should have density-measuring arrangement.

  
 Prepared by

  
 Agreed by

<b>SPECIFICATION</b> <b>No.</b> <b>MDTS 46303</b>	<b>Schedule of Technical Requirements for</b> <b>Composite Decorative Glass Fabric Reinforced</b> <b>Plastic (DGFRP) Sheets</b>	<b>DATED 15.11.2016</b> <b>PAGE 10 OF 11</b>
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4.5 The firm should have in-house testing facilities, complying test mentioned in Table 1 & 2.

4.6 The firm should have the following instruments.

- a) Vernier calipers with Digital display
- b) Micro meters with Digital display/Dial Thickness Gauge
- c) Moisture meter with Digital display
- d) Hydrometer
- d) Measuring scale
- f) Measuring tape

4.7 The firm should have arrangement for periodical calibration of all the gauges & instruments.

## 5 Quality Control Requirements

5.1 There should be a system to ensure the traceability of the product from raw material stage to finished product stage. The system should also facilitate to identify the raw material composition from the finish product stage.

5.2 It should be ensured that there is a Quality Assurance Plan for the product detailing the following various aspects:

- Organisation chart
- Process flow chart
- Stage inspection details from raw materials stage to finish product stage
- Various parameters to be checked and level of acceptance of such parameters indicated and method to ensure control over them.
- Disposal system of rejected raw material and components.

5.3 The firm must ensure that proper analysis is being done on monthly basis to study the rejections at various internal stages and it is documented.

5.4 The firm should ensure that latest version all the relevant specifications, IS standards are available with the firm.

## 6. Documentation

Firm shall maintain following documents/records:

6.1 A well documented Quality Plan.

6.2 Incoming raw material register with Test Certificates references of suppliers and internal test results.

6.3 Stage inspection results including finished products results.

  
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<b>SPECIFICATION</b> <b>No.</b> <b>MDTS 46303</b>	<b>Schedule of Technical Requirements for</b> <b>Composite Decorative Glass Fabric Reinforced</b> <b>Plastic (DGFRP) Sheets</b>	<b>DATED 15.11.2016</b> <b>PAGE 11 OF 11</b>
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- 6.4 Records of internal rejection and its analysis vis-a-vis action plan.
- 6.5 Records for maintenance of dies/moulds.
- 6.6 Records for checking of plates of the press and its frequency.
- 6.7 Ensure that proper systems are available for dealing with customer complaint.

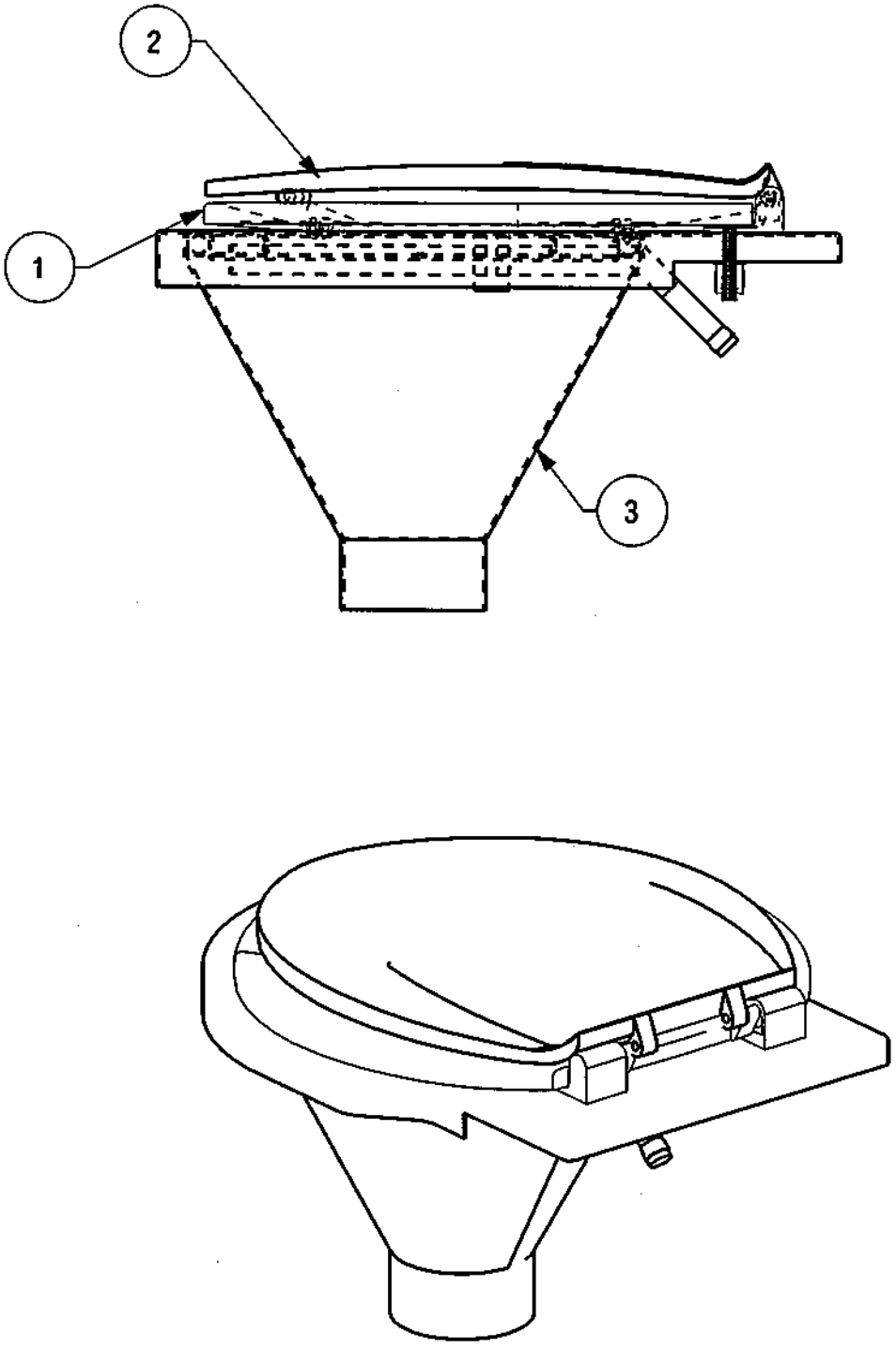
**7. Training:**

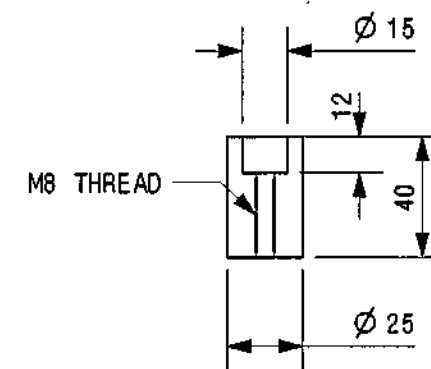
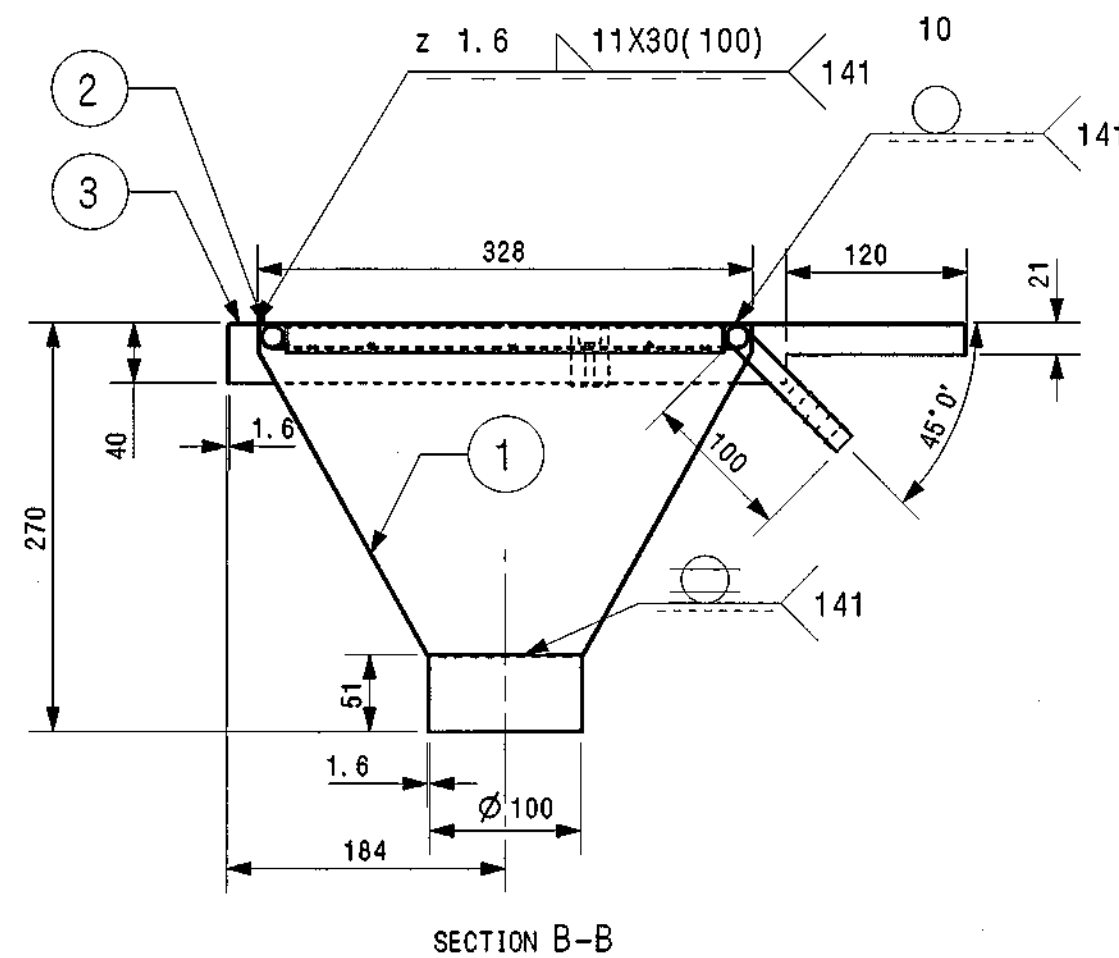
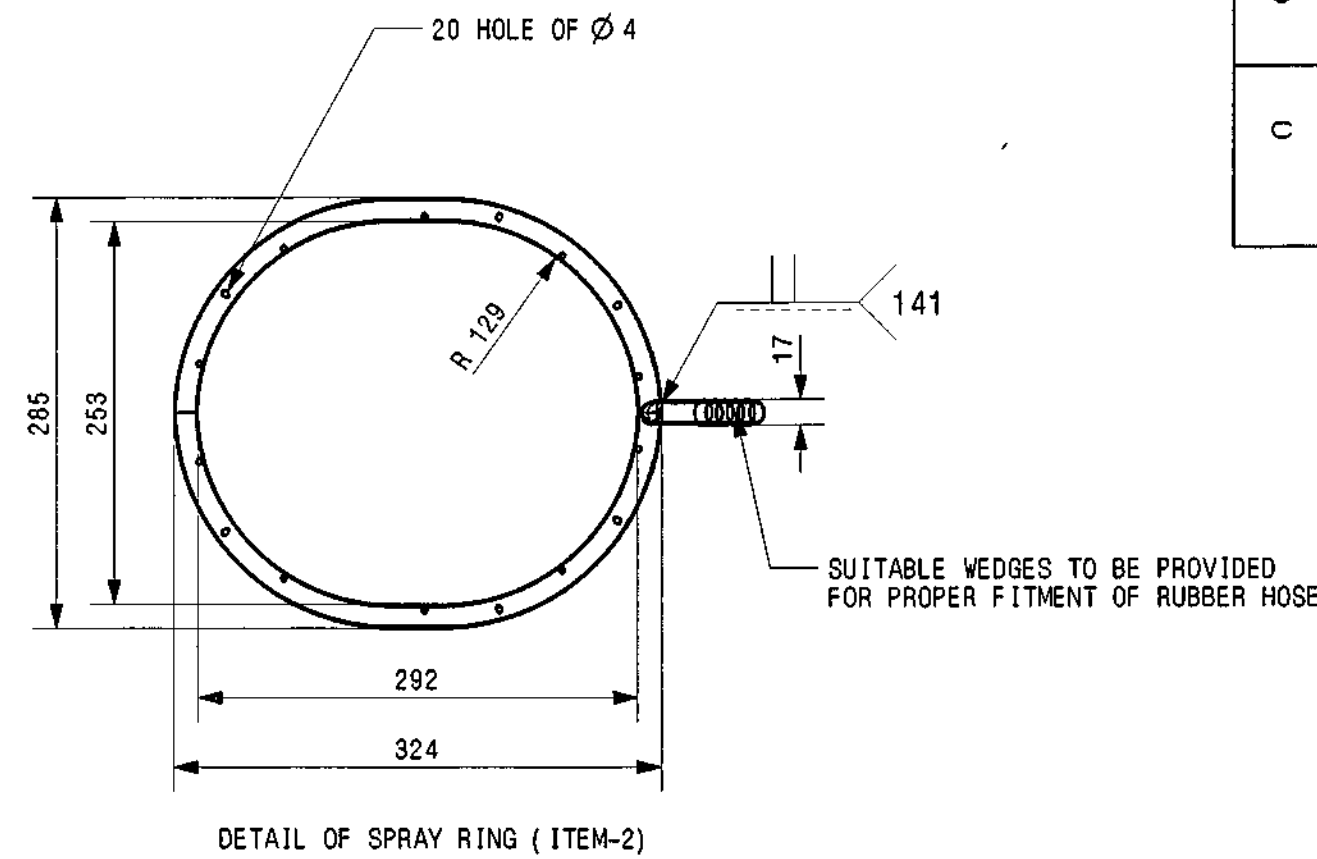
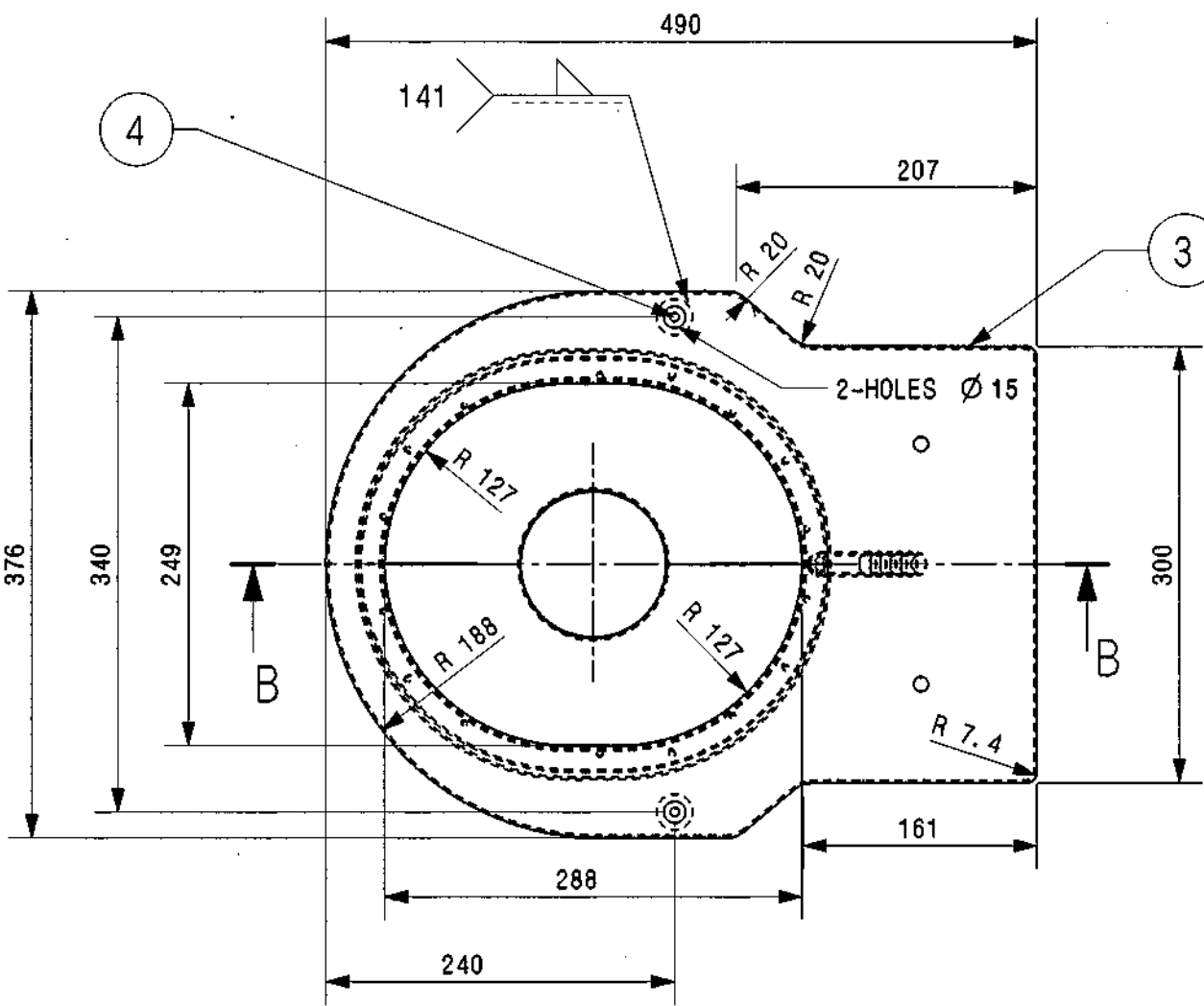
- 7.1 Training needs should be identified for all concerned officials and regular training shall be organised and imparted on maintenance of machines, quality assurance, safety parameters etc.

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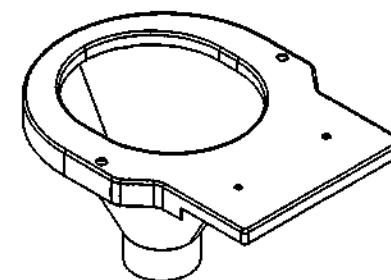
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*[Signature]*  
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<p>THIS DRAWING IS THE INTELLECTUAL PROPERTY OF RAIL COACH FACTORY, KAPURTHALA. THIS DRAWING SHOULD NOT BE REPRODUCED, ALTERED, USED FOR MANUFACTURING OF COMPONENTS, SOLD OR TRANSFERRED WITHOUT PERMISSION FROM CHIEF DESIGN ENGINEER, RAIL COACH FACTORY, KAPURTHALA.</p>													<table border="1"><thead><tr><th>WELD LENGTH</th><th>ITEM</th><th>DESCRIPTION &amp; DIMENSIONS</th><th>QTY</th><th>DETAIL DRG</th><th>MATL. &amp; SPEC.</th><th>REMARKS</th></tr></thead><tbody><tr><td>NIL</td><td>3</td><td>EURO BOWL ASSEMBLY</td><td>01</td><td>LS63119</td><td>NIL</td><td>NIL</td></tr><tr><td>NIL</td><td>2</td><td>SEAT COVER</td><td>01</td><td>LS63120</td><td>NIL</td><td>NIL</td></tr><tr><td>NIL</td><td>1</td><td>SEAT</td><td>01</td><td>LS63118</td><td>NIL</td><td>NIL</td></tr></tbody></table> <table border="1"><thead><tr><th>WEIGHT</th><th>FILE</th><th>DESCRIPTION &amp; DIMENSIONS</th><th>QTY</th><th>DETAIL DRG</th><th>MATL. &amp; SPEC.</th><th>REMARKS</th></tr></thead><tbody><tr><td>8.040</td><td>KO</td><td>LAVATORY &amp; ITS FITTINGS</td><td>01</td><td>LS63117</td><td>ALT NIL</td><td></td></tr><tr><td colspan="7">Z:\LS63117a.pr1 (3D)</td></tr></tbody></table> <table border="1"><thead><tr><th>SCALE</th><th>SSE/REC</th><th>CHK</th><th>TPSI</th><th>DN</th><th>NKML</th></tr></thead><tbody><tr><td>1:5</td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table> <table border="1"><thead><tr><th>REF. DRG. NO.</th><th>PL NO.</th><th>DRG. NO.</th><th>SIZE</th><th>SHEET</th></tr></thead><tbody><tr><td>NIL</td><td>NIL</td><td>LS63117</td><td>A3</td><td>1/1</td></tr></tbody></table>													WELD LENGTH	ITEM	DESCRIPTION & DIMENSIONS	QTY	DETAIL DRG	MATL. & SPEC.	REMARKS	NIL	3	EURO BOWL ASSEMBLY	01	LS63119	NIL	NIL	NIL	2	SEAT COVER	01	LS63120	NIL	NIL	NIL	1	SEAT	01	LS63118	NIL	NIL	WEIGHT	FILE	DESCRIPTION & DIMENSIONS	QTY	DETAIL DRG	MATL. & SPEC.	REMARKS	8.040	KO	LAVATORY & ITS FITTINGS	01	LS63117	ALT NIL		Z:\LS63117a.pr1 (3D)							SCALE	SSE/REC	CHK	TPSI	DN	NKML	1:5						REF. DRG. NO.	PL NO.	DRG. NO.	SIZE	SHEET	NIL	NIL	LS63117	A3	1/1
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DETAIL OF BOSS (ITEM-4)



ISO VIEW  
(FOR REF. ONLY)

NOTE :-

1. SUPPLIER MAY GET A SAMPLE APPROVED BY CDE/RCF BEFORE BULK SUPPLY.
2. SUPPLIER'S NAME & DATE OF MANUFACTURING TO BE INDICATED ON THE BODY ON THE BACKSIDE.
3. HOLES AT SUITABLE LOCATIONS TO BE PROVIDED IN WATER JACKET FOR PROPER FLUSHING.
4. ALL THE WELDED JOINTS ARE TO BE SEALED WITH APPROVED SEALING COMPOUND.
5. ASSEMBLY SHALL HAVE MIRROR FINISH NO.-8 OF IS: 6911-92, TAB-8.

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ALT.NO	ALT.DATE	ZONE	ALTERATIONS	AUTHORITY
b	31/05/2012	D8	DIA. OF BOSS (ITEM-4) REDUCED FROM 25 TO 18MM.	MD46111 DT. 29.5.12
c	20/05/2014	D7 A3B3	1.DETAIL OF ITEM-4 REVISED 2. HOLES DIA 15 ADDED IN TOP PLATE.	MD140016

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Date Bar

26 MAY 2014

4	BOSS	02	NIL	AISI304	NIL
3	TOP COVER PLATE	01	NIL	AISI304	NIL
2	SPRAY RING	01	NIL	AISI304	NIL
1	EURO BOWL	01	NIL	AISI304	NIL

WELD LENGTH		ITEM	DESCRIPTION & DIMENSIONS		QPASSLY	DETAIL DRG		MATL. & SPEC.		REMARKS		
NIL		M	GROUP	LAVATORY & ITS FITTINGS		SUPERSEDES: LS63119 ALT b						
WEIGHT		FILE	Z:\ls63119c.prt (3D)									
6.600		KG	EURO BOWL ASSEMBLY						SCALE		SSE/REC	
S.AREA		1:5							CHD		TPSI	
NIL		M <sup>2</sup>	RAIL COACH FACTORY, KAPURTHALA						DRN		DNHS	
LENGTH / DIA		REF.DRG.No.							NIL			
NIL		M	रेल कोच फैक्टरी कपूरथला						PL NO.		NIL	
WIDTH / THICK		DRG.NO.							LS63119			
NIL		M	ADE/SME						ALT.		C	
HEIGHT		SIZE							A2		SHEET	
NIL		M	DY.CME						CDE			

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UNTOLERANCED DIMENSIONS REFER MDG0008

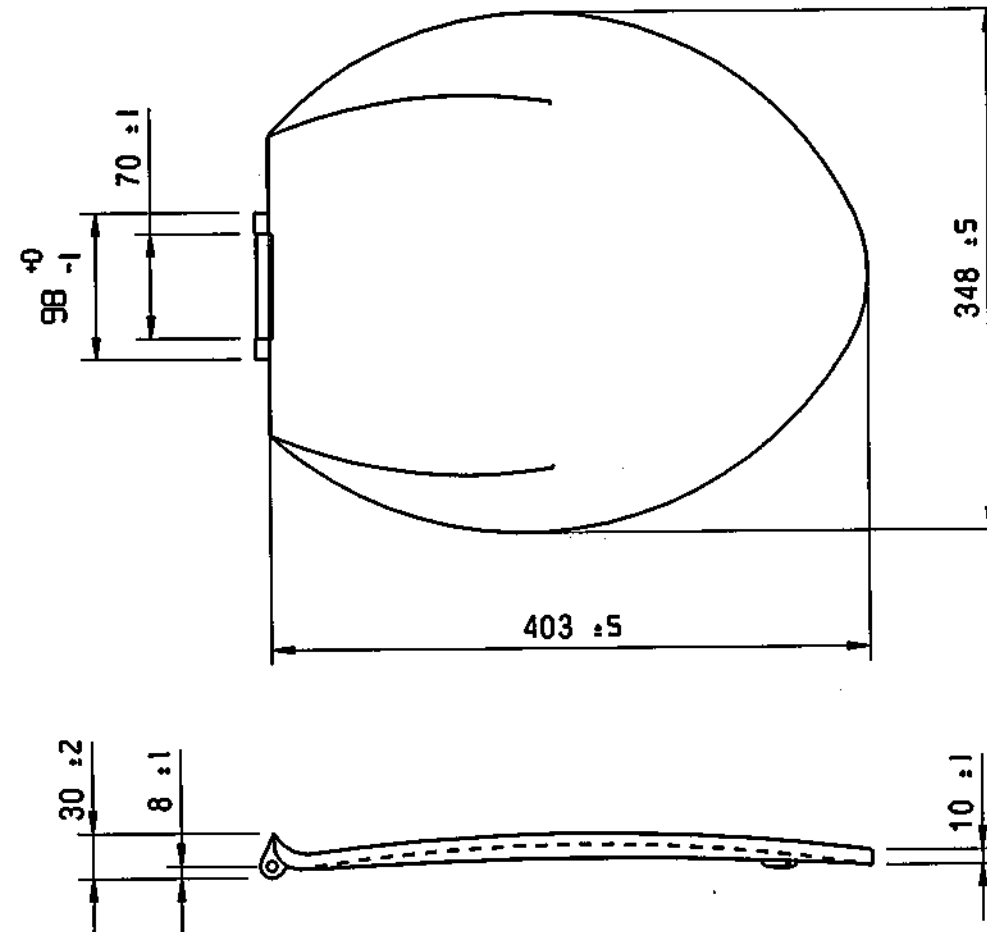
DATE OF FIRST ISSUE 15/09/2010

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ALT. NO.	ALT. DATE	ZONE	ALTERATIONS	AUTHORITY
0	23/02/2015	D-4	1. DIMENSION 403±5 WAS 410.	DIC
		C-6	2. DIMENSION 348±5 WAS 346.	MDI40055
		C-2	3. DIMENSION 98 WAS 96.	
		F-8	4. SEAT COVER'S WEIGHT WAS 1.190 KG.	

NOTE:

1. IS: 2548(PART I)-1996 SHOULD BE REFERED FOR MATERIAL. SHAPES & REQUIRED DIMENSIONS WHICH ARE NOT COVERED IN DRAWING.
- \* 2. COLOUR DOVE GREY.



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27 FEB 2015

NIL	SEAT COVER	NIL	NIL	IS: 2548(PART I)-1996	
WELD LENGTH	ITEM	DESCRIPTION & DIMENSIONS	OPASSLY	DETAIL DRG	REMARKS
NIL	M	LAVATORY & IT'S FITTINGS			
WEIGHT	FILE	FILE \\LS63120a.prt (3D)			
0.680	KG				
S. AREA					
NIL	M <sup>2</sup>				
LENGTH / - DIA					
NIL	M				
WIDTH / - THICK					
NIL	M				
HEIGHT					
NIL	M				

RAIL COACH FACTORY, KAPURTHALA

रेल कोच फैक्टरी कपूरथला

IRS

PL NO.

NIL

DRG. NO.

LS63120

ALT. 0

SIZE A3 SHEET 1/1

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FOR UNTOLERANCED DIMENSIONS REFER MD00008

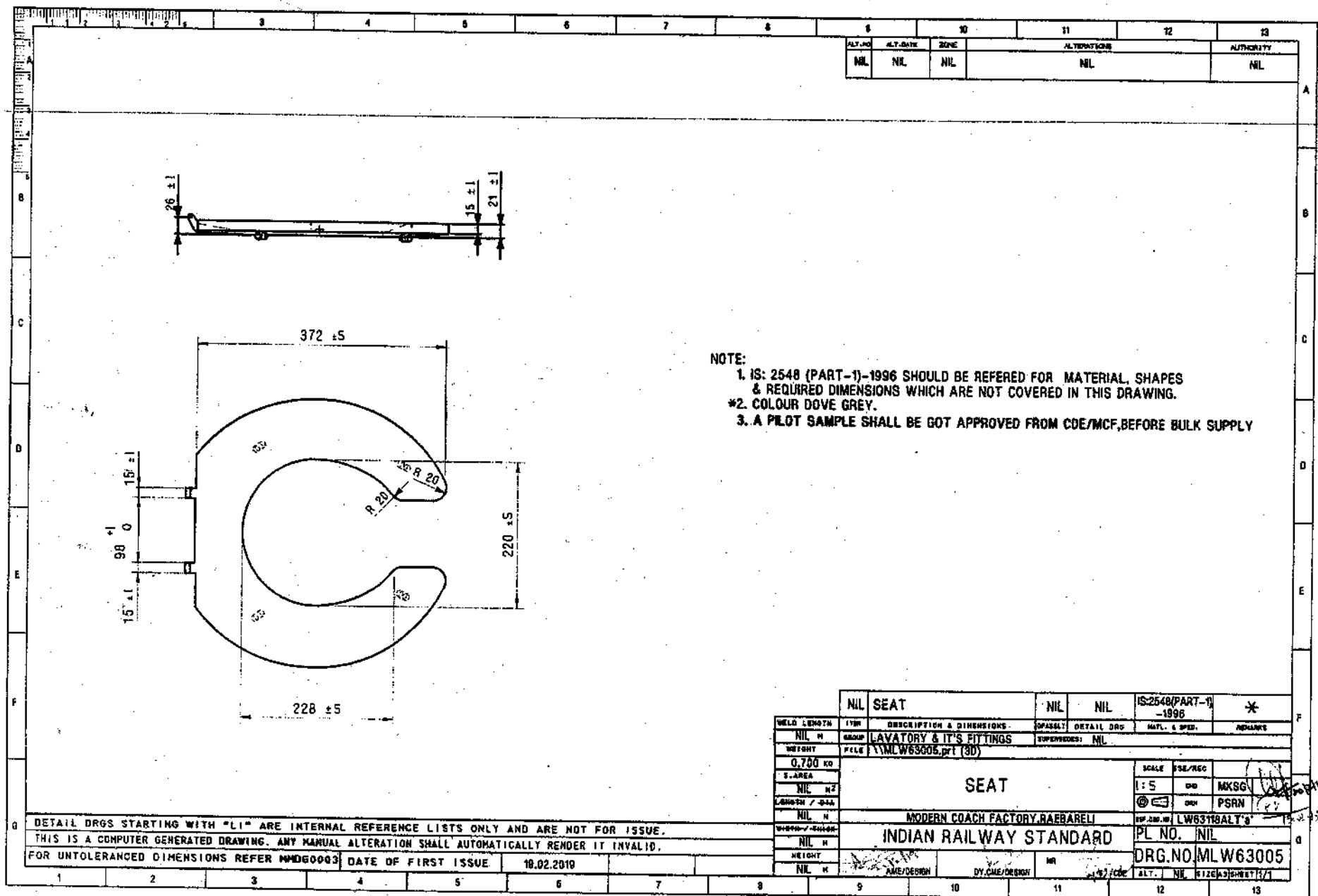
DATE OF FIRST ISSUE 14/09/2010

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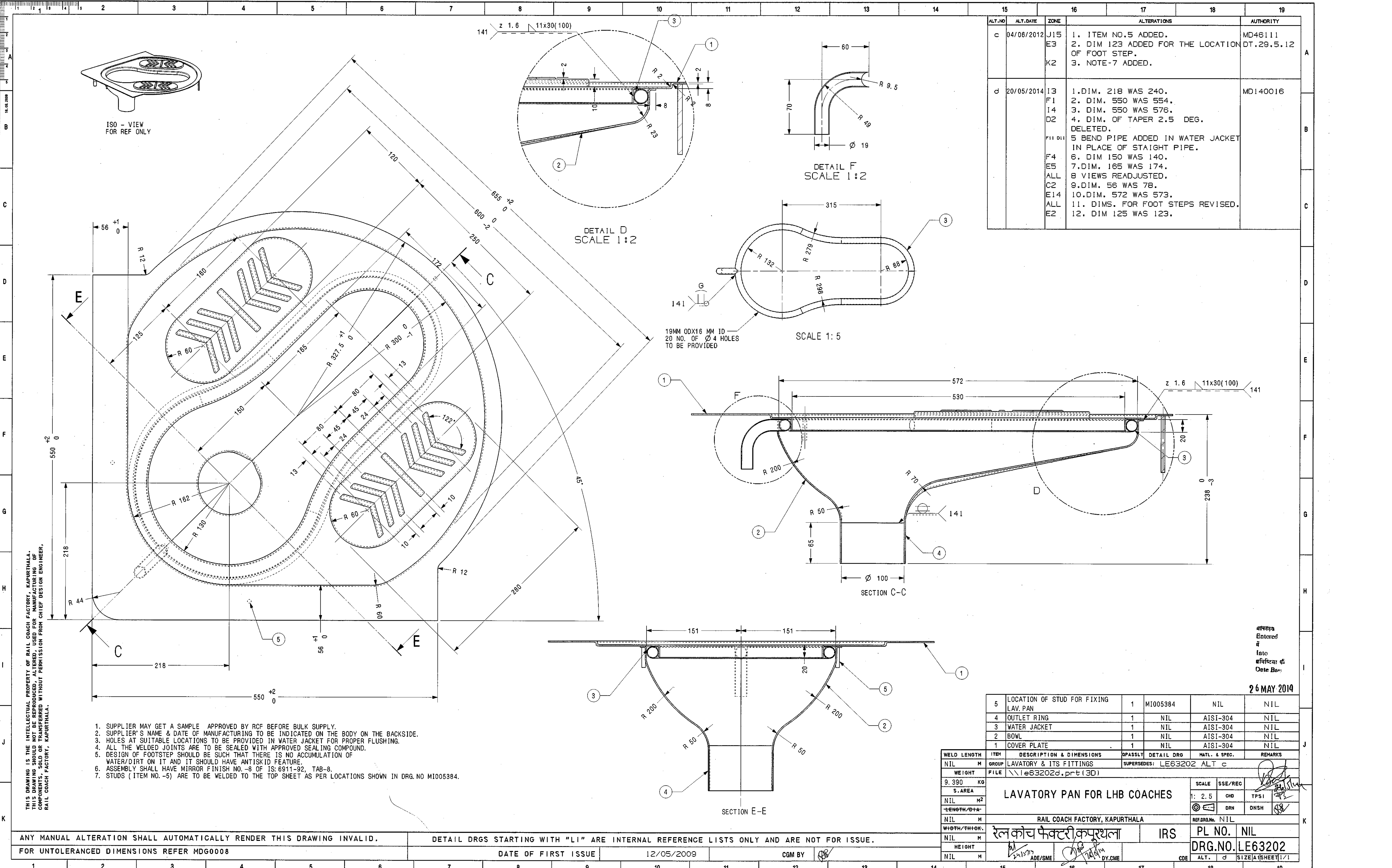
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NABAJYOTI CHETIA  
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10:38:43 IST  
Reason: IREB'S CMIS  
Location: New Delhi



ALT. NO.	ALT. DATE	ZONE	ALTERATIONS	AUTHORITY
c	04/08/2012	J15 E3 K2	1. ITEM NO.5 ADDED. 2. DIM 123 ADDED FOR THE LOCATION OF FOOT STEP. 3. NOTE-7 ADDED.	MD46111 DT.29.5.12
d	20/05/2014	I3 F1 I4 D2 F11 D11 F4 E5 ALL C2 E14 ALL E2	1.DIM. 218 WAS 240. 2. DIM. 550 WAS 554. 3. DIM. 550 WAS 576. 4. DIM. OF TAPER 2.5 DEG. DELETED. 5 BEND PIPE ADDED IN WATER JACKET IN PLACE OF STRAIGHT PIPE. 6. DIM 150 WAS 140. 7.DIM. 165 WAS 174. 8 VIEWS READJUSTED. 9.DIM. 56 WAS 78. 10.DIM. 572 WAS 573. 11. DIMS. FOR FOOT STEPS REVISED. 12. DIM 125 WAS 123.	MD140016

26 MAY 2012						
5	LOCATION OF STUD FOR FIXING LAV. PAN		1	M1005384	NIL	NIL
4	OUTLET RING		1	NIL	AISI-304	NIL
3	WATER JACKET		1	NIL	AISI-304	NIL
2	BOWL		1	NIL	AISI-304	NIL
1	COVER PLATE		1	NIL	AISI-304	NIL
ITEM	DESCRIPTION & DIMENSIONS		QPASSLY	DETAIL DRG	MATL. & SPEC.	REMARKS
GROUP	LAVATORY & ITS FITTINGS		SUPERSEDES: LE63202 ALT c			
FILE	\\le63202d.prt (3D)					
LAVATORY PAN FOR LHB COACHES					SCALE	SSE/REG
					1: 2.5	CHD
					TPSI	
					DRN	DNSH
RAIL COACH FACTORY, KAPURTHALA					REF.DRG.No.	NIL
रेल कोच फैक्टरी कपूरथला			IRS		PL NO. NIL	
					DRG.NO. LE63202	
ADE/SME			DY.CME		CDE	ALT. d
						SIZE A1 SHEET 1/1

1. SUPPLIER MAY GET A SAMPLE APPROVED BY RCF BEFORE BULK SUPPLY.  
2. SUPPLIER'S NAME & DATE OF MANUFACTURING TO BE INDICATED ON THE BODY ON THE BACKSIDE.  
3. HOLES AT SUITABLE LOCATIONS TO BE PROVIDED IN WATER JACKET FOR PROPER FLUSHING.  
4. ALL THE WELDED JOINTS ARE TO BE SEALED WITH APPROVED SEALING COMPOUND.  
5. DESIGN OF FOOTSTEP SHOULD BE SUCH THAT THERE IS NO ACCUMULATION OF WATER/DIRT ON IT AND IT SHOULD HAVE ANTISKID FEATURE.  
6. ASSEMBLY SHALL HAVE MIRROR FINISH NO.-8 OF IS: 6911-92, TAB-8.  
7. STUDS (ITEM NO.-5) ARE TO BE WELDED TO THE TOP SHEET AS PER LOCATIONS SHOWN IN DRG.NO M1005384.

ANY MANUAL ALTERATION SHALL AUTOMATICALLY RENDER THIS DRAWING INVALID.  
FOR UNTOLERANCED DIMENSIONS REFER MDG0008

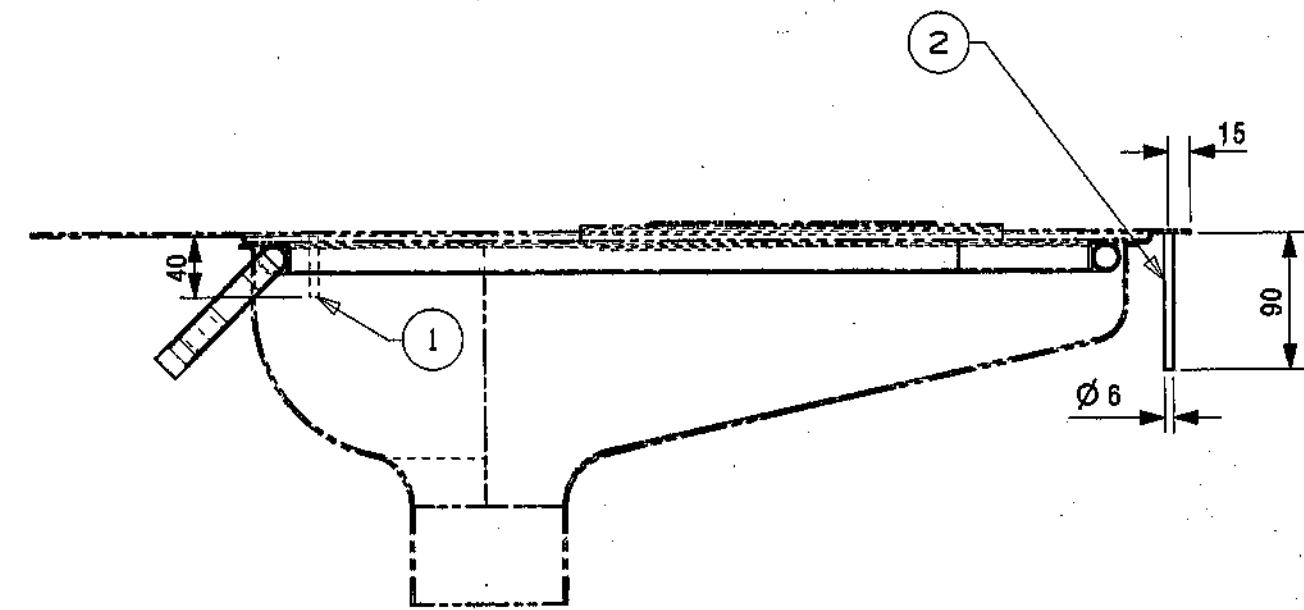
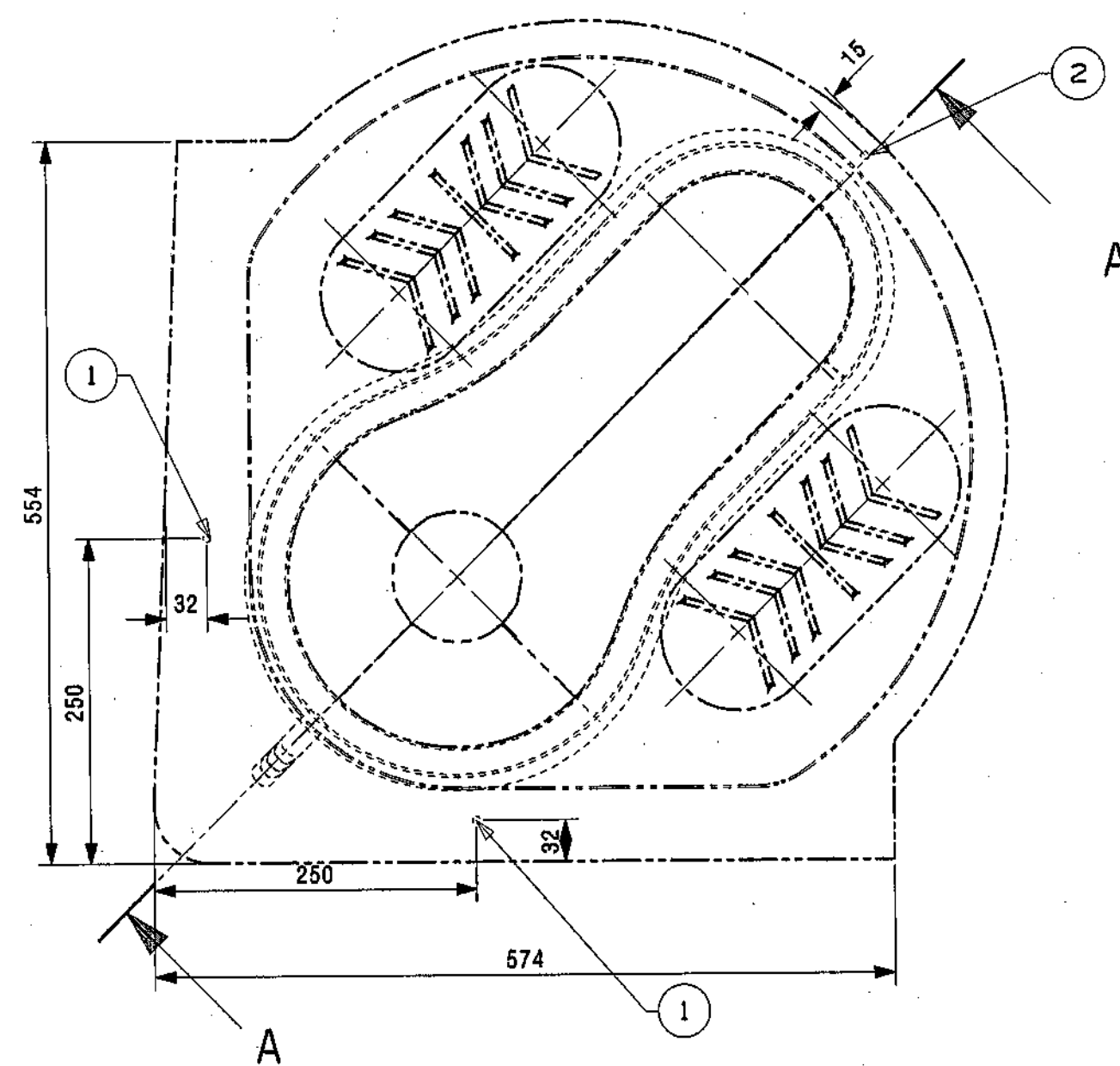
DATE OF FIRST ISSUE 12/05/2009  
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26 MAY 2014



ALT. NO.	ALT. DATE	ZONE	ALTERATIONS	AUTHORITY
NIL	NIL	NIL	NIL	NIL



SECTION A-A

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Date Bar

23 NOV 2010

	2	SS STUD M6X90	1	NIL	NIL	NIL	
	1	SS STUD M6X40	2	NIL	NIL	NIL	
WELD LENGTH	ITEM	DESCRIPTION & DIMENSIONS	OPASSLY	DETAIL DRG	NATL. & SPEC.	REMARKS	
NIL	M	GROUP	LAVATORY & ITS FITTINGS				
WEIGHT	FILE	\MI005384.prt (3D)					
NIL	KG	LOCATION OF STUDS FOR FIXING				SCALE	
S. AREA	LAV. PAN ON LAV. TROUGH				5	SE/REC	
NIL					M <sup>2</sup>	CHD	TPSI
LENGTH / - DIA					DRN	ANGD	
NIL	M	LHB COACHES				REF. DRG. NO.	
		RAIL COACH FACTORY, KAPURTHALA				NIL	
WIDTH / - THICK	रेलकॉच फैक्टरी कपूरथला				IRS	PL NO.	
NIL	M					NIL	
HEIGHT						DRG. NO.	
NIL	M					MI005384	
		DATE/SME	DY. CME	CDE	ALT.	NIL	
						SIZE A3 SHEET	

DETAIL DRGS STARTING WITH "LI" ARE INTERNAL REFERENCE LISTS ONLY AND ARE NOT FOR ISSUE.  
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