

Colaboración INSIA-IRIZAR

Nuevas estructuras

INSIA
CENTRO SUPERIOR
DE INVESTIGACION DEL AUTOMOVIL
DE LA COMUNIDAD DE MADRID



mayo 2020



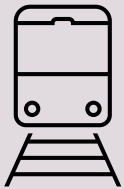
Emergency lighting standards review

Reg 107 comparison with Railway standards

2007

October

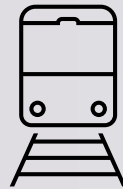
RSSB



2010

June

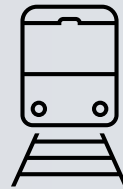
APTA RT-VIM-S-020-10



2011

October

CFR 49 238.115



2014

june

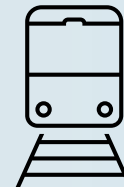
Reg 107



2017

December

APTA RT-VIM-S-020-10, Rev 1



Regulation 107: Emergency lighting System

- 2.42. 'Emergency lighting system' means a system that provides a minimum level of lighting necessary to enable occupants to safely egress from the vehicle, including the emergency exits.
- **ANNEX 3: REQUIREMENTS TO BE MET BY ALL VEHICLES**
- 7.8.3. Vehicles of Classes II, III and B shall be equipped with an emergency lighting system:
 - 7.8.3.1. It shall be possible for the driver to activate the emergency lighting system from the driver's seating position.
 - 7.8.3.2. The operation of the emergency control of any service or emergency door shall activate the emergency lighting system.
 - 7.8.3.3. The emergency lighting system, once activated, **shall remain active for at least 30 minutes** unless deactivated by the driver.
 - 7.8.3.4. The power supply for the emergency lighting shall be suitably located within the vehicle to minimise the risk of its continued operation being prejudiced as the result of an accident.
 - 7.8.3.5. All units providing the emergency lighting shall produce a **white light**.
 - 7.8.3.6. The uniformity of illuminance of the lighting shall be assessed in accordance with the following measures:

$$\text{Maximum uniformity of illuminance} = \frac{\text{Maximum lighting level recorded}}{\text{Average lighting level recorded}}$$

$$\text{Minimum uniformity of illuminance} = \frac{\text{Minimum lighting level recorded}}{\text{Average lighting level recorded}}$$

Regulation 107: Emergency lighting System

- 7.8.3.7. The emergency lighting system shall provide a minimum illuminance of **10 lux directly under each light unit in the passenger compartment at a height of 750 mm** above the centreline of all access passages and gangways.
- 7.8.3.8. The **uniformity** of the illuminance over the length of the passenger compartment at a height of 750 mm above all access passages and gangways shall be **between 0,15 and 2**.
- 7.8.3.9. The emergency lighting system shall provide a **minimum illuminance of 1 lux at floor level** in the centreline of all access passages and gangways and at the centre of any step, at step level.
23.2.2018 L 52/62 Official Journal of the European Union EN
- 7.8.3.10. Conformity with the uniformity requirements shall be demonstrated over a period of at least 30 minutes from initiation of the emergency lighting by measurements taken at distances not exceeding 2 metres.

Rail Safety Standards Board

- **Project title**
- Requirements for emergency lighting on passenger rail vehicles (T314)
 - **Project number:** T314
 - **Topic:** Rolling Stock
 - **Status:** Completed
- **Report Link:** <https://catalogues.rssb.co.uk/Pages/research-catalogue/PB009491.aspx>

Requirements for emergency lighting on passenger rail vehicles (T314)

Table 1 - Details of Draft Specification for Best Practice (Derived from T314 Phase 1)

Locations		Illumination and (Uniformity)		Description
		0-90 mins	90-180mins	
Saloon Areas	Floor level	1 lux (0.5)	1 lux (0.5)	Measured in non shadowed areas along aisle
	750mm above floor	20 lux (0.5)	5 lux (0.5)	Measured in non shadowed areas along aisle
Vestibules and Gangway	750mm above floor	20 lux (0.5)	No Requirement	Measured in non shadowed areas
Vehicle Exterior	Exit Thresholds	40 lux		Only when exterior door is open
	Track Level	40 lux elliptic or circular pattern		Only when exterior door is open
Equipment and Notices	Equipment Cubicles	20 lux		At opening edge of cupboard
	Safety Instructions	Brightness of 0.5 Cd/m ²		Brightness requirement
Passive Systems	Saloon	0.2 lux		

Requirements for emergency lighting on passenger rail vehicles (T314)

Figure 2 illustrates the difference between having poor (left photograph) and good uniformity (right photograph).

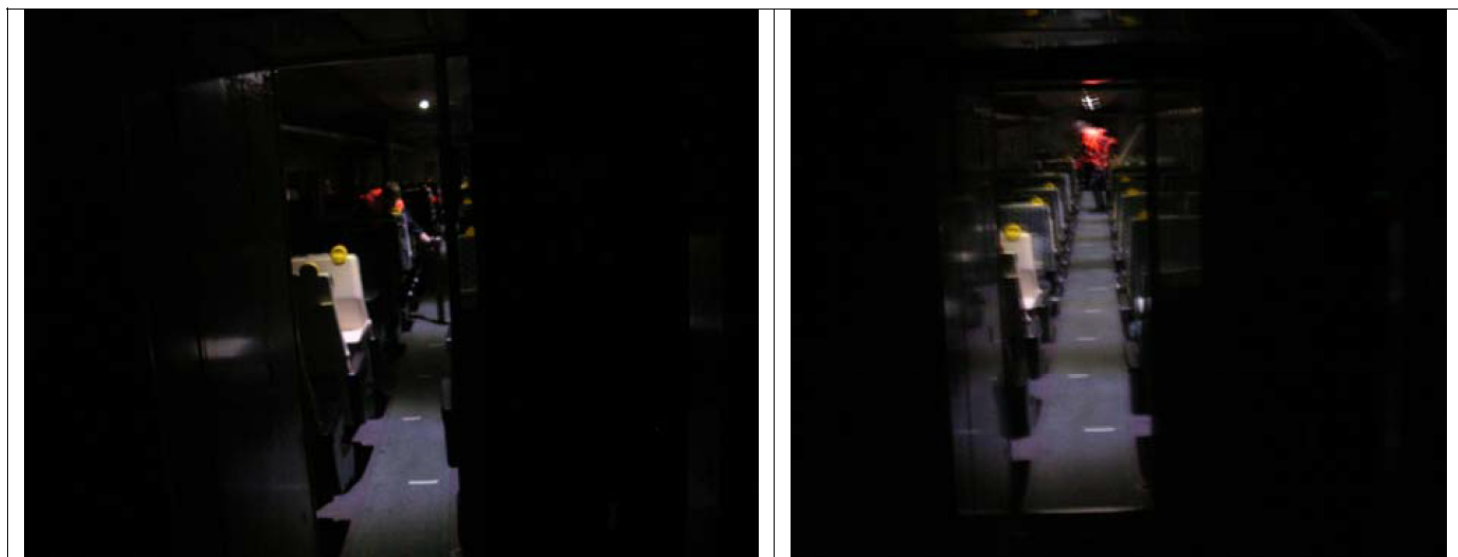


Figure 2 - Photographs Illustrating Uniformity

Requirements for emergency lighting on passenger rail vehicles (T314)

- Passive systems
 - The second vehicle was fitted with photoluminescent material manufactured to DIN67510.
 - The material had been charged for 1 hour under normal (fluorescent) vehicle lighting to represent a real life situation.
 - The photoluminescent material was located
 - Along the luggage rack edge on both sides
 - Along all table edges
 - Along the aisle armrest of alternate seats on both sides
 - Around the sides and top edges of the door frames
 - The illuminance was enough to see to navigate through the vehicle but one could not read or make out fine details. An illuminance of 0.1 lux was recorded on the light meter at table level.
 - The level in the draft specification was not met. However, the system was successful in providing a low level of illuminance to facilitate egress and edge finding.

Requirements for emergency lighting on passenger rail vehicles (T314)

- Participants were brought into the vehicle and all lights were extinguished.
- The photoluminescent material immediately provided an indication of orientation and once the participant's eyes had adjusted, it was possible to see other occupants in the vehicle.
- The level of illuminance measured at a height of 750mm above floor was 0.1-0.2 lux.
- The following comments were made regarding the test:
 - "they are OK as a supplementary illumination but not as an independent source"
 - "the material around the doors was very good to see the exit. Can walk around OK but not as good as active lighting" "it was evenly and uniformly lit throughout the coach. It was easy to define the door and seats"
 - "[I was] really surprised by how good they were at providing a general uniform level of light. The armrests and door aperture were particularly helpful in highlighting a point to aim for and hazards to avoid"
- There was a general consensus that this passive system would not be suitable in most cases as it gave the wrong message to passengers (highlighted exits), which may give rise to inappropriate behaviour.
- In the cases of trains nearing the end of their life it may provide a useful and cost-effective solution, if used correctly.
- The addition of the material in the diffusers reduced the normal lighting levels from 140 lux to around 110 lux. This reduction was not noticeable to the naked eye when comparing vehicles with and without the material applied, however, this should be considered if fitting material around the normal lighting. It should be noted that development in this field has been significant.

APTA STANDARDS DEVELOPMENT PROGRAM

- STANDARD: APTA RT-VIM-S-020-10, Rev 1
- American Public Transportation Association
- Published: June 6, 2010
- First Revision: December 6, 2017
- Links:
 - [https://www.apta.com/wp-content/uploads/Standards Documents/APTA-RT-VIM-S-020-10-Rev-1.pdf](https://www.apta.com/wp-content/uploads/Standards_Documents/APTA-RT-VIM-S-020-10-Rev-1.pdf)
 - [https://www.apta.com/wp-content/uploads/Standards Documents/APTA-PR-E-RP-012-99.pdf](https://www.apta.com/wp-content/uploads/Standards_Documents/APTA-PR-E-RP-012-99.pdf)

Emergency Lighting System Design for Rail Transit Vehicles

TABLE 1
Minimum Emergency Lighting Performance Criteria

Area	Illumination Level, Initial	Illumination Level, After 1.5 hours	Where Measured
Door exits	1.0 fc (10.8 lx)	0.6 fc (6.5 lx)	At location of emergency/manual door control release/instructions
Entrance/exit/vestibule	1.0 fc (10.8 lx)	0.6 fc (6.5 lx)	At doors, at floor, center
Diaphragm area	1.0 fc (10.8 lx)	0.6 fc (6.5 lx)	At floor, center
Stairway (interior)	1.0 fc (10.8 lx)	0.6 fc (6.5 lx)	At floor, center of steps
Passageway	1.0 fc (10.8 lx)	0.6 fc (6.5 lx)	Approximately 25 in. (64 cm) above floor at centerline*
Aisle	1.0 fc (10.8 lx)	0.6 fc (6.5 lx)	Approximately 25 in. (64 cm) above floor at centerline*
Operator Areas	1.0 fc (10.8 lx)	0.6 fc (6.5 lx)	At location of emergency/manual door control release/instructions

* Values for these areas are averages of all the measurements made. No single measurement shall be less than one-tenth of the values in **Table 1** (i.e., 0.1 fc initially, and 0.6 fc after 1.5 hours).

49 CFR § 238.115 - Emergency lighting.

- **Category:** Regulatory Information
- **Collection:** Code of Federal Regulations (annual edition)
- **Contained Within**
 - Title 49 - Transportation
 - Part 238 - PASSENGER EQUIPMENT SAFETY STANDARDS
 - Subpart B - Safety Planning and General Requirements
 - Section 238.115 - Emergency lighting.
 - Subtitle B - Other Regulations Relating to Transportation (Continued)
 - Chapter II - FEDERAL RAILROAD ADMINISTRATION, DEPARTMENT OF TRANSPORTATION
- **Link:** <https://www.govinfo.gov/content/pkg/CFR-2011-title49-vol4/pdf/CFR-2011-title49-vol4-sec238-115.pdf>

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- Link:
 - <https://www.govinfo.gov/app/details/CFR-2011-title49-vol4/CFR-2011-title49-vol4-sec238-115/summary>
 - <https://www.govinfo.gov/content/pkg/CFR-2011-title49-vol4/pdf/CFR-2011-title49-vol4-sec238-115.pdf>

49 CFR § 238.115 - Emergency lighting.

- Emergency lighting shall be provided in each passenger car and shall include the following:
 - A minimum, average illumination level of 10.8 lux at floor level adjacent to each exterior door
 - A minimum, average illumination level of 10.8 lux measured 63.5 cm above floor level along the center of each aisle and passageway
 - A minimum illumination level of 1.08 lux measured 63.5 cm above floor level at any point along the center of each aisle and passageway;
 - A back-up power system capable of:
 - Operating in all equipment orientations within 45 degrees of vertical;
 - Operating after the initial shock of a collision or derailment resulting in the following individually applied accelerations:
 - (A) Longitudinal: 8g; (B) Lateral: 4g; and (C) Vertical: 4g;
 - Operating all emergency lighting for a period of at least 90 minutes without a loss of more than 40% of the minimum illumination levels specified in this paragraph (b).

Comparision vs CEPE ONU 107

		R107				T314				RT-VIM-S-020-10				49 CFR § 238.115			
		Illumination (lux)	Duration (min)	Uniformity min	Uniformity max	Illumination (lux)	Duration (min)	Uniformity max	Uniformity max	Illumination (lux)	Duration (min)	Uniformity max	Uniformity max	Illumination (lux)	Duration (min)	Uniformity max	Uniformity max
Saloon	Floor level	1	30			1	180	0,5	1,5	6,5	90			6,5	90		
	750 mm	10	30	0,15	2	20	90	0,15	2	6,5	90	N/A	N/A	6,5	90	0,1	N/A
		0	0			5	180			6,5	90			6,5	90		
Vehicle exterior	Exit thresholds	0	0			40	180			6,5	90			6,5	90		
	Track Level	0	0			40	180			6,5	90			6,5	90		



From 10.8 at t=0



Questions

M2 or M3 vehicles with regard to their general construction

Should be considered a more independent power supply?

Should it demonstrate strength vs impact?

Should it be useful to require a lighting trajectory to exists?

Should it be useful to require some lighting to emergency exits?

Should it be considered to require lighting for the exit?

M2 or M3 vehicles with regard to operation

Should it be useful to assign priority exits to each seat?



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Thanks

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