Vehicle Fire, Safety and Evacuation

Synopsis
This document mandates requirements for the provision of rail vehicle fire safety and evacuation arrangements. In particular, it addresses matters of rail vehicle design associated with fire safety, diesel propulsion, emergency lighting, emergency and safety equipment, emergency and safety information and emergency evacuation.
### Issue record

<table>
<thead>
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<th>Issue</th>
<th>Date</th>
<th>Comments</th>
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<tr>
<td>One</td>
<td>June 2008</td>
<td>Original document Supersedes GM/RT2120, GM/RT2176, GM/RT2177, GM/RT2300, GM/RT2462, AV/ST9002 and AV/ST9005</td>
</tr>
<tr>
<td>Two</td>
<td>August 2009</td>
<td>Replaces issue one Small scale change amendment – addition of clause 8.2.2.2</td>
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<td>December 2013</td>
<td>Replaces issue three Revised to align with fire categories in the Rolling Stock Technical Specification for Interoperability (RST TSI) and BS EN 45545:2013, to facilitate open wide gangways, remove duplication of testing between GM/RT2130 and BS 6853:1999, revise the requirements for emergency lighting outside of exterior doorways and remove the requirements for emergency lighting to charge luminescent signage.</td>
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Amended or additional parts and / or sections of revised pages have been marked by a vertical black line in the adjacent margin.

### Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

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<tr>
<td>GM/RT2130, Issue Three, December 2010 Vehicle Fire, Safety and Evacuation</td>
<td>All</td>
<td>01 March 2014</td>
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</table>

GM/RT2130 Issue Three ceases to be in force and is withdrawn as of 01 March 2014.

### Supply

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Part 1  Purpose and Introduction

1.1  Purpose
1.1.1  This document mandates requirements for the provision of rail vehicle fire, safety and evacuation arrangements. In particular, it addresses matters of rail vehicle design associated with fire safety, diesel propulsion, emergency lighting, emergency and safety equipment, emergency and safety information and emergency evacuation.

1.2  Introduction
1.2.1  Background
1.2.1.1  The implementation of the Technical Specifications for Interoperability (TSIs) mandated through a series of European Union Directives has resulted in a review of all requirements mandated in Railway Group Standards.

1.2.2  Support to Essential Requirements
1.2.2.1  The EU Directives applicable to Interoperability mandate that each TSI is required to address a number of essential requirements. In supporting specific requirements in Rolling Stock (RST) TSIs, the following essential requirements are addressed.

1.2.2.2  The Directive 2008/57/EC contains within Annex III Essential Requirements the following relevant essential requirements:

2.4. Rolling stock
   2.4.1. Safety
   Emergency exits must be provided and indicated.
   Appropriate provisions must be laid down to take account of the particular safety conditions in very long tunnels.
   An emergency lighting system of sufficient intensity and duration is compulsory on board trains.

2.4.2. Reliability and availability
   The design of the vital equipment, of the running, traction and braking equipment and of the control and command system must be such as to enable the train to continue its mission, in a specific degraded situation, without adverse consequences for the equipment remaining in service.

1.2.3  Supporting documents
1.2.3.1  The following Railway Group documents support this Railway Group Standard:
   a) GM/GN2630 Guidance on Rail Vehicle Fire Safety
   b) GM/RC2531 Recommendations for Rail Vehicle Emergency Lighting
   c) GM/RC2532 Recommendations for Rail Vehicle Emergency and Safety Equipment
   d) GM/RC2533 Recommendations for Rail Vehicle Emergency and Safety Information
   e) GM/RC2534 Recommendations for Rail Vehicle Emergency Evacuation
1.3 Approval and authorisation of this document

1.3.1 The content of this document was approved by Rolling Stock Standards Committee on 28 June 2013.

1.3.2 This document was authorised by RSSB on 31 July 2013.
Part 2  Fire Safety

2.1  General requirements

2.1.1  The objectives of Part 2 of this document are to minimize the probability of a fire starting, to control the rate and extent of fire development and through this, to minimize the impact of the products of fire on passengers and staff. The objectives are considered in the context of the Operation Category and design characteristics of the rail vehicle.

2.1.2  The objectives set out in 2.1.1 of this document, in terms of the vehicle design configuration and the materials used in its construction, are to ensure that:

a) The mechanical strength of the primary vehicle structure is retained to achieve continued operation as required (see 2.3 of this document) and to enable evacuation and escape.

b) The rates of fire propagation, of flame spread, heat release and of smoke and toxic gas emissions are controlled to:

i) Enable people not to be unduly hindered in their escape and evacuation to a place of safety, taking account of the specific operational characteristics of the category of vehicles as described in 2.2 of this document.

ii) Minimise the effects on the railway infrastructure and on railway operations, which could endanger people not on the vehicle.

2.2  Vehicle fire performance categories

2.2.1  All rail vehicles shall be designed, constructed and maintained in accordance with one of the following fire categories:

a) Operation Category 1 (OC1)

Rail vehicles for operation on infrastructure where rail vehicles are able to be stopped with minimum delay, and where a safe area for train evacuation can always be reached immediately.

b) Operation Category 2 (OC2)

Rail vehicles for operation on underground sections, tunnels and / or elevated structures, with side evacuation available and where a safe area is reachable within a short running time.

c) Operation Category 3 (OC3)

Rail vehicles for operation on underground sections, tunnels and / or elevated structures, with side evacuation available and where a safe area is reachable within a long running time.

d) Operation Category 4 (OC4)

Rail vehicles for operation on underground sections, tunnels and / or elevated structures, without side evacuation available and where a safe area is reachable within a short running time.
Note:

The Operation Category required for the vehicles to form a given service should form part of the route compatibility assessment process in accordance with GE/RT8270. The Operation Categories are consistent with BS EN 45545:2013 and the relationship between these categories and applicable TSIs. See Appendix A of this document for guidance on the characteristics of the infrastructure.

2.2.2 In the event of a fire on a rail vehicle, to permit continued operation and facilitate evacuation of the train, in accordance with the requirements of 2.3 of this document, the following running times shall be required (also referred to as the ‘relevant period of the incident’ in BS EN 50553:2012):

a) OC1: A running time is not specified as these vehicles may be stopped with minimum delay and evacuation started.

b) OC2: The running time shall be 4 minutes.

c) OC3: The running time shall be 15 minutes.

d) OC4: The running time shall be 4 minutes.

2.2.3 Material properties shall be determined according to the following classifications and therefore the required performance:

a) Materials for OC1: Vehicles shall meet the requirements for BS 6853:1999 Category 2.

b) Materials for OC2: Vehicles shall meet the requirements for BS 6853:1999 Category 1b.

c) Materials for OC3: Vehicles shall meet the requirements for BS 6853:1999 Category 1b.

d) Materials for OC4: Vehicles shall meet the requirements for BS 6853:1999 Category 1a.

2.2.4 Irrespective of Operation Category, vehicles with berths or seating intended for sleeping passengers or traincrew shall assumed to be OC3 vehicles and meet the requirements for BS 6853:1999 Category 1b.

2.2.5 Rail vehicles in OC4 shall be equipped for evacuation of passengers and traincrew from either end of any train formed of such vehicles.

2.2.6 For vehicles operating on infrastructure subject to EU Directives applicable to Interoperability (see Part 1) the following relationships shall apply:

a) OC2 corresponds to TSI Category A.

b) OC3 corresponds to TSI Category B.

2.2.7 The suitability of vehicles for a given infrastructure shall be in accordance with compatibility matrix set out in Table 1 of this document.
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<table>
<thead>
<tr>
<th>OC1 infrastructure</th>
<th>OC2 infrastructure</th>
<th>OC3 infrastructure</th>
<th>OC4 infrastructure</th>
</tr>
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<tbody>
<tr>
<td>OC1 vehicle</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>OC2 vehicle</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>OC3 vehicle</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>OC4 vehicle</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 1  Vehicle fire safety and evacuation compatibility matrix

2.3 Safeguarding continued operation in the event of fire

2.3.1 Rail vehicles in OC2, OC3 and OC4 shall comply with the requirements of BS EN 50553:2012.

2.3.2 Rail vehicles in OC2, OC3 and OC4 shall comply with the requirements for fire barriers set out in BS 6853:1999 section 7.

2.3.3 Rail vehicles in OC2, OC3 and OC4, where open wide gangways are used and there are no vehicle end fire barriers, shall satisfy the following requirements:

   a) The gangway floor shall be considered to be a continuation of the vehicle floor and, accordingly, shall satisfy the applicable floor fire barrier integrity and insulation requirements specified (see 2.5 and 2.8 of this document and BS 6853:1999 section 7).

   b) The gangway interior floor, sides and ceiling shall be considered to be a continuation of the vehicle interior and, accordingly, shall satisfy the applicable requirements specified for these surfaces (see 2.8 of this document and BS 6853:1999 section 6).

   c) Automatic smoke or fire detection equipment shall be fitted to the vehicles in accordance with the requirements of BS 6853:1999 section 8.

2.3.4 A means of visually assessing whether fire is present shall be incorporated in doors in fire barriers that are part of an escape route (such as bulkhead doors between vestibules and engine compartments). Where a means of visual assessment is provided it shall meet the conformance requirements of the fire barrier.

2.3.5 Doors in fire barriers shall be self-closing. However, the passage of people through such doors shall not be impeded by that feature.

2.4 Reducing the risk of ignition

2.4.1 The design of the vehicle and its equipment (either located inside the vehicle or located outside), including its structures, systems, equipment, components and materials, and their relative positions and proximities to each other, shall be arranged so that as far as reasonably practicable the risks of ignition are minimised.
2.4.2 An assessment of normal operation, foreseeable equipment and component failure modes shall be undertaken to demonstrate that fire risks have been identified and measures adopted to control these risks.

2.4.3 Except where functionality demands otherwise, sources of heat and ignition such as internal combustion engines, electrical equipment, braking systems, cooking equipment, heaters and hot surfaces, shall be separated from flammable fluid systems and lubricating oil systems along with associated tanks, pipework and ancillary equipment by physical distance or suitable barriers.

2.4.4 The measures contained in BS 6853:1999 section 5 relating to design considerations with the aim of protecting passengers and staff in rail vehicles in the event of a fire on board shall apply to all categories of rail vehicle. The objectives are to minimise the risk of a fire starting, to delay fire development and to control the spread of fire products through the rail vehicle.

2.4.5 Any potential leakage or seepage of flammable liquids shall be managed. This shall include consideration of flexible pipes or joints in the lines used for circulation or distribution of pressurised fluids.

2.4.6 Equipment containing flammable liquid, such as fuel and oil tanks, transformers, hydraulic systems, cooling systems using flammable refrigerants and their associated pipework, shall be either:

a) Protected against risk of puncture.

Or

b) Of proven durability for its environment.

2.4.7 Where sparks are inherent to normal vehicle operation, shielding shall be provided to prevent ignition of combustible materials by such sparks. Particular attention shall be given to mechanical sources below the floor of the vehicle. Examples of such mechanical sources include cast iron brake blocks, and rail grinding equipment.

2.5 Reducing the risk of fire development

2.5.1 The measures contained in BS 6853:1999 section 7 for the control of spread of fire and its products, primarily requirements for fire barriers, shall apply to all categories of rail vehicle.

2.6 Fuel systems and storage

2.6.1 The fuel installation shall be so designed and constructed that its components are able to resist internal and external corrosion phenomena to which they are exposed.

2.6.2 Risks from fuel storage on the vehicle are reduced by achieving the following:

a) The fuel tank(s) shall be made of a fire-resistant material.

b) A fire barrier shall be provided to separate the fuel tank(s) from passenger compartments.

c) The fuel tank(s) shall be placed so as to ensure that any fuel leaking from the tank(s), its filler hole or its pipe connections does not come into direct contact with any source of ignition.
d) Fuel tanks shall not be located forward of the leading bogie of a vehicle which could be the leading vehicle in a train formation and shall not be located in crash energy absorption zones.

e) Fuel tanks shall not be located directly adjacent to a bogie, in order to reduce the probability of the vehicle’s bogie prejudicing the integrity of the fuel tank in the event of an accident or derailment. This shall be achieved by either:

i) Installing other equipment to separate the fuel tank from the bogie.

Or

ii) Where locating away from the bogies is not practicable, there shall be a clearance between the bogie and the fuel tank to permit full unconstrained rotation of the bogie prior to it coming free of the centre pivot, in the case of derailment, without impacting the fuel tank.

f) Fuel tanks shall either:

i) Not be located in the vicinity of dc power lines where there is a danger of stray arcs occurring.

Or

ii) Be protected from stray arcs (for example, by a proven arc barrier material).

g) Where externally mounted fuel lines supplying fuel under pressure are vulnerable to impact, they shall be provided with cut-off devices.

2.7 Equipment cubicles and equipment cases

2.7.1 When installed in areas accessible by passengers or traincrew, equipment cubicles and equipment cases containing electrical equipment which do not meet the requirements for minor materials in accordance with 2.8.1 of this document shall satisfy the following requirements:

a) The cubicle or case shall be constructed to achieve a fire resistance performance of 15 minutes when tested in accordance with BS EN 1363-1:1999.

b) The cubicle or equipment case shall be either:

i) Sealed to preclude oxygen from entering to feed a fire inside. It is permissible to use intumescent material to obtain a seal.

Or

ii) Additional measures shall be implemented to prevent fire propagation into the remainder of the vehicle where the ventilation paths through the cabinet could facilitate this. It is permissible to use intumescent material to achieve this objective.

2.7.2 When installed in areas accessible by passengers or traincrew, equipment cubicles and equipment cases containing electrical equipment all of which meet the requirements for minor materials in accordance with 2.8.1 of this document shall be constructed of materials which satisfy the requirements of 2.8.1 of this document.
2.8 Material fire performance categories and selection

2.8.1 The measures contained in BS 6853:1999 section 6 relating to material properties in terms of their reaction to fire, smoke and toxic emissions shall apply to all categories of rail vehicle and for all products used in the construction of vehicles which may be produced from a single material or from several materials (for example laminates, composites, cables, seats) with the exception of driving cabs and equipment operator seats.

2.8.2 It is permissible to exclude the following externally-mounted components from the requirements of this standard:

a) Rubber suspension elements, for example air springs, auxiliary springs and equipment mountings.

b) Hoses and similar components associated with the engine and its auxiliaries that are located within the scope of the engine fire protection system.

2.8.3 There are no specific requirements for fire performance of films attached to the cab windscreen for anti-spall protection of the driver. The risk of such films contributing significantly to a fire in the cab is considered far lower than the risk of the driver being injured by spalling of the windscreen in the event of an impact. The fire risk is also mitigated by the mandatory installation of a fire extinguisher accessible to the driver as set out in 2.9.2 of this document.

2.8.4 Particular attention shall be given to ensuring that the integrity of layered materials can be maintained in situations where the overall performance depends on the use of fire-resistant outer layers to protect non-compliant inner layers.

2.8.5 Layered materials, whether in isolation or forming part of an assembly, shall be tested as single assemblies which reflect the installed condition, including air gaps, as far as reasonably practicable.

2.8.6 Where the requirements set out in 2.8.1 of this document cannot be met in full for a particular product or item of equipment, evidence shall be produced and recorded demonstrating that:

a) Full compliance with 2.8.1 of this document would prejudice other safety-critical operational requirements (for example parts of, or equipment fitted to, seats provided for drivers or equipment operators).

And / or

b) The risk is mitigated by, for example, the provision of fire extinguishing equipment or by other precautions appropriate to the particular installation (for example for driver's or equipment operator's seats by the isolation of equipment when the seat is not used and the protection of the seat from sources of radiant heat).

2.9 Fire protection

2.9.1 The measures contained in BS 6853:1999 section 8 related to fire detection and suppression systems shall apply to all categories of rail vehicle subject to the following requirements.
2.9.2 Portable fire extinguishers, in accordance with the recommendations set out in BS 6853:1999 clause 8.2, shall be provided:
   a) In all driving cabs.
   b) Within, or adjacent to, accommodation provided for staff on passenger trains.
   c) In vehicles with catering equipment (excluding at-seat service catering trolleys).

2.9.3 In passenger carrying vehicles, and other areas where staff have regular access, portable fire extinguishers or fire blankets shall be provided in accordance with the recommendations set out in BS 6853:1999 clause 8.2. In situations where there is a high risk of vandalism, consideration shall be given as to whether the extinguishers should not be available to passengers.

2.9.4 Fire blankets shall be provided in vehicles with catering equipment where overheated food or the use of cooking oil could cause a fire.

2.9.5 The method of operation of the fire protection systems shall be published in operating instructions. The details shall encompass the locations, purpose, method of operation and safety precautions to be observed.

2.10 Emergency stop and isolation devices

2.10.1 Emergency stop devices

2.10.1.1 Emergency stop device(s) shall be provided to enable an engine to be stopped as quickly as possible in an emergency. As a minimum there shall be an emergency stop in each cab and externally, for vehicles equipped with engines, an emergency stop on each side of the vehicle for either each individual engine or a group of engines. If an engine is installed in a compartment accessible by staff there shall be an emergency stop device adjacent to the engine.

2.10.1.2 The device(s) shall be clearly labelled.

2.10.1.3 The positioning of such devices shall take into account:
   a) The use of in cab engine stop devices.
   b) Devices external to the engine compartment (where present).
   c) The accessibility of devices when the vehicle is adjacent to a platform.
2.10.2 Means of isolating electrical supplies and equipment

2.10.2.1 In case of fire, means shall be provided for traincrew to:

   a) Isolate all electrical supplies to a train, from either inside or outside the train.

      And

   b) Isolate equipment with large current-carrying capacities from inside the train.

2.11 Retaining and upgrading fire performance during modifications

2.11.1 Modifications

2.11.1.1 When engineering change occurs, subject to the requirements of 2.11.2 of this document, then:

   a) The areas subject to change shall meet the requirements of the applicable parts of this document.

      Or

   b) The net effect of the changes shall be such that the performance of the vehicle is not degraded in terms of fire initiation and development.

      Or

   c) Where the level of amenity in the vehicle is being increased by the addition of more seats, tables, luggage racks, etc the fire performance of the newly introduced items shall be at least that of the existing items in the vehicle.

2.11.2 Components

2.11.2.1 Any parts of a vehicle replaced on a fleet basis within the scope of this document shall meet the fire performance and testing requirements of this document for the vehicle category applicable.
Part 3  

Engine Exhaust

3.1 Engine exhaust

3.1.1 Excepting where engines only operate within a possession, the location and direction of the engine exhaust exiting from the vehicle shall be in accordance with Figure 1.

Figure 1  Direction of engine exhaust

Railway Group Standard  
GM/RT2130  
Issue  Four  
Date  December 2013
Part 4  Requirements for Emergency Lighting

4.1 General requirements for emergency lighting

4.1.1 Emergency lighting shall be provided to operate in the event of the loss of general or standby lighting, and is in addition to the provision of general lighting and standby lighting. Guidance on the provision of general lighting and standby lighting is set out in BS EN 13272:2012.

4.1.2 The emergency lighting system shall be independent of the main vehicle battery to avoid loss of emergency lighting as a result of loss of the main vehicle power supply. The charge of the emergency lighting system shall be maintained by means of the vehicle’s main power supply system during normal operation.

4.1.3 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.

4.1.4 All units providing the interior emergency lighting shall produce a white light. It is permissible to use alternative colours for the exit threshold and for the vehicle exterior but red or green shall not be used in such cases.

4.1.5 When fully discharged the emergency lighting system shall be capable of being sufficiently charged, by the vehicle’s main electrical supply, after 100 minutes to achieve the minimum specified levels at full lighting output for a period of 90 minutes when the vehicle main power supply is removed.

4.1.6 When fully discharged the emergency lighting system shall be capable of being sufficiently charged, by the vehicle’s main electrical supply, within four hours to enable it to comply with the requirements of 4.2 to 4.5 of this document when the vehicle main power supply is removed.

4.1.7 The uniformity of illuminance of the lighting shall be assessed in accordance with the following measures:

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

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

4.1.8 The emergency lighting system for new vehicles shall meet the performance criteria described within this section. Where emergency lighting is installed during vehicle refurbishment the system shall comply with the principles outlined in this section as far as reasonably practicable. Code of Practice GM/RC2531 provides recommendations regarding appropriate levels of performance for retrospective installation including improvement of vehicles reaching the end of their service life.

4.1.9 The emergency lighting system, including the energy source and all associated equipment required for continued operation, shall continue to function after being subjected to two successive shock pulses in accordance with the pulse defined in GM/RT2100 Appendix E Dynamic Test Procedures when mounted in a manner representative of its installation in the vehicle.
4.2 Emergency lighting in passenger saloons

4.2.1 The emergency lighting system shall provide a minimum illuminance of 15 lux directly under each light unit in the saloon at a height of 750 mm above the floor for at least 180 minutes, except as set out in 4.2.7 of this document.

4.2.2 The uniformity over the length of the vehicle saloon at a height of 750 mm above the floor shall be between 0.15 and 2.

4.2.3 The emergency lighting system shall provide a minimum illuminance of 1 lux at floor level in the aisle of the saloon.

4.2.4 The uniformity at floor level over the length of the vehicle saloon shall not exceed 1.5.

4.2.5 The emergency lighting system shall provide a minimum illuminance of 1 lux over the top surface of each permanent bay table for at least 180 minutes.

4.2.6 Conformance with the uniformity requirements shall be demonstrated by measurements taken at intervals not exceeding 1 m.

4.2.7 Where there is a need to conserve battery life, after 90 minutes’ operation it is permissible to reduce the emergency lighting at a height of 750 mm above floor level to 5 lux directly under each light. This shall be maintained until at least 180 minutes after the original initiation of the emergency lighting.

4.3 Emergency lighting at egress points

4.3.1 An emergency light shall be provided directly above each bodyside door in the vestibule which shall provide a minimum illuminance at a height of 750 mm above the floor of 15 lux directly under each light, and a minimum illuminance at floor level of 0.2 lux, for at least 180 minutes after the train power supply has been lost. In the case of vehicles having end vestibules accessible from the saloon via intermediate doors, an emergency light in the vestibule shall not be located directly in line with the intermediate door (see Figure 2 of this document).
4.3.2 Door operating handles, door locking emergency overrides and their associated signage, required for use in an emergency, shall be included within the field of the illumination referred to in 4.3.1 of this document.

4.3.3 An emergency light shall be provided, in addition to the lighting referred to in 4.3.1 of this document, to give a minimum illuminance of 40 lux at each threshold when the exterior bodyside door is opened.

4.3.4 For the purposes of evacuation in darkness when not at a platform, when the exterior bodyside door is opened the adjacent trackside shall be illuminated. The illuminated area shall be aligned with the bodyside door opening and equivalent to a zone at rail height of at least the length of the bodyside door opening and extending laterally at least 500 mm from the vehicle threshold. Within this zone an average lighting level of a minimum of 40 lux shall be achieved at rail level.

4.3.5 The duration of the illumination referred to in 4.3.3 and 4.3.4 of this document shall, when the door is opened, be sufficient to permit all passengers of the vehicle in question to be evacuated to go to a place of safety, taking account of the specific operational characteristics of the category of vehicle as described in 2.2 of this document.

4.4 Emergency lighting in escape routes

4.4.1 In escape routes other than the saloon and vestibules referred to in 4.2 and 4.3 of this document, the emergency lighting system shall provide a minimum illuminance at a height of 750 mm above the floor and at floor level in accordance with the levels and uniformities defined in section 4.2 of this document for at least 180 minutes after the train power supply has been lost.

4.5 Emergency lighting adjacent to emergency equipment

4.5.1 The emergency lighting system shall illuminate emergency equipment locations for a period of 180 minutes from initiation of the emergency lighting. The minimum level of illuminance shall be no less than the average saloon lighting level achieved by the emergency lighting system at a height of 750 mm above the floor.
Part 5 Requirements for Emergency and Safety Equipment

5.1 General requirements

5.1.1 The following items of equipment (except the equipment in 5.1.1 d) of this document shall be provided on trains for use by traincrew only and shall not be available to passengers:

a) In each operative driving cab:
   i) At least ten detonators.
   ii) Two sets of track circuit operating clips (except that only one set of such clips is required in the cab on multiple unit type trains operated with a guard, where an additional two sets are located in the guard’s accommodation).
   iii) Two red flags with sticks (one in each cab on a multiple unit train).
   iv) Requirements for portable fire extinguishers are set out in 2.9.2 of this document.

b) Readily available to the driver (preferably in the driving cab):
   i) One brake stick on locomotive hauled trains comprising vehicles fitted with manually operated ‘lever’ type hand brakes such as those installed on freight vehicles.
   ii) One spare portable tail lamp on locomotive hauled driver-only trains.
   iii) Four wheel scotches in trains where electric parking brakes are provided.

c) Available to the guard, within, or adjacent to, accommodation provided for a guard on passenger trains:
   i) Two sets of track circuit operating clips.
   ii) Requirements for portable fire extinguishers are set out in 2.9.2 of this document.
   iii) Six wheel scotches on air braked locomotive hauled trains.

d) Available to members of the traincrew for use in passenger and other crew areas, (this item may be made accessible for passengers’ use as well as that of traincrew if desired):
   i) One ladder or step ladder made from non-conducting material.

5.2 Services operating on dc electrified lines

5.2.1 Where trains operate over Network Rail managed third or fourth rail dc electrified lines, the railway undertaking shall determine the need to carry any of the equipment set out in 5.2.3 of this document, based on perceived risk.
5.2.2 Account shall be taken of factors such as:

a) Frequency of operation over electrified lines.

b) Duration of operation over electrified lines.

c) Availability of such equipment from other sources.

d) Whether detraining of passengers may be necessary.

e) Availability of radio communications.

This list is not exhaustive.

5.2.3 Additional equipment, preferably in the operative driving cab, shall be easily and quickly accessible to the traincrew:

a) One conductor rail short-circuiting bar.

b) One conductor rail hook switch pole.

c) Shoe fuse key (where applicable).

d) Shoe paddles - the quantity of shoe paddles carried shall be the greater of:

i) One paddle for each track short-circuiting bar carried.

ii) For vehicles with non-retractable shoe gear, the number of paddles shall equal the number of current collector shoes plus one.

iii) For vehicles with retractable shoe gear, a minimum of two paddles.

e) One roll of insulating tape.

f) 8 m of stout cord.

5.3 Specific rail applications

5.3.1 Additional equipment may be required for specific rail applications, for example, for operation through tunnels. The railway undertaking shall determine the requirements for such additional equipment in co-operation with Network Rail.

5.4 Examination and testing

5.4.1 Emergency equipment shall be fit for purpose when required to be used.
Part 6  Requirements for Emergency and Safety Information

6.1 Provision of information

6.1.1 Emergency and safety information shall be provided to mitigate against the risks to people from the train and from the train operating in its particular environment.

6.2 General signage requirements

6.2.1 Emergency and safety signs shall be provided on rail vehicles to identify to persons conveyed by or working on rail vehicles, and to persons attending emergencies:

a) The location, access and operation of equipment or facilities provided for use in an emergency.

b) Actions that are prohibited for reasons of safety.

c) Objects, actions, hazards and situations which affect or could affect safety.

d) Instructions that are mandatory for the purposes of safety.

6.2.2 Provision of emergency and safety signs on rail vehicles shall be to a recognised railway standard set to give consistency across the railway and which takes account of the requirements in the Health and Safety (Safety Signs and Signals) Regulations 1996, supported by BS 5378 and BS 5499.

6.2.3 The railway undertaking shall:

a) Ensure that new or additional signs that are provided where other equipment or arrangements exist meet the requirements in the Regulations and in this document.

b) Approve both the provision and specification of these new or additional emergency and safety signs on a vehicle type basis.

6.3 Information for passengers

6.3.1 General requirements

6.3.1.1 Emergency and safety information shall be provided for passengers on trains to enable them to act in a foreseeable and pre-determined way.

6.3.2 Process of delivery

6.3.2.1 Train emergency and safety procedures shall be communicated to passengers in a readily comprehensible manner.

6.3.3 Information content

6.3.3.1 Before an information system is designed, an analysis shall be undertaken of what the passenger needs to know and how this information is to be provided.

6.3.4 User variability

6.3.4.1 The railway undertaking shall take account of likely passenger limitations, behaviours and expectations to anticipate realistically how information will be acted upon. The role of the information is to explain the situation and potential risks to enable the passengers to decide the appropriate action they should take.
6.3.5 **Determine contextual constraints**

6.3.5.1 The contextual constraints appropriate to the vehicle operation shall be determined and taken into account.

6.3.6 **Media options and combinations**

6.3.6.1 The railway undertaking shall consider the most appropriate media for transmitting train emergency and safety information.

6.3.7 **Equipment signage**

6.3.7.1 On train safety signs shall be displayed where equipment is provided for passenger use. The signs shall provide clear information and instruction on the use of the equipment.

6.4 **Positioning**

6.4.1 Emergency and safety signs shall be positioned so as to be easily read and the information easily understood in relation to any necessary action.

6.4.2 The positioning of emergency and safety signs shall have priority over all other signs.

6.4.3 The number of signs used shall be kept to a minimum. This may be achieved by combining signs that are located in close proximity.

6.4.4 Where photo-luminescent signage is used a minimum illumination of 50 lux shall be provided by the normal lighting in the area to ensure the signs are charged to cater for emergency conditions that may arise.

6.5 **Materials**

6.5.1 Materials for signs shall be chosen to reduce the likelihood of damage in the environment in which the sign is located and to facilitate cleaning.

6.5.2 Signs provided for passenger emergency equipment, egress facilities and routes shall use photo-luminescent materials and shall not rely solely on the availability of emergency electric supplies.

6.6 **Review and evaluation**

6.6.1 Safety and emergency signs shall be subjected to a recognised validation process of review and evaluation designed to demonstrate a high probability of comprehension on the part of the travelling public. A suitable validation process is described in GM/RC2533.
Part 7 Requirements for Evacuation

7.1 Vehicle design for evacuation and escape

7.1.1 Vehicles shall be designed to ensure that evacuation and escape to platforms or track level can be performed safely under reasonably foreseeable emergency conditions and risks posed by the operation of the vehicles on the particular infrastructure over which it is to operate, such as reduced clearances and the need for end egress.

7.1.2 A formal risk assessment shall be undertaken to identify those foreseeable risks, including misuse of equipment provided.

7.1.3 Passengers shall be able to open internal doors in rail vehicles, regardless of the state of the power supplies to the door or the door controls.

7.1.4 To assist people to escape from partially or wholly overturned vehicles, internal doors shall slide open in opposing directions or be hinged from opposite sides at each end of the passenger saloon. Alternatively, a means of escape through the doors may be provided within the door opening which allows through egress in the event of the door becoming jammed.

7.1.5 Doorways and throughways used for passenger evacuation and escape shall be designed to facilitate safe egress by 99th percentile fully clothed British male in accordance with current published anthropometrical data.

7.1.6 Each new design of rail vehicle, or vehicle in which the interior configuration or passenger carrying capacity has been altered or egress facilities have changed, shall undergo validation of the design by either structured evacuation trials, or by direct comparison with other vehicles which have been validated by such tests. Vehicles whose design has not been validated, fail validation, or cannot be directly compared to a vehicle that has been successfully validated, shall not be used in passenger service. Where egress facilities are enhanced in an accepted vehicle, full scale validation of the enhancement is not required.

7.1.7 Designs for refurbishment or modifications to the layout of a vehicle in which the ability of people to egress, evacuate or escape has not been changed or adversely affected do not require re-validation.

7.1.8 Where a vehicle design is to be validated by structured trials, then the design shall be considered to be validated when appropriate evacuation trials are successfully conducted. The criteria for successful completion of the trials are as follows:

a) For side evacuation, under conditions of ‘team effort’ and with maximum passenger loading conditions, all passengers shall be evacuated to platform level in a period not exceeding 90 seconds. In this case, the considerations are identified in 7.2 of this document.

b) For end evacuation, where evacuation to track level through the end door is required, a minimum flow rate of 30 passengers per minute shall be achieved once the end door has been opened. The time taken for the end door to be opened and the evacuation device to be deployed shall be measured and the risk associated with that time shall be reviewed. In this case the considerations are identified in 7.3 of this document.
c) For vehicle to vehicle evacuation, under conditions of ‘team effort’ and with maximum passenger loading conditions in the vehicle under test, all passengers shall be evacuated to adjacent vehicles in a period not exceeding 90 seconds. Where the vehicle under test is the end of a train formation, then a minimum passenger flow rate to the adjacent vehicle of 40 passengers per minute shall be achieved. In this case there are no specific additional considerations.

7.1.9 The flow rates set out in 7.1.8 b) and c) of this document shall be the evacuation rate averaged over the evacuation period. In the case of 7.1.8 b) of this document, it is to be measured once the door has been opened and in the case of 7.1.9 c) of this document, it is met in the case where initially there are no people in the adjacent vehicle or vehicles.

7.2 Side evacuation

7.2.1 No passenger seat in a passenger saloon or location at which a passenger may reasonably be expected to be in a side corridor shall be further than 12 m from a bodyside door or a bodyside emergency escape exit on both sides of the vehicle. In the case of dead ends the maximum distance shall be reduced to 6 m.

7.2.2 Where access to a bodyside door is not directly via an open, unhindered route, additional bodyside emergency escape exits or means to guarantee access via the designated route shall be provided.

7.2.3 Where the risk of not being able to gain access through the passenger evacuation route, or the risk of not being able to open an external bodyside door is considered to be high, and no other means of direct access is available, then additional bodyside emergency escape exits shall be provided.

7.2.4 Passenger and staff accommodation with a plan view of greater than 4 m² shall have at least two separate exits, either directly through a bodyside door or bodyside escape exit or a way leading to such a door or exit on both sides of the vehicle.

7.2.5 Power operated bodyside doors and manually operated slam doors fitted with a secondary locking system shall have emergency door release facilities adjacent to each door.

7.3 End evacuation

7.3.1 Where it has been deemed necessary that passenger vehicles require train end egress facilities (see 7.1.1 of this document), the following additional requirements shall be met.

7.3.2 Train end evacuation and detrainment devices shall be considered as applying to both ends of a train formation. An evacuation route shall be preserved to enable passengers to move freely from one end of the train formation to the other. In an emergency, the locks on normally locked internal doors shall be capable of being overridden by passengers without the use of keys or tools, but with adequate deterrence from unauthorised use under normal conditions.

7.3.3 The provision of such facilities and devices permitting evacuation and escape shall reduce as far as reasonably practicable any risk, including the risk of interference with the driver or vehicle controls, as a result of unauthorised access using override facilities.
7.3.4 External train end evacuation doors shall provide a safe throughway to either the track or to an adjacent vehicle when formed as an intermediate vehicle. An override device shall be provided to allow passengers to unlock the end door from the inside, and from the outside when formed as an intermediate vehicle, in an emergency without the use of tools or keys. The override device shall be provided with adequate deterrence from unauthorised use under normal conditions.

7.3.5 A means shall be provided within, or in the immediate vicinity of, the train end evacuation door for passengers to alight from the vehicle to track level. Such a detrainment device shall be simple and safe for passengers to apply and operate.
Part 8 Application of this document

8.1 Scope

8.1.1 The requirements of this document apply to all new and existing rolling stock.

8.1.2 The requirements of this document apply to all work that affects fire, safety and evacuation on vehicles, whether new or altered.

8.1.3 When vehicles are undergoing major modification in a related subject area, then the requirements of this document are applicable.

8.1.4 Action to bring existing rolling stock into compliance with the requirements of this document is not required.

8.2 Exclusions from scope

8.2.1 The requirements in the document are not applicable to the following types of vehicles:

a) On-track machines within the scope of GM/RT2400.

b) General Contract of Use (GCU) wagons.

8.3 General compliance date

8.3.1 This Railway Group Standard comes into force and is to be complied with from 01 March 2014, except as specified in 8.4 of this document. Where the dates specified in 8.4 of this document are later than the above date, this is to allow sufficient time to achieve compliance with the specified exceptions.

8.3.2 After the compliance date, or the date by which compliance is achieved if earlier, compliance with the requirements set out in this Railway Group Standard is to be maintained. Where it is considered not reasonably practicable to comply with the requirements, permission to comply with a specified alternative should be sought in accordance with the Railway Group Standards Code.

8.4 Exceptions to general compliance date

8.4.1 There are no exceptions to the general compliance date specified in 8.3 of this document.

8.4.2 The vehicle design requirements mandated in this document are to be complied with by 01 March 2014.

8.5 Health and safety responsibilities

8.5.1 Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.
Appendix A  Guidance on the designation of Operation Categories

The content of this appendix is not mandatory and is provided for guidance only.

This appendix provides guidance on the ideal characteristics of the infrastructure for the operation categories set out in European standards. A compatible operation category of vehicle for the purposes of compatibility is normally to be assumed. The categorisation of the infrastructure, in particular existing infrastructure, is outside the scope of this document.

A.1  Operation Category 1 (OC1)
A.1.1 Applicable to vehicles which operate on infrastructure where:

a) They form part of a train that is within the range of permitted train lengths for that infrastructure.

b) Side evacuation is normally available and there are no tunnels or elevated structures longer than the minimum permitted train length where side evacuation is not possible.

c) In the event of activation of a fire alarm, braking can be initiated immediately and evacuation to a safe area can take place as soon as the train has stopped.

d) There are only tunnels or elevated sections of no greater than 1 km in length.

e) Open sections between tunnels and / or elevated structures are longer than the maximum permitted train length.

A.2  Operation Category 2 (OC2)
A.2.1 Applicable to vehicles which operate on infrastructure where:

a) Side evacuation is available.

b) There are only tunnels and / or elevated sections of no greater than 5 km in length.

A.3  Operation Category 3 (OC3)
A.3.1 Applicable to vehicles which operate on infrastructure where:

a) Side evacuation is available.

b) There are tunnels and / or elevated sections greater than 5 km in length.

A.4  Operation Category 4 (OC4)
A.4.1 Applicable to vehicles which operate on infrastructure where:

a) Evacuation from either end or both ends of the train is available but side evacuation is not available.

b) There are only tunnels and / or elevated sections of no greater than 5 km in length.
Definitions

Brake stick
A device used to assist in applying hand brakes on certain freight vehicles.

Conductor rail short-circuiting bar
A device used to cut off the supply to the electrified conductor rail in an emergency and to prevent its re-energisation until the device is removed.

Detonator
A device placed on a running rail which explodes when impacted by a vehicle wheel causing an audible warning to the driver and to persons on or near the track in the vicinity of the train.

Egress
The normal actions of passengers and crew as they get off rail vehicles in normal conditions.

Electrical equipment
Equipment used, intended to be used or installed for use, to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy.

Emergency lighting
Lighting that is independent of the vehicle’s main power supply and is designed to operate in an emergency when the vehicle’s power supply has been disabled.

Emergency signs
Signs provided on trains indicating what to do in the event of a fire, accident or other emergency.

Engineering change
Any alteration or modification to the design of a rail vehicle that affects its ability to comply with the requirements of this document.

Escape (1)
The actions of passengers and crew as they seek to get off rail vehicles in abnormal conditions and when normal egress routes and facilities are unavailable, or are blocked as a result of the vehicle condition. Passengers may have to use the emergency equipment provided in the process of escape.

Escape route
A route which provides a means of escape from a point in a vehicle to a final exit from the train.

Evacuation (1)
The act of emptying rail vehicles of passengers and crew using normal egress routes or facilities as a reaction to abnormal conditions.

Fire performance
The measured or assessed behaviour of the constituent combustible materials and component parts of a vehicle, or of the vehicle as a whole, when subjected to prescribed fire tests.
Vehicle Fire, Safety and Evacuation

Fire protection system
A system incorporating any or all of the following:

a) Automatic fire detection.

b) Automatic fire alarm.

c) Fire extinguishment by means of portable extinguishers or of a fixed system which can be either manually or automatically activated.

d) Fire containment by which the spread of fire is limited by barriers.

General lighting
The lighting provided within a vehicle interior when the vehicle is in its normal operating condition.

Hook switch pole
An insulated device used to open or close conductor rail isolating ‘hook’ switches.

Illuminance
The ratio of the light power received by a surface to the area of the illuminated surface.

Units: lux (lx) and 1 lux = 1 lumen / m²

Interior
A location which is within the bodyshell, except as specified in Appendix A for gangways.

Material
A single substance or a combination of substances with differing constructions and compositions which is classified as an unspecified material, a minor material or a surface.

Minor material (exterior)
An item, (or group of items), which has a mass equal to or in excess of 400 g but not greater than 2000 g and is not itself a surface.

Minor material (interior)
An item, (or group of items), which has a mass equal to or in excess of 100 g but not greater than 500 g and is not itself a surface.

On-track machine
Any rail-mounted machine meeting the requirements of GM/RT2400 and permitted by GE/RT8000 to be moved, either self-propelled or in train formation, outside a possession.

Operative driving cab
The driving cab from which the train is being driven, including any vestibule or other area immediately accessible from the driving cab to which only staff have access when the cab is in use.

Photo-luminescent material
A material that absorbs light in the presence of a light source and emits that energy over a period of time after the light source has been removed.

Place of safety
A location that is free from danger and from which it is possible to move freely without threat from a fire.
Rail vehicles
Any vehicle described as traction and rolling stock (for example locomotives, coaching stock, multiple units or wagons) and on-track machines.

Safety signs
Signs provided on trains to give safety information.

Safe area
A temporary survivable space, for passengers and staff to find refuge after they have evacuated from a train.

Shoe paddle
An insulated device used to raise conductor rail current collector shoes and support them clear of the conductor rail thus electrically isolating the train from the conductor rail.

Standby lighting
A reduced level of lighting to which the vehicle’s main lighting system is switched in order to preserve battery life for key safety systems when battery charging has ceased.

Surface
Any continuous surface in any orientation (HS, V or HP) with an area greater than 0.2 m$^2$. In assessing whether 0.2 m$^2$ is exceeded, the maximum linear dimension considered shall be 1 m unless the surface consists of an unspecified material.

Traincrew
Staff and personnel such as drivers, guards and conductors employed on board a train who have responsibilities for its safe operation on Network Rail managed infrastructure, as defined in the Rule Book GE/RT8000.

Track circuit operating clip
A device used to cause a track circuit to operate when connected between both rails of a running line.

Uniformity of illuminance
The ratio of the minimum illuminance to the average illuminance.

Unspecified material
A material which has a mass less than that of a minor material (exterior or interior) and is not itself a surface and is separated from another unspecified material by a minimum distance of 0.5 m as measured on an HP and / or a V surface or 0.2 m as measured on an HS surface.

Wheel scotch
A device that prevents train movement in one direction when inserted between the running rail and wheel.

Notes:
(1) Definitions differ from those in HSE publication INDG358 ‘Guidance on the provision of equipment and arrangements for evacuation and escape from trains in an emergency’. Definitions in this document relate to whether the route of exit is a normal or an abnormal route, whereas those in the HSE publication relate to whether the exit is supervised or unsupervised.
Vehicle Fire, Safety and Evacuation

References

The Catalogue of Railway Group Standards gives the current issue number and status of documents published by RSSB. This information is also available from www.rgsonline.co.uk.

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