Vehicle Fire Safety

Synopsis

This document sets out National Technical Rules for the design of rail vehicles for fire safety.
### Issue record

<table>
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<tr>
<th>Issue</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>June 2008</td>
<td>Original document. Supersedes GMRT2120, GMRT2176, GMRT2177, GMRT2300, GMRT2463, AVST9002 and AVST9005</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>
</tr>
<tr>
<td>Three</td>
<td>December 2010</td>
<td>Replaces issue two. Small scale change amendment - withdrawal of 6.5.3, and revision of clauses 6.5.2 and 8.2.2.1.</td>
</tr>
<tr>
<td>Four</td>
<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>
</tr>
<tr>
<td>Five</td>
<td>June 2020 [proposed]</td>
<td>Replaces issue four. References to withdrawn standard BS 6853 removed. Non-NTR content moved to RIS-2730-RST.</td>
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</table>

Revisions have not been marked by a vertical black line in this issue because the document has been revised throughout.

### Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

**Note**: The listed documents are superseded by the combination of GMRT2130 issue five and RIS-2730-RST issue one.
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<tr>
<td>GMRT2130 issue four Vehicle Fire, Safety and Evacuation</td>
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<td>GMGN2630 issue one Guidance on Rail Vehicle Fire Safety</td>
<td>All</td>
<td>June 2020 [proposed]</td>
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<td>GMRC2531 issue one Recommendations for Rail Vehicle</td>
<td>All</td>
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<td>GMRC2533 issue one Recommendations for Communication</td>
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**Supply**

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Part 1  Purpose and Introduction

1.1  Purpose

1.1.1  This document sets out national technical rules (NTRs) applicable to passenger rolling stock and locomotives intended for use on the mainline railway in Great Britain (GB), to:

a) minimise the probability of a fire starting;
b) control the rate and extent of fire development; and hence
   c) minimise the impact of fire on passengers and staff.

1.1.2  The requirements in this document are for new vehicles and those undergoing renewal or upgrade as defined in clause 7.1.2 of the Locomotives and Passenger Rolling Stock (LOC & PAS) Technical Specification for Interoperability (TSI).

1.1.3  This document is intended to be read in conjunction with RIS-2730-RST and has been updated to reflect the withdrawal of BS 6853.

1.1.4  The objectives, considered in the context of the Operation Category and design characteristics of the rail vehicle, are to minimise the risks associated with a fire:

a) starting in a vehicle;
b) breaking out of a vehicle and affecting the railway infrastructure and operations, which could also affect people not on the vehicle;
c) affecting the required continued operation of the vehicle (mechanical strength and critical systems), which may prevent the vehicle from stopping in a suitable place for evacuation and escape;
d) hindering people in escape and evacuation by propagation, spread of flame, heat release, smoke and toxic gas emissions.

1.2  Introduction

1.2.1  Background

1.2.1.1  Requirements for fire safety on rail vehicles are contained within the locomotives and passenger rolling stock (LOC & PAS) technical specification for interoperability (TSI). Further requirements for operation in tunnels are contained within clause 4.2.3.1 of the safety in rail tunnels (SRT) TSI.

1.2.1.2  This document sets out national technical rules, reflecting updates to the LOC & PAS TSI and associated European Standards (ENs).

1.2.1.3  Requirements for rolling stock are contained within the BS EN 45545 series of standards, BS EN 16989:2018 and BS EN 17084:2018.

1.2.1.4  Due to a GB concern over the seat tests in BS EN 45545-2:2013, the continued use of BS 6853 as a national rule for this purpose was only permitted for a transition period. This transition period has now ended; BS EN 16989:2018 addresses this concern, when used with the acceptance criteria specified in prEN 45545:2018.
1.2.2 Principles

1.2.2.1 The requirements of this document are based on the following principles.

1.2.2.2 This document sets out requirements that meet the criteria of National Technical Rules (NTRs) and are applicable to the Great Britain (GB) mainline railway system. Compliance with NTRs is required under the Railways Interoperability Regulations 2011 (as amended).

1.2.2.3 The requirements in this document are used for the following purposes:
   a) To fill identified open points in Technical Specifications for Interoperability (TSIs).
   b) To enable technical compatibility between vehicles that conform to the requirements of the TSIs, and the existing infrastructure subsystem.

1.2.3 Structure of this document

1.2.3.1 Where relevant, the national rules relating to relevant TSI parameters have been identified together with the relevant clause from the TSI.

1.2.3.2 This document sets out a series of requirements that are sequentially numbered. This document also sets out the rationale for the requirement, explaining why the requirement is needed and its purpose and, where relevant, guidance to support the requirement. The rationale and the guidance are prefixed by the letter ‘G’.

1.2.3.3 Some subjects do not have specific requirements but the subject is addressed through guidance only and, where this is the case, it is distinguished under a heading of ‘Guidance’ and is prefixed by the letter ‘G’.

1.2.4 Related requirements in other documents

1.2.4.1 The following documents contain requirements that are related to the scope of this document:
   a) BS EN 16989:2018 Railway applications. Fire protection on railway vehicles. Fire behaviour test for a complete seat. This document sets out a procedure for fire testing of passenger seats;
   b) BS EN 17084:2018 Railway applications. Fire protection on railway vehicles.
   c) BS EN 45545 series: Railway applications. Fire protection on railway vehicles:
      i) BS EN 45545-1:2013 General;
      ii) BS EN 45545-2:2013+A1:2015 Requirements for fire behaviour of materials and components;
      iii) BS EN 45545-3:2015 Fire resistance requirements for fire barriers;
      iv) BS EN 45545-4:2013 Fire safety requirements for rolling stock design;
      v) BS EN 45545-6:2013 Fire control and management systems;

1.2.5 Supporting documents

1.2.5.1 Rail Industry Standard RIS-2730-RST is harmonised with requirements in this Railway Group Standard.
1.3 Approval and authorisation of this document

1.3.1 The content of this document will be approved by Rolling Stock Standards Committee on 3 April 2020 [proposed].

1.3.2 This document will be authorised by RSSB on 24 April 2020 [proposed].
Part 2  Design requirements for rail vehicle fire safety

2.1  Vehicle fire performance and infrastructure compatibility

2.1.1  The compatibility of vehicles with a given infrastructure shall be in accordance with the matrix set out in Table 1, where the vehicle Operation Categories (OC) are as defined in clause 5.2 of BS EN 45545-1:2013.

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>OC1</th>
<th>OC2</th>
<th>OC3</th>
<th>OC4</th>
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<tbody>
<tr>
<td>Vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC1</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>OC2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>OC3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>OC4</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 1: Vehicle fire safety and evacuation compatibility matrix

2.1.2  Rail vehicles in OC4 shall be equipped for evacuation of passengers and traincrew from both the front and rear end of any train formed of such vehicles, in accordance with clause 4.3.2.3 of BS EN 45545-4:2013.

Rationale

G 2.1.3  These requirements are national technical rules for compatibility with the legacy GB infrastructure, supporting clause 4.2.10.5.1 of the LOC & PAS TSI. Complying with these requirements controls the hazards associated with evacuation from trains in long tunnels. For the Operation Category selected for the infrastructure, the table gives the range of acceptable Operation Categories for a vehicle.

G 2.1.4  The requirement for vehicle end evacuation in 2.1.2 reflects GB practice for vehicles operating in existing tunnels with limited or no side access.

Guidance

G 2.1.5  The Operation Category required for the vehicles to form a given service will form part of the route compatibility assessment process in RIS-8270-RST. See Note 2 under clause 5.2.1 of BS EN 45545-1:2013.

G 2.1.6  There is no formal allocation of Operation Categories for the infrastructure. The characteristics of the route to be operated will be considered as part of the compatibility assessment process, in terms of the definitions given in this standard. Guidance on the categorisation of infrastructure is set out in Annex B of BS EN 45545-1:2013.

G 2.1.7  Commission Implementing Regulation (EU) 2019/777 on the common specification for the register of railway infrastructure requires infrastructure managers to maintain a register of infrastructure.
G 2.1.8 Clause 4.2.3 of the SRT TSI defines four categories for rolling stock:

a) Category A is the minimum standard required for passenger vehicles operating on the rail network in scope of the Railway Interoperability Directive 2008/57/EC;

b) Category B is specified for operation of passenger vehicles in tunnels greater than 5 km in length;

c) Freight and passenger locomotives; and

d) Self-powered on track machines.

G 2.1.9 Clause 7.2.4 (b) of the SRT TSI states that new rolling stock of category A is permitted to operate in existing tunnels longer than 5 km, provided that the new rolling stock offers an equivalent or improved level of fire safety to previous rolling stock, and that the level of safety to passengers and staff is to be demonstrated using the Common Safety Method on Risk Evaluation and Assessment (CSM-RA); see also GEGN8646 Guidance on the Common Safety Method for Risk Evaluation and Assessment.

G 2.1.10 The Severn and Totley tunnels are the only tunnels longer than 5 km on the GB mainline railway that existed at the date the SRT TSI came into force (1st January 2015). The passenger vehicles operating through these tunnels at that date included vehicle designs that pre-date formal requirements for reaction to fire, or which were designed to earlier, less-demanding standards which are now obsolete. Examples of passenger vehicles operated through Totley and Severn tunnels when the SRT TSI came into force include:

a) For long distance services:
   i) British Rail HST sets (Class 43 power cars and BR Mk III coaches);
   ii) post-privatisation Classes 220, 221 and 222.

b) For regional and local services:
   i) British Rail Classes 142, 150, 153, 156, 158;
   ii) post-privatisation Classes 170, 185.

All traction was diesel powered.

G 2.1.11 TSI Category A requires HL2 (as defined in BS EN 45545-2:2013) materials, which are equivalent to BS 6853 Category 1b. The vehicles listed in G 2.1.10 as operating through Totley and Severn tunnels were designed to older, less stringent requirements. New rolling stock, designed to meet the requirements of the BS EN 45545 series of standards, will therefore have demonstrably improved fire performance.

G 2.1.12 When undertaking a risk assessment for existing rolling stock to operate in the Totley or Severn tunnels where it has not been operated before, the vehicle classes listed in G 2.1.10 can be used as comparators in order to satisfy the requirement of clause 7.2.4 (b) of the LOC & PAS TSI.
2.2 Open wide gangways

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

a) The gangway floor shall be considered as a continuation of the vehicle floor and, accordingly, shall satisfy the applicable fire barrier integrity and insulation requirements specified for floors (see BS EN 45545-3:2013 and BS EN 45545-2:2013+A1:2015).

b) The gangway interior (comprising the floor, sides and ceiling) shall be considered as a continuation of the vehicle interior and, accordingly, shall satisfy the applicable requirements specified for these surfaces (see BS EN 45545-3:2013 and BS EN 45545-2:2013+A1:2015).

c) Automatic smoke or fire detection equipment shall be fitted to the vehicles in accordance with the requirements of BS EN 45545-6:2013.

Rationale

G 2.2.2 These requirements address the open point in clause 4.2.10.3.4 (4) of the LOC & PAS TSI. No requirements are given for OC1 vehicles as these can be stopped and evacuated quickly.

G 2.2.3 Points (a) and (b) control the hazards of fire spreading from the underframe of the unit into the passenger saloon, and reflect GB practice for gangway design.

G 2.2.4 Point (c) controls the hazards of fire arising from items brought on to the train by passengers.

Guidance

G 2.2.5 Clause 4.2.10.3.4 of the LOC & PAS TSI sets out requirements for fire barriers for vehicles in OC3 and OC4. GB practice is to apply the same requirements for fire barriers to vehicles in OC2 where open wide gangways are fitted.

G 2.2.6 Requirements for fire detection systems are set out in clause 4.2.10.3.2 of the LOC & PAS TSI.

2.3 Engine exhaust

2.3.1 The location and direction of the internal combustion engine exhaust exiting from the vehicle shall be in accordance with Figure 1.

Rationale

G 2.3.2 Complying with this requirement ensures compatibility with the GB legacy infrastructure subsystem, specifically depots and stations which are fitted with exhaust extraction systems, and avoids contamination of the overhead line.

Guidance

G 2.3.3 Additional requirements for exhaust systems are set out in RIS-2730-RST.
Figure 1: Direction of engine exhaust
Part 3  Application of this document

3.1  Scope

3.1.1 If a change to a vehicle is considered new, renewal or upgrade as defined in the Railways (Interoperability) Regulations 2011 (as amended), then all or part of the vehicle is required to comply with the LOC & PAS TSI and other relevant TSIs and NTRs, unless given exemptions allowed for in the Regulations.

3.1.2 The requirements of this document apply to all new and modified (excluding like-for-like replacement of components) vehicles where 3.1.1 applies to the subsystem.

3.1.3 Action to bring existing vehicles into compliance with the requirements of this document is not required.

3.2  Exclusions from scope

3.2.1 The requirements in this document are not applicable to the following types of vehicles:
   a)  On-track machines; and
   b)  On-track plant.

3.3  General enter into force date

3.3.1 The requirements in this document enter into force from September 2020, except where exceptions to the general enter into force date are specified.

3.4  Exceptions to general enter into force date

3.4.1 There are no exceptions to the general enter into force date.

3.5  Applicability of requirements for projects already underway

3.5.1 The Office of Rail and Road (ORR) can be contacted for clarification on the applicable requirements where a project seeking authorisation for placing into service is already underway when this document enters into force.

3.6  Deviations

3.6.1 Where it is considered not reasonably practicable to comply with the requirements of this document (including any requirement to comply with a TSI requirement referred to in the Scope), permission to comply with a specified alternative should be sought in accordance with the deviation process set out in the Railway Group Standard Code.

3.6.2 In the case where TSI compliance is required for a new, renewed or upgraded vehicle or structural subsystem, the derogation process to be followed is set out in the Railways (Interoperability) Regulations 2011 (as amended).
3.7 Health and safety responsibilities

3.7.1 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.
## Definitions

**Escape**  
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.

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

**Fire barrier**  
Element that is intended for use in maintaining separation between two adjacent areas of a railway vehicle in the event of a fire which resists the passage of flame and/or heat and/or effluents for a period of time under specified 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.

**Interior**  
A location which is within the bodyshell.

**on-track machine (OTM)**  
Any rail-mounted machine, whose primary function is for the renewal, maintenance, inspection or measurement of the infrastructure, meeting the requirements of GMRT2400 and permitted by the Rule Book to be moved, either self-propelled or in train formation, outside a possession.

**On-track plant**  
Machine with rail wheels capable of running on railway track, limited by their engineering acceptance to running within a possession only.

**Operation Category (OC)**  
Relationship between service, infrastructure and evacuation conditions for passengers and staff. See clause 5.2 of *BS EN 45545-1:2013*

**Open wide gangway**  
Intervehicle gangway with no internal doors, usually with a clearway of more than 800 mm in transverse width; see clause 7.3.3 of *BS EN 16286-1:2013*

**Possession**  
A line is under possession when the arrangements set out in GERT8000 Rule Book Handbook 11 or Handbook 13 have been carried out to block the line to normal passage of trains.

**Rail vehicle**  
Any vehicle described as traction and rolling stock (for example: locomotives, coaching stock, multiple units or wagons) and on-track machines.

**Working mode**  
Mode when an on-track machine is used to perform any of its permitted designed working tasks.
References

The Standards catalogue gives the current issue number and status of documents published by RSSB: [http://www.rssb.co.uk/railway-group-standards](http://www.rssb.co.uk/railway-group-standards).

RGSC 01 Railway Group Standards Code
RGSC 02 Standards Manual

Documents referenced in the text

**Railway Group Standards**

GERT8000 Rule Book
GMRT2400 issue six Engineering Design of On-Track Machines in Running Mode.

**RSSB documents**

GEGN8646 Issue one Guidance on the Common Safety Method for Risk Evaluation and Assessment
RIS-2730-RST Issue one Vehicle Fire Safety and Evacuation
RIS-8270-RST Issue one Route Level Assessment of Technical Compatibility between Vehicles and Infrastructure

**Other references**

BS 6853:1999 Code of practice for fire precautions in the design and construction of passenger carrying trains.
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Safety in Rail Tunnels TSI (SRT TSI) | Other relevant documents
--- | ---
Persons with Reduced Mobility TSI (PRM TSI) | Commission Regulation (EU) No 1300/2014 on the technical specifications for interoperability relating to accessibility of the Union’s rail system for persons with disabilities and persons with reduced mobility.