Audibility and Visibility of Trains

Synopsis
This document mandates requirements for audible and visible warning devices such that an approaching train is clearly audible and visible to members of the public and trackside staff.
Audibility and Visibility of Trains

Issue record

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Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

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GM/RT2483 issue one and GM/RT2484 issue two cease to be in force and are withdrawn as of 05 March 2016.

Supply

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# Audibility and Visibility of Trains

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Part 1 Purpose and Introduction

1.1 Purpose
1.1.1 This document mandates requirements for audible and visible warning devices such that an approaching train is clearly visible and audible to members of the public and trackside staff.

1.2 Introduction
1.2.1 General
1.2.1.1 This document sets out requirements for the audibility and visibility of trains to comply with the Locomotives and Passenger Technical Specifications for Interoperability (LOC & PAS TSI).

1.2.1.2 This document sets out National Technical Rules (NTRs) for the GB mainline railway. Compliance with NTRs is required under the Railways Interoperability Regulations 2011 (RIR 2011) (as amended).

1.2.1.3 This document sets out National Technical Rules (NTRs) associated with audibility and visibility of trains which are additionally needed to maintain compatibility with existing operating practices.

1.2.1.4 This document sets out the NTR supporting the specific case permitted by the LOC & PAS TSI, associated with the sound pressure levels of warning horns. These requirements are the minimum and maximum sound pressure levels that warning horns are to emit that are consistent with giving safe warning to members of the public and trackside staff.

1.2.1.5 This document sets out National Safety Rules (NSRs) to assess compatibility of a train, powered by a shunting or steam locomotive, with existing operating practice in terms of its visibility on the particular route where it is likely to be operated.

1.2.2 Background on audibility requirements
1.2.2.1 An approaching train needs to be clearly audible and recognisable as a train to members of the public and trackside staff.

1.2.2.2 The warning horn of an approaching train needs to be audible for a distance of at least 400 m along the track. This condition is considered adequately fulfilled if the warning horn sound pressure levels specified further in this document are achieved when measured using the method specified in this document.

1.2.3 Background on visibility requirements
1.2.3.1 An approaching train needs to be clearly visible and recognisable as a train to members of the public and trackside staff.

1.2.3.2 The head lamps must give sufficient warning of an approaching train running at its maximum permitted speed, to allow track workers or others on or near the line time to move to a position of safety.

1.2.3.3 For track workers working alone, at night, a warning time of 15 seconds is deemed to be adequate. For track workers, working during the day, under the protection of lookouts, 45 seconds warning time is deemed to be adequate. Head lamps meeting the requirements of the LOC & PAS TSI will achieve this up to the highest permissible speed of 200 km/h (125 mph).

1.2.3.4 The LOC & PAS TSI also sets out requirements for the positioning of head lamps, colour and intensity in order to give a sufficient and clearly distinguishable warning of the approach of a train.
1.2.3.5 If a train is fitted with front end lamps (head lamps and marker lamps) which do not comply with the requirements set out in the LOC & PAS TSI, then yellow front ends need to be provided to assist the visibility of the train. This document sets out requirements for yellow front ends in such a scenario.

1.2.3.6 The rear end of a train needs to be visible for a distance of 400 m behind that train, this condition is considered adequately fulfilled by a tail lamp meeting the requirements of the LOC & PAS TSI, or a portable tail lamp meeting the requirements set out in Appendix B.

1.2.4 Structure of this document
1.2.4.1 This document sets out a series of requirements that are sequentially numbered.

1.2.4.2 This document also sets out the rationale for the requirement. The rationale explains why the requirement is needed and its purpose. Where relevant, guidance supporting the requirement is also set out in this document. The rationale and the guidance are indicated by prefixing the clause number with the letter ‘G’.

1.2.4.3 The national rules relating to relevant TSI parameters have been identified together with the relevant clauses from TSI(s).

1.2.5 Related requirements in other documents
1.2.5.1 Requirements for warning horns fitted to on-track machines (OTMs) for use in running mode are set out in GM/RT2400.

1.3 Approval and authorisation of this document
1.3.1 The content of this document will be / was approved by Rolling Stock Standards Committee on 28 August 2015.

1.3.2 This document will be / was authorised by RSSB on 08 October 2015.
Part 2 Requirements for Warning Horns

2.1 Audibility requirements

2.1.1 Except where otherwise required by this document, the requirements of the LOC & PAS TSI set out in section 4.2.7 covering ‘audible warning devices’ applicable to the audibility of trains shall apply as if they were requirements mandated by this document.

G 2.1.1.1 Rationale for clause 2.1.1: The LOC & PAS TSI requirements for audible warning devices are also applicable to vehicle modifications to ‘audible warning devices’ where the vehicle is deemed not to be new, renewed and upgraded as defined in RIR 2011 (as amended). These requirements together with any exceptions set out in this RGS, will help achieve compatibility with the TSI and the non-TSI compliant parts of the existing railway system.

G 2.1.1.2 This RGS includes additional requirements and guidance for audible warning devices on rail vehicles and is intended to be read in conjunction with the LOC & PAS TSI. The exceptions to the LOC & PAS TSI are set out in this document such as the sound pressure levels of warning horns, where a Great Britain (GB) Specific Case applies.

G 2.1.1.3 See Appendix A of this document for further guidance on audibility requirements.

2.2 Warning horn sound pressure levels

2.2.1 The minimum and maximum sound pressure levels for warning horns sounded separately, or in a group if designed to sound simultaneously as a chord, shall comply with Table 1 of this document.

<table>
<thead>
<tr>
<th></th>
<th>Minimum C weighted sound pressure level ($L_{PCeq,T}$ at 25 m)</th>
<th>Maximum C weighted sound pressure level ($L_{PCeq,T}$ at 25 m)</th>
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<tbody>
<tr>
<td>Trains with design speeds less than or equal to 160 km/h (100 mph)</td>
<td>86 dB$^1$</td>
<td>94 dB$^1$</td>
</tr>
<tr>
<td>Trains with design speeds greater than 160 km/h (100 mph)</td>
<td>101 dB$^2$</td>
<td>109 dB$^2$</td>
</tr>
</tbody>
</table>

Table 1 Warning horn sound pressure levels

G 2.2.1.1 Rationale for clause 2.2.1: This requirement supports the GB specific case for warning horn sound pressure levels, applicable to the GB mainline network, permitted by the LOC & PAS TSI (7.3.2.9).

G 2.2.1.2 Sound pressure levels are measured using the method described in BS EN 15153-2:2013 section 6.

$^1$ As specified in the GB A-deviation in BS EN 15153-2:2013 Annex D.
$^2$ As specified in BS EN 15153-2:2013
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G 2.2.1.3 Measurement of the sound pressure at the fixed distance of 25 m, as specified in BS EN 15153-2:2013, avoids the need to measure in a direct horizontal alignment with the horn position.

2.2.2 To minimise environmental impact it is permissible for the warning horn sound pressure levels to be able to switch with the actual train speed (in accordance with Table 1 of this document).

G 2.2.2.1 Rationale for clause 2.2.2: The close proximity of its neighbours to the rail system in GB justified the specific case for lower sound pressure levels than those mandated in the LOC & PAS TSI. Trains with a maximum speed of less than 160km/h (100 mph) require a horn meeting the sound pressure levels specified for that speed band. However, trains with a maximum speed of greater than 160 km/h (100 mph) could only have the louder horn as specified, or use a warning horn automatically switchable between the two sound pressure levels:

a) One with the higher sound pressure levels, to be used when operating at speeds over 160 km/h (100 mph).
b) One with the lower sound pressure levels, to be used when operating at speeds up to 160 km/h (100 mph).

2.3 Control

2.3.1 The requirements of the LOC & PAS TSI associated with control of audible warning devices applicable to trains shall apply as if they were requirements mandated by this document.

G 2.3.1.1 Rationale for clause 2.3.1: The requirements of the LOC & PAS TSI are also applicable to vehicle modifications to the control of audible warning devices where the vehicle is deemed not to be new, renewed and upgraded as defined in RIR 2011 (as amended). These requirements will help achieve compatibility with the TSI and the non-TSI compliant parts of the existing railway system.

G 2.3.1.2 Compliance with this requirement will also achieve the requirements of the Operation and Traffic Management (OPE) TSI which requires that that trains are fitted with an audible warning device to indicate the approach of a train and the activation of the audible warning device is possible from all driving positions (i.e. from both active and non-active cabs).
Part 3 Requirements for Visibility of Trains

3.1 Visibility requirements

3.1.1 Except where otherwise required by this document, the requirements of the LOC & PAS TSI set out in section 4.2.7 covering ‘external lights and visible warning devices’ applicable to visibility of trains shall apply as if they were requirements mandated by this document.

G 3.1.1.1 **Rationale for clause 3.1.1:** The LOC & PAS TSI requirements for external lights and visible warning devices are also applicable to vehicle modifications to ‘external lights and visible warning devices’ where the vehicle is deemed not to be new, renewed and upgraded as defined in RIR 2011 (as amended). These requirements together with any exceptions set out in this RGS, will help achieve compatibility with the TSI and the non-TSI compliant parts of the existing railway system.

G 3.1.1.2 The provision of headlamps that meet the functionality of both ‘Full beam’ and ‘Dimmed’ enables compatibility with the GB operational requirements of ‘Day time’ (using ‘Full beam’) and ‘Night time’ (using ‘Dimmed’) arrangements as set out in GE/RT8000.

G 3.1.1.3 This RGS includes additional requirements and guidance for external lights and visible warning devices on rail vehicles and is intended to be read in conjunction with the LOC & PAS TSI. The exceptions to the LOC & PAS TSI are set out in this document.

G 3.1.1.4 To achieve the necessary visibility when installing headlamps it is useful to take into account any possible obstruction so that the visibility of the headlamp is not impeded.

G 3.1.1.5 The visibility and recognisability of the train is achieved by the combination of headlamps and the top marker lamp.

G 3.1.1.6 Front end lamp luminosities are measured using the method described in BS EN15153-1 Section 6.

G 3.1.1.7 For existing vehicles fitted with fixed head lamps that do not conform to the requirements set out in the LOC & PAS TSI, Appendix F provides guidance on a methodology for establishing whether installation of LOC & PAS TSI compliant head lamps is the appropriate course of action.

3.1.2 Head lamp glare shall be controlled through the use of head lamps complying with Clause 5.3.4 Table 3 of EN15153-1:2013

G 3.1.2.1 **Rationale for clause 3.1.2** Headlamps that are adjusted using the ‘alternative approach’ to glare control will not achieve the necessary warning times.

G 3.1.2.2 The ‘alternative approach’ for glare control is not permitted.

3.2 Lamp installation

3.2.1 Fixed lamps shall meet the environmental requirements set out in the LOC & PAS TSI such that they are capable of operating in the T1 ambient temperature range as defined in BS EN 50125-1:2014.
**3.3 Control, switching arrangements**

3.3.1 Controls shall be provided that enable the switching of the lamps on and off, and between modes, as shown below, from the normal driving position. The modes are:

a) Marker lamps only (white marker lamps at the front of the train and red tail lamps at the rear of the train).

b) Day time running (1 or 2 ‘Full beam’ head lamps, with a total of 3 white front end lights in a triangle arrangement as defined in the OPE TSI, the remainder being marker lamps).

c) Night time running (2 ‘Dimmed’ head lamps and one top marker lamp).

d) Tail lamps only.

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**Rationale for clause 3.3.1:** The provision of a control to select the correct lamp configuration avoids the risk of an incorrect combination of lamps being displayed. This requirement is additional to requirements in the LOC & PAS TSI, in order to maintain compatibility with existing operating practice (GE/RT8000). It is permissible to provide separate switching to extinguish all lamps.

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**G 3.3.1.3** A display in the cab showing the driver which lamps are illuminated can help the driver check they are running in the correct mode and also highlight to the driver when a lamp has failed.

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**3.4 Simultaneous lighting of tail and front end lamps at one end of the vehicle**

3.4.1 It shall not be possible to light tail lamps and front end lamps simultaneously at the same end of the vehicle.

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**Rationale for clause 3.4.1:** This requirement is additional to requirements in the LOC & PAS TSI and is in order to maintain compatibility with existing operating practice.

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**3.5 Hazard warning**

3.5.1 Controls shall be provided such that a driver is able to control either all front lamps or two head lamps to flash simultaneous at a frequency of 40 cycles per minute (±10%).

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**Rationale for clause 3.5.1:** This requirement supplements the requirements in the LOC & PAS TSI and is in order to maintain compatibility with existing operating practice and to enable a driver to warn oncoming trains of a perceived hazard.
3.5.2 A driver’s switch shall be provided as the control for the hazard warning. A means of reminding the driver that it is switched on shall also be provided.

G 3.5.2.1 **Rationale for clause 3.5.2:** This requirement is additional to requirements in the LOC & PAS TSI, in order to maintain compatibility with existing operating practice by the provision of a control which provides a reminder to the driver of its activation.

G 3.5.2.2 Existing GB practice is to provide a switch which is coloured orange with an unfilled black triangle, as shown in Figure 1. This is considered to be distinctive as a hazard warning control.

![Orange button with an unfilled black triangle](image)

**Figure 1** Orange button with an unfilled black triangle

G 3.5.2.3 A means of reminding the driver can be provided by a switch which is illuminated when operated and flashes when the head lamps flash.

3.6 **Shunting locomotives**

3.6.1 A shunting locomotive with a maximum speed of 50 km/h (30 mph) shall be deemed to be compatible with existing operating practice for a particular route in terms of sufficient visibility, recognition and warning to track workers and members of the public, if it is equipped with tail lamps and marker lamps conforming to requirements set out in the LOC & PAS TSI.

G 3.6.1.1 **Rationale for clause 3.6.1:** Shunting locomotives (Class 08 and Class 09) which have a maximum speed of 20 km/h (15 mph) and 42 km/h (27 mph) respectively, are excluded from the scope of the Railway (Interoperability) Regulations 2011 (as amended), and are not covered by the LOC & PAS TSI. This requirement is the National Safety Rule (NSR) for compatibility of a shunting locomotive with existing operating practices.

3.7 **Steam locomotives**

3.7.1 A steam locomotive shall be equipped with the necessary brackets to allow the attachment of a portable head lamp at the front of the locomotive (in the direction of travel) and a portable tail lamp at the rear of the locomotive (in the direction of travel).
G 3.7.1.1  **Rationale for clause 3.7.1:** Steam locomotives are excluded from the scope of the Railway (Interoperability) Regulations 2011 (as amended), and are not covered by the LOC & PAS TSI. This requirement is the NSR for compatibility of a train powered by a steam locomotive with existing operating practice on the particular route where it is likely to be operated. A steam locomotive shall be deemed to be compatible with existing operating practice for a particular route in terms of sufficient visibility, recognition and warning to members of the public and trackside staff, if it is equipped with at least one portable head lamp and one portable tail lamp conforming to requirements set out in Appendix B of this document. This requirement facilitates the attachment of the portable headlamp and tail lamp.

G 3.7.1.2  A steam locomotive will need to be fitted with a lamp bracket to allow the attachment of one portable lamp at each end. A ‘British type’ lamp bracket, as specified in Appendix G of this document permits the attachment of either a portable tail lamp or portable head lamp designed in accordance with Appendix B of this document.

### 3.8 Portable lamps

3.8.1 Where provided, portable head lamps and portable tail lamps shall meet the requirements set out in Appendix B of this document.

G 3.8.1.1  **Rationale for clause 3.9.1:** This requirement is additional to requirements in the LOC & PAS TSI, in order to maintain technical compatibility with existing operating practice.

G 3.8.1.2  It is standard practice in GB to use the ‘GB type’ lamp bracket described in Appendix G, to attach portable lamps to the train.

### 3.9 Front end colour

3.9.1 Where a vehicle is fitted with front end lamps (head lamps and marker lamps) which do not meet the minimum requirements set out in the LOC & PAS TSI, then yellow front ends, which comply with the requirements contained in Appendix D, shall be provided.

G 3.9.1.1  **Rationale for clause 3.10.1:** The presence of a head lamp meeting the requirements of the LOC & PAS TSI will give a sufficient visual warning that a train is approaching. The provision of a yellow front end on vehicles with front end lamps below the minimum required by the LOC & PAS TSI will increase the train’s visibility to members of the public and trackside staff.

G 3.9.1.2  Appendix E provides guidance on factors to consider in any risk assessment to determine the impact of the change to a train’s front end colour if a train is fitted with front end lamps (head lamps and marker lamps) which comply with the requirements set out in the LOC & PAS TSI.

### 3.10 Shunting locomotives and snowploughs

3.10.1 Shunting locomotives, self-propelled snowploughs and independent snowploughs shall have, so far as is reasonably practicable, all forward-facing surfaces painted yellow with black diagonal stripes.
3.10.2 The stripes shall be applied at a nominal angle of 45° from the vertical.

3.10.3 The width of each stripe, measured at 90° to the edge of the stripe, shall be in accordance with Table 2 of this document.

<table>
<thead>
<tr>
<th>Vehicle maximum design speed</th>
<th>Minimum width of stripe</th>
</tr>
</thead>
<tbody>
<tr>
<td>km/h (mph)</td>
<td>mm</td>
</tr>
<tr>
<td>30 (20)</td>
<td>80</td>
</tr>
<tr>
<td>50 (30)</td>
<td>120</td>
</tr>
<tr>
<td>60 (40)</td>
<td>160</td>
</tr>
<tr>
<td>100 (60)</td>
<td>240</td>
</tr>
</tbody>
</table>

Maximum width of diagonal stripes shall be 2 x the appropriate minimum width given in the table.

Table 2 Warning stripes on shunting locomotives and independent snowploughs

3.10.4 The distance between adjacent stripes shall be the same as the width of the stripes. An example of how the front end of vehicles meeting these requirements might look is shown in Figure 1 of this document.

![Figure 1](image1.png)

3.10.5 The markings on vehicles with curved ends shall be applied so that they are perceived as uniform stripes when viewed, at a large distance, head on in front of the vehicle.

G 3.10.5.1 *Rationale for section 3.11*: These requirements are additional to requirements in the LOC & PAS TSI, in order to maintain technical compatibility with existing operating practice.
Part 4  Application of this document

4.1  Scope

4.1.1  The requirements of this document apply to the fitment of new or modified (this excludes like-for-like replacement of components) warning horns, head lamps, marker lamps and tail lamps to vehicles fitted with a driver’s cab (unless as set out in 4.1.2).

4.1.2  The requirements set out in clauses 2.1.1, 2.3.1, and 3.1.1 only apply to modifications to vehicles set out in 4.1.1 where the vehicle is deemed not to be new, renewed or upgraded.

4.1.3  New, renewed and upgraded vehicles as defined in the Railway (Interoperability) Regulations 2011 (RIR 2011) (as amended) are required to comply with the LOC & PAS TSI and all relevant NTRs.

4.1.4  Action to bring existing warning horns, head lamps, marker lamps and tail lamps into compliance with the requirements of this document is not required.

4.2  Exclusions from scope

4.2.1  Warning horns, head lamps, marker lamps and tail lamps fitted to OTMs for use in running mode are excluded from the scope of this document.

4.3  General compliance date

4.3.1  This Railway Group Standard becomes mandatory and is to be complied with from 05 March 2016, except as specified in 4.4. Where the dates specified in 4.4 are later than the above date, this is to allow sufficient time to achieve compliance with the specified exceptions.

4.3.2  After the compliance dates, 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.

4.4  Deviations

4.4.1  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 4.1.2), permission to comply with a specified alternative should be sought in accordance with the deviation process set out in the Railway Group Standards Code.

4.4.2  Note: In the case where TSI compliance is required for a new, renewed or upgraded vehicle or structural subsystems, the derogation process to be followed is set out in the Railway (Interoperability) Regulation 2011 (as amended).

4.5  Exceptions to general compliance date

4.5.1  There are no exceptions to the general compliance date specified in section 4.3 of this document.

4.5.2  If, at the time this document becomes mandatory, a project is at an advanced stage of development, having regard to the impact that a change in technical specification would have on the project, it is permissible to continue to meet the equivalent requirements in the Railway Group Standards applying before this document enters into force.

4.5.3  If the project requires an authorisation for placing into service, a decision to continue to meet the equivalent requirements in the Railway Group Standards applying before this document enters into force should be discussed with the Office of Rail and Road.
4.6 Health and safety responsibilities

4.6.1 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 Audibility requirements

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

A.1 Audible warning device for use in depots and sidings

A.1.1 To reduce the environmental impact (e.g. annoyance to neighbours) and avoid the risk of hearing damage to personnel that could arise from the frequent use of audible warning devices in depots and shunting sidings, an independent audible warning device is often provided for this purpose. A minimum sound pressure level of that warning device of 66 dB (when measured using the method described in BS EN 15153-2:2013 section 6) is appropriate.

A.1.2 So that the independent warning device can be clearly heard, it is necessary to achieve a sound pressure level of 10 dB above ambient background noise levels at depots and sidings that a train is likely to visit.

A.1.3 Where provided, the independent warning horn is used as the ‘low tone, soft setting’ for use in sidings and depots in GE/RT8000.

A.2 LOC & PAS TSI requirements

A.2.1 The LOC & PAS TSI section 4.2.7.2 contains the general requirements for audible warning devices. It references Appendix J-1, index 41 which is the applicable Euronorm for audible warning devices.

A.2.2 The LOC & PAS TSI section 5.3.9 contains requirements that are applicable to audible warning when assessed as an Interoperability Constituent. An Interoperability Constituent is an item of equipment for which certain requirements can be assessed away from a rail vehicle and then installed without further testing of those requirements - in the case of an audible warning device, the fundamental frequencies at which it operates.

A.2.3 The LOC & PAS TSI section 6.1.3.6 contains the assessment requirements for achieving the sound pressure levels of audible warning devices when installed on a rail vehicle.

A.3 Typical tones for audible warning devices when used on the GB mainline network

A.3.1 The notes of the audible warning horns are intended to be recognisable as being from a train and should not be similar to warning devices used in road transport or to factory or other common warning devices.

A.3.2 BS EN 15153-2:2013 clause 5.2.1 lists four different combinations of warning horn notes that will meet this requirement; options (a) or (d) from this list are used in GB.

A.3.3 Option (a) in BS EN 15153-2:2013, clause 5.2.1, specifies the high and low notes that will be the two separately sounded horns.

A.3.4 Where option (d) in BS EN 15153-2:2013, clause 5.2.1, is used, the two separately sounded horns will be the high, middle and low notes specified, sounded together, followed by a separate sounding of the low note on its own.

A.3.5 For any party considering using horn tones complying with options (b) or (c) from BS EN 15153-2:2013 clause 5.2.1 it is beneficial to consider the risks and benefits associated with those tones.
Appendix B  Portable lamps

Section B.1 and B.2 of this appendix are mandatory.
Section B.3 of this appendix is not mandatory and is provided for guidance only.

B.1  Portable head lamps

B.1.1  Portable head lamps shall meet the minimum luminosity levels specified in Table 3 of this document.

<table>
<thead>
<tr>
<th>Mode: Continuously on (when selected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour: BS 1376 Signal White Class B with restriction of the x co-ordinate under the CIE 1931 Colour System less than or equal to 0.45</td>
</tr>
<tr>
<td>Lit area: 10,000 mm² to 12,000 mm² when viewed ‘head on’ in front</td>
</tr>
<tr>
<td>Minimum dimension of lit area: (when viewed ‘head on’) 66 mm</td>
</tr>
<tr>
<td>Maximum dimension of lit area: (when viewed ‘head on’) 120 mm</td>
</tr>
<tr>
<td>Beam shape: Circular; no secondary maxima</td>
</tr>
</tbody>
</table>

| Luminous intensity: Portable head lamp: for maximum speed of 120 km/h (75 mph) |
|----------------------------------|-----------------|-----------------|
| Vertical                        | Horizontal      | Minimum luminous intensity (cd) | Maximum luminous intensity (cd) |
| All angles up to and including 5° from the axis | 600          | 1200          |

Table 3  Requirements for portable head lamps

B.1.2  Portable head lamps conforming to BR Specification BR/TS0629 meet these visibility requirements.

B.2  Portable tail lamps

B.2.1  In the following tables, vertical and lateral values of luminous intensity are relative to the optical axis of each system. This axis is parallel to the vehicle axis. (The following notation is used: U = up; D = down; L = left; R = right).
Audibility and Visibility of Trains

Mode: Flashing (120 cycles/min ±10%)
Duration of flash 25 ±5 milliseconds
Colour: BS 1376 Signal Red Class B or Class C
Lit area: 8,000 mm² to 12,000 mm²
Minimum dimension of lit area: (when viewed ‘head on’) 66 mm
Maximum dimension of lit area: (when viewed ‘head on’) 120 mm
Beam shape: Elliptical with no secondary maxima

The front of a portable tail lamp case (that is to say the surface of the case that faces a train approaching from the rear) shall exhibit a red retro-reflective rectangular surface with a minimum retro-reflective area of 14,000 mm² and a minimum dimension of 95 mm.

Luminous intensity (mean over duration of flash): Portable tail lamp

<table>
<thead>
<tr>
<th>Vertical</th>
<th>Horizontal</th>
<th>Minimum luminous intensity (cd)</th>
<th>Minimum luminous intensity (cd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° U, D</td>
<td>0° L, R</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>0° U, D</td>
<td>5° L, R</td>
<td>40</td>
<td>120</td>
</tr>
<tr>
<td>5° U</td>
<td>0° L, R</td>
<td>40</td>
<td>120</td>
</tr>
<tr>
<td>5° D</td>
<td>0° L, R</td>
<td>20</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 4  Portable tail lamps

B.2.2 The minimum coefficients of retro-reflection shall be as in Table 5 of this document, in accordance with publication CIE 54: 1982.

<table>
<thead>
<tr>
<th>Observation angle (Alpha) minutes of arc</th>
<th>-5°</th>
<th>15°</th>
<th>40°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrance angles (Beta 1) (Beta 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>215</td>
<td>150</td>
<td>25</td>
</tr>
<tr>
<td>20</td>
<td>150</td>
<td>95</td>
<td>22</td>
</tr>
<tr>
<td>30</td>
<td>45</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Rotation angle (Epsilon)</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
</tr>
</tbody>
</table>

Table 5  Minimum coefficients of retro-reflection of red panel on portable tail lamp (cd/m²)/lux

<table>
<thead>
<tr>
<th>Co-ordinates</th>
<th>X</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red limit on the spectrum locus</td>
<td>0.690</td>
<td>0.310</td>
</tr>
<tr>
<td>Amber limit on the spectrum locus</td>
<td>0.655</td>
<td>0.345</td>
</tr>
<tr>
<td>Desaturated / red boundary limit</td>
<td>0.595</td>
<td>0.315</td>
</tr>
<tr>
<td>Desaturated / amber boundary limit</td>
<td>0.569</td>
<td>0.341</td>
</tr>
</tbody>
</table>

Table 6  Colour co-ordinates of red panel on portable tail lamp (BS 873-6:1983)
Audibility and Visibility of Trains

B.2.3 The luminance factor of the retro-reflector shall be greater than 0.03.

B.2.4 Portable tail lamps complying with BR Specification BR/TS0630 meet the visibility requirements set out in Table 4 of this document.

B.3 Portable lamp general guidance (for both head and tail lamps)

B.3.1 The provision of a battery condition indicator system in portable lamps, that gives a visual warning when the emitted light level is not complying with the requirements set out in this standard, is useful in identifying when functionality of a lamp deteriorates below the required levels.

B.3.2 The indicator giving a warning when less than four hours of useful light remain also aids in identifying when the functionality of the lamp will fall below required levels and allows the user to take corrective action. Useful light is deemed to be a minimum of 1000 candelas on axis luminosity.

B.3.3 It is beneficial to incorporate the battery charger socket into the lamp body to allow charging without the need to open the case.

B.3.4 In GB, a portable lamp can be charged from a 240 volt, 50 Hz mains supply.

B.3.5 It is useful to provide visual indicators by the charger of the following conditions to aid ease of identification of any malfunction:

a) Connection of the charge to the mains supply voltage.

b) Battery charging.

c) Battery charging complete.

d) Battery reverse polarity.

B.3.6 It is useful if the design of the lamp body is such that the lamp can be placed on a flat, horizontal surface without falling over.

B.3.7 BS EN 60529:1992+A2:2013, IP65 provides requirements for the design of the body of the lamp to have a weatherproof construction.

B.3.8 Marking each portable lamp with its type, owner identification mark and serial number in a prominent position on the external surface aids the identification of each lamp and management of the asset.

B.3.9 A lamp's lens or cover made from a clear, scratch and impact resistant material protects the lamp and increases its functional life.

B.3.10 The provision of an on-off switch that is internally mounted on the front half of the lamp body allows easy access to the control.

B.3.11 The inclusion of a seal for this switch is necessary to achieve the specified IP65 rating.

B.3.12 In GB, the size of the portable lamp unit tends to be no greater than 200 mm wide, 370 mm tall and 200 mm deep, and the mass is generally no greater than 7.5 kg.

B.3.13 The robustness of the portable lamp (excluding the filament if a filament bulb is used) in terms of maintaining its functionality can be assessed if it is still functioning after experiencing a drop of 1 m onto concrete, and landing on any of its sides.
B.3.14 It is standard GB practice to use a ‘British type’ lamp bracket, as described in Appendix G, as a means of attaching portable lamps to vehicles; to avoid the introduction of a range of different bracket types it is useful for portable headlamps to be designed with an attachment device that is compatible with the ‘British type’ brackets.

B.3.15 A well designed attachment device ensures a secure fastening of the portable lamp to the lamp brackets such that it cannot become disconnected or significantly shift its position when subjected to vibrations which occur during the operation of a rail vehicle.
Appendix C  Axis Adjustments for GM/RT2180 Head lamps

The content of this appendix is mandatory only for those vehicles fitted with head lamps compliant with GM/RT2180, issue three.

C.1  Head lamp axis adjustments

C.1.1  Because of problems with glare caused by the high luminous intensity of head lamps produced in compliance with GM/RT2180 issue three, it is necessary to adjust their optical axis in order to reduce the glare problem. Tables 7 and 8 of this document set out the necessary adjustments.

<table>
<thead>
<tr>
<th>Maximum train speed for trains equipped with 300 km/h (190 mph) head lamps</th>
<th>Axis adjustment Day-time head lamp</th>
<th>Axis adjustment Night-time head lamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 km/h (125 mph)</td>
<td>0.5° below the vehicle axis</td>
<td>1.0° below the vehicle axis</td>
</tr>
<tr>
<td>160 km/h (100 mph)</td>
<td>1.0° below the vehicle axis</td>
<td>1.5° below the vehicle axis</td>
</tr>
<tr>
<td>125 km/h (75 mph)</td>
<td>1.5° below the vehicle axis</td>
<td>2.0° below the vehicle axis</td>
</tr>
</tbody>
</table>

Table 7  Optical axis settings for GM/RT2180 issue three head lamps designed for speeds up to and including 300 km/h (190 mph) for different vehicle maximum speeds

<table>
<thead>
<tr>
<th>Maximum train speed for trains equipped with 225 km/h (140 mph) head lamps</th>
<th>Axis adjustment Day-time head lamp</th>
<th>Axis adjustment Night-time head lamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 km/h (125 mph)</td>
<td>0.5° below the vehicle axis</td>
<td>No adjustment</td>
</tr>
<tr>
<td>160 km/h (100 mph)</td>
<td>1.0° below the vehicle axis</td>
<td>0.5° below the vehicle axis</td>
</tr>
</tbody>
</table>

Table 8  Optical axis settings for GM/RT2180 issue three head lamps designed for speeds up to and including 225 km/h (140 mph) for different vehicle maximum speeds

C.1.2  The lateral axis of the head lamp shall remain parallel to the vehicle axis.

C.1.3  The requirements set out in this appendix are to be applied to existing head lamps conforming to GM/RT2180 issue three (section B2.2).
Appendix D  Requirements for a Yellow Warning Panel

The content of this appendix is mandatory when applied in accordance with 3.10.1.

D.1  Yellow front ends

D.1.1 The forward facing front end of the leading vehicle of a train shall include a warning panel, with a yellow colour conforming to any of the following paint colours:

   a) RAL 1003, RAL 1004, RAL 1018, RAL 1021, or RAL1023 from the RAL Classic Colour Collection.

   b) BS 4800 Item 08E51.

   c) BR81 Item 202.

   d) NCS (Natural colour system) target value 1080-Y 10-R or 1475-Y 11R.

   e) EC 222.69.79 in the Eurocolour table.

D.1.2 Where vinyl and gel coats are used for this panel, the colour shall be a reasonable match to the colours listed above.

D.1.3 No measurement of the colour when applied to the vehicle is necessary. Conformance is assessed by visual comparison, and through confirmation that the colour has been applied using the manufacturer's specification and approved process.

D.2  Area of yellow

D.2.1 There shall be a minimum forward facing continuous area of yellow of 1 m² when viewed head on from in front of the vehicle.

D.2.2 The minimum dimension of that area shall be 0.6 m when viewed head on, from in front of the vehicle.

D.2.3 If necessary it is permissible to divide the yellow area by elements of an end gangway.

D.2.4 If the minimum required area or dimension exceeds the available area on the front end of the leading vehicle of the train, the yellow warning panel can be provided over the maximum reasonably practicable area (not including active optical surfaces, for example, windscreen and head, marker and tail lamps).

D.2.5 If it is necessary to divide a yellow warning panel into more than one area, each area shall have a substantially uninterrupted yellow area not less than 0.4 m², with a minimum dimension of 0.6 m. Minor interruptions to the continuous area, such as panel joints or seals of a different colour (not exceeding 10 mm in width) and similar interruptions are acceptable.
Appendix E  Guidance on Front End Colours

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

E.1  Front end colours

E.1.1 The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) requires a transport operator to:

a) To make a suitable and sufficient assessment of the risk to the safety of any persons for the purpose of identifying the measures the transport operator needs to take to ensure safe operation of the transport system in question insofar as this is affected by his operation.

b) Implement the measures referred to in a).

E.1.2 Commission Regulation (EC) No. 352/2009 established a 'common safety method on risk evaluation and assessment' (the CSM RA). The CSM RA, contained in Annex I to the regulation, sets out a mandatory risk management process for the rail industry that is common across Europe. The CSM RA has applied to all significant changes to the railway system since 01 July 2012. The changes may be of a technical (engineering), operational or organisational nature.

E.1.3 Commission Implementing Regulation (EU) No 402/2013 establishes a revised CSM RA. The revised CSM RA has been in force since 23 May 2013 (meaning it can be used from that date), and applies from 21 May 2015 (meaning that it must be used from that date), repealing Commission Regulation (EC) No. 352/2009.

E.1.4 The CSM RA is a legal requirement for significant changes and it represents a good process for assessing and controlling the risk associated with any change. The Office of Rail Regulation issued a policy statement on the relationship between the CSM RA and other risk assessment requirements (RGD-2013-06, December 2013). In this statement the ORR considered CSM RA to be a suitable and sufficient risk assessment approach in terms of complying with other domestic safety legislation.

E.1.5 Furthermore detailed guidance on the application of CSM RA is provided in a suite of six complementary Rail Industry Guidance Notes – GE/GN8640, GE/GN8641, GE/GN8642, GE/GN8643, GE/GN8644 and GE/GN8645.

E.1.6 If a non-yellow front end is selected, thus would be considered as a significant change and the CSM RA would apply.

E.1.7 In any suitable and sufficient risk assessment, it will be beneficial to consider:

a) All operating conditions likely to be experienced by that train.

b) The impact on the safety of railway workers, passengers and members of the public.

c) The impact on safety at level crossings.

d) The effect of front end colour on the perceived position of a stationary train when a driver is undertaking a permissive move into a platform already occupied by another unit.

e) Reliability and maintenance of the head lamps.

E.1.8 Where a non-yellow front end train is being considered, it is important to consult all affected parties to make them aware of the change so that they can manage its impact.
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The following issues have been identified for different types of train front end colours which could introduce a potential increase in the risk to operating practice:

a) Using colours which already have an operational meaning to drivers and track staff. These include: red and green which are associated with signal aspects; orange, which is associated with track staff high visibility clothing. Colour characteristics could be manipulated to mitigate this risk (for example, using different shades of the colour).

b) Using colours and surface finishes which may impact on the visibility of the train headlight. These are likely to include white, grey, gold, silver, reflective, retro-reflective and fluorescent surfaces. These impacts would need to be assessed for different environmental factors including sunlight, fog and snow.

c) Patterns and text (for example, logos) which may make the shape of the front end of the train difficult for trackside staff to identify when the train is approaching them. Whilst the headlight provides the main means of identifying the train, as it moves closer, colours and patterns may impact on the reliability of track staff judgements in relation to the train front end.
Appendix F  Train Head Lamp Upgrade Guidance

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

F.1  Assessment guidance

F.1.1  Introduction

F.1.1.1  To be clearly visible and recognisable as an approaching train to members of the public and trackside staff trains were painted with a yellow front ends, from the 1960s as diesel and electric trains replaced louder (and more visible) steam trains. This was later enhanced by the provision of head lamps and later marker lamps as well. The front end lamp intensities and layout required by this document achieve are deemed to provide sufficient warning.

F.1.1.2  For new, renewed and upgraded vehicles the front end lamp requirements included in Section 3 are mandatory.

F.1.1.3  There may be benefits in replacing the head lamps on existing fleets, with head lamps meeting the requirements of this standard; any party considering this it is beneficial to take into account the reduction (or possible increase) in risk that the change will achieve and balance that against the cost of replacement and the effect of the change on maintenance costs.

F.1.1.4  This appendix gives guidance on carrying out an assessment for retro-fitting LOC & PAS TSI compliant head lamps to an existing train fleet to replace lower intensity head lamps. However, the approach is generic and can be used to assess any change to head lamps.

F.1.1.5  This guidance can also be used when changing to LOC & PAS TSI compliant head lamps from the brighter GM/RT2483 compliant head lamps. A full assessment of that change would need to take into account the reduction in glare to other drivers, which the risk mitigation figures in section F.1.2 of this document do not include.

F.1.1.6  As set out in Appendix E (E1.1 to E1.6) of this document, CSM RA represents a suitable and sufficient risk assessment approach when making any change to the railway system.

F.1.2  Factors for consideration in a risk assessment

F.1.2.1  The following factors are deemed to have an impact on the effectiveness of head lamps and are useful to consider in a risk assessment when a change in head lamp type is considered. The list is not exhaustive. These factors can be considered where appropriate and additional factors included if necessary.

a)  Current condition of head lamps:

   i)  The risk assessment based on the actual condition of existing head lamps rather than their condition when first installed will provide a more accurate quantification of the actual risk.

b)  Comparison with other head lamps on the route:

   i)  Variation in head lamp types on a line could potentially lead to errors regarding distance perception of an oncoming train.

   ii)  An incident at the Bayles and Wylies footpath crossing in 2008 (described in RAIB report 32/2009) is possibly thought to have been caused by the relative difference in brightness of tram head lamps, which was running on an adjacent line and head lamps on the class 158.

c)  Glare to other train drivers:
i) Brighter head lamps may increase the risk of glare to other train drivers.

d) Fleet size:
   i) The risk assessment considering the entire fleet will allow for the full scale of the risk to be accurately estimated.

e) Frequency of level crossings:
   i) Lines with more level crossings will be more exposed to the risk associated with those level crossings. Head lamps are one of the measures to control that risk and the type (luminous intensity) of head lamp will affect the level of risk exposure.

f) Level crossings:
   i) A change in head lamps will have a greater effect on level crossing types which rely on the user seeing the train, such as footpath crossings and user worked crossings, particularly where miniature warning lights or telephones are not provided.
   
   ii) How often a level crossing is used as this affects the risk exposure, therefore it is a key consideration in the assessment.
   
   iii) This could potentially have a large effect on the risk at a level crossing but will be difficult to quantify so a qualitative assessment instead can aid the decision making process.


g) Provision of whistle boards:
   i) Some whistle boards are no longer used at night in residential areas and therefore, at these crossings, there will be a greater reliance on the head lamp to indicate a train approaching.

h) Sighting distances:
   i) Vegetation on the line could impinge on the potential sighting distance available.
   
   ii) Curvature on the line - the straighter the track the more important a head lamp will be.
   
   iii) On routes where there is a large variation in train speeds, the sighting time will be shorter for trains that operate at higher speeds.

i) Trespass hotspots:
   i) For a trespasser on the line, one of the main indications that a train is approaching is the head lamps. If the fleet operates on routes where there is a high frequency of trespassing, then the benefits of head lamps with higher luminosity will also be greater.

j) Frequency of engineering works on the line:
   i) Type of maintenance carried out and maintenance regime in place may differ depending on whether the line is mainline or rural.
Audibility and Visibility of Trains

k) Environmental conditions:
   i) Some areas are more prone to suffering environmental conditions such as fog.
   ii) Although difficult to quantify, it will be worth taking note of the environmental conditions in order to aid the decision of whether to change head lamps.

l) Accident history:
   i) A review of the number of accidents that have happened in the past on a line can help determine whether more effective head lamps could have helped prevent them.

F.1.3 Other factors for consideration in an assessment
F.1.3.1 It is useful to take the following factors into account during an assessment when a change in head lamp type is considered as they will contribute to the assessment of the cost of replacement and the effect of the change. The list is not exhaustive. These factors can be considered where appropriate and additional factors included if necessary:

a) Reliability of current head lamps and proposed head lamps:
   i) Modern head lamp designs (including head lamps designed to comply with the LOC & PAS TSI) can be more reliable and have a longer life than older filament bulb head lamps.
   ii) With improved reliability and longer life, there will not be a need to hold as many replacement stock as for filament bulbs.
   iii) Modern head lamp designs (including head lamps designed to comply with the LOC & PAS TSI) can result in lower energy consumption and improve the overall reliability of the vehicle on which they are installed.

b) Cost of modification:
   i) This includes any loss of utilisation due to replacing the head lamps.
   ii) The replacement head lamps may not fit in existing housings which could increase the cost of installation.

c) Residual life of rolling stock:
   The residual life of the rolling stock will help in assessing whether making a change to the head lamps will provide enough benefit to justify the cost of the change.

d) Fleet size:
   i) Taking into account the number of trains in the fleet and potential cost per unit savings from efficiencies of scale will aid in the accurate assessment of the cost of making the change.

e) Layout of front end lamps:
   i) Full compliance with the front end lamp requirements in Section 3 includes head lamps and markers lamps and their layout. If only partial compliance will be achieved by the change (i.e. only headlamps replaced or headlamps and marker lamps replaced but not in positions complying with Section 3) this effect on visibility should be taken into account in the risk assessment.
F.1.4 Summary of Bayles and Wylies risk assessment

Following the Bayles and Wylies footpath crossing incident, 2012, RAIB recommended that the risk associated with the operation of trains with less luminous intensity from night-time headlights than that required from current Railway Group Standards (GM/RT 2483, Issue one was in force at the time), should be assessed.

RSSB carried out a risk study and some key results from the risk assessment are given below for information; they may serve as a useful starting point for a risk assessment for a specific fleet.

The following hazards were identified, from the RSSB GB Safety Risk Model, which can potentially be mitigated by train head lamps.

<table>
<thead>
<tr>
<th>Hazardous Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HET-10</td>
<td>Passenger train collision with road vehicle on level crossing.</td>
</tr>
<tr>
<td>HET-11</td>
<td>Non-passenger train collision with road vehicle on level crossing.</td>
</tr>
<tr>
<td>HEM-14</td>
<td>Workforce (not infrastructure worker) struck / crushed by train.</td>
</tr>
<tr>
<td>HEM-19</td>
<td>Infrastructure worker struck / crushed by train in motion.</td>
</tr>
<tr>
<td>HEM-25</td>
<td>Member of the public (trespasser) struck / crushed by train while on railway infrastructure not at a station.</td>
</tr>
<tr>
<td>HEM-11</td>
<td>Passenger struck / crushed by train while crossing the track at or near a station on a crossing.</td>
</tr>
<tr>
<td>HEM-12</td>
<td>Member of the public (trespasser) struck / crushed by train while on tracks at a station.</td>
</tr>
<tr>
<td>HEM-27</td>
<td>Member of the public (non-trespasser) pedestrian or cyclist struck / crushed by train on level crossing or footpath crossing.</td>
</tr>
</tbody>
</table>

Table 9 Hazardous events that head lamps have the potential to mitigate

The assessment compared the assumed residual risk on the network if the whole train fleet was fitted with dimmed ‘pre-GM/RT2483’ head lamps (assumed to be headlamps complying with GM/RT2180, Issue 1, 1995) compared with the residual risk if the whole train fleet was fitted with GM/RT2483 or LOC & PAS TSI compliant head lamps.

The estimated risk benefit of head lamps compliant with GM/RT2483 or LOC & PAS TSI compared with ‘pre-GM/RT2483’ head lamps was estimated to be in the order of 3 Fatalities and Weighted Injuries (FWI) per year over the whole GB network. This means that converting the national fleet from pre-GM/RT2483 specification head lamps to GM/RT2483 or LOC & PAS TSI compliant head lamps would theoretically result in a risk reduction of 3 FWI per year, over the whole network. To consider the impact of fitting an individual fleet this figure can be scaled by annual train kilometres for the fleet in question to give an indicative potential risk reduction.

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3 The RSSB document ‘Taking Safety Decisions’ outlines the industry consensus view on the principles that companies apply to protect people’s safety, satisfy the law, respect the interests of stakeholders and meet commercial objectives when taking decisions.


5 HET and HEM are hazard codes used in Safety Risk Model, HET is a Hazard Event – Train accident, HEM is a Hazard Event – Movement accident.
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F.1.4.6 It should be noted that it is difficult to separate the benefits of head lamps from the benefits of other control measures, and as such there is a degree of uncertainty in the estimated risk impact; this uncertainty should be considered if the value is used as part of an assessment.
Appendix G  Lamp brackets

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

G.1  Tail lamp brackets for freight wagons

G.1.1  Tail lamp brackets meeting the design set out in Figure 3 are compatible with the standard 'British type' flashing tail lamps.

G.2  Lamp brackets for locomotives and passenger stock

G.2.1  Lamp brackets fitted on locomotives and passenger stock meeting the design set out in Figure 3 are suitable for use on vehicles that are likely to be at the leading or trailing end of a train.

Figure 3  Tail lamp bracket for freight wagons

G.2.2  For freight wagons the bracket can be welded or bolted to the end of the wagon.

G.2.3  The top half of the bracket is the interface with the portable lamp, it is permissible to modify the bottom half as necessary to facilitate the attachment of the bracket to the vehicle body in the most suitable manner.
Audibility and Visibility of Trains

Definitions

Audibility
The ability of an approaching train, through its warning device, to be heard at a predetermined distance by a person.

Leading vehicle
For the purpose of this document, a leading vehicle is a vehicle intended to be the first vehicle in a train formation when travelling in its normally designated direction but excluding vehicles being propelled during shunting movements.

On-track machine
Any rail-mounted machine, whose primary function is for the renewal, maintenance, inspection or measurement of the infrastructure, meeting the requirements set out in GM/RT2400 and permitted to be moved, either self-propelled or in train formation, outside of a possession. This definition includes all vehicles classified as on-track machines in accordance with section 6.4 of GM/RT2000 issue two.

Shunting locomotive
A rail vehicle primarily designed for shunting with a maximum design speed of no greater than 50 km/h (30 mph).

Vehicle axis
The longitudinal axis of the vehicle.

Visibility
For the purpose of this document, visibility is defined as the physical characteristics of an approaching train which enable it to be seen at a predetermined distance by a person whose eyesight and colour vision when assessed are found to be normal as set out in GE/RT8067.

Visual range
The maximum distance in metres for which the atmospheric properties are such that a black object of large size can be seen in daylight. Large in this sense means that the object would be resolved by the human eye at the viewed distance.

Warning horn
A horn, whistle or other audible device operated by a member of the train crew to warn people on or near the line of the approach or movement of a train.

Weighted sound pressure level
A numeric value of the sound pressure level after frequency weighting to simulate the frequency response of the human ear.
Audibility and Visibility of Trains

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.

RGSC 01 Railway Group Standards Code
RGSC 02 Standards Manual

Documents referenced in the text

Technical Specification for Interpretability
LOC & PAS TSI Locomotives and Passenger Rolling Stock TSI Regulation No. 1302/2014/EU (L356, 12.12.2014, p228)


Railway Group Standards
GE/RT8000 Rule Book
GE/RT8067 Personal Track Safety
GM/RT2000 Engineering Acceptance of Rail Vehicles
GM/RT2180 Visibility and Audibility Requirements for Trains
GM/RT2400 Engineering Design of On-track Machines in Running Mode
GMRT2483 Visibility Requirements for Trains
GMRT2484 Audibility Requirements for Trains

RSSB documents
GE/GN8640 Guidance on Planning an Application of the Common Safety Method on Risk Evaluation and Assessment
GE/GN8641 Guidance on System Definition
GE/GN8642 Guidance on Hazard Identification and Classification
GE/GN8643 Guidance on Risk Evaluation and Risk Acceptance
GE/GN8644 Guidance on Safety Requirements and Hazard Management
GE/GN8645 Guidance on Independent Assessment
T530 Research into Train Head Lamps Optical Performance

Other references
Publication CIE No. 54 Retroreflection Definition and Measurement (TC 2.3), 1982
Audibility and Visibility of Trains

Railway Group Standard
GM/RT2131
Issue One
Date December 2015

SI 2006/599 The Railways and Other Guided Transport Systems (Safety) Regulations 2006
SI 2011/3066 Railways (Interoperability) Regulations 2011
UIC 503 Continental wagons running in Great Britain (via the Channel Tunnel and on Network Rail Infrastructure) - General conditions (reference profile, axle-load, etc.) for the acceptance, in international traffic with Great-Britain, of 2-axle and bogie wagons registered with other UIC member RUs - 01 March 2007

Euronorms and British Standards
BR/TS0629 Equipment Specification for Portable head lamp System
BR/TS0630 Equipment Specification for Portable tail lamp System
BS 873-6:1983 Road traffic signs and internally illuminated bollards Specification for retroreflective and non-retroreflective signs
BS EN 15153-1:2013 Railway applications. External visible and audible warning devices for trains – Part 1: Head, marker and tail lamps
BS EN 50125-1:2014 Railway applications. Environmental applications – Environmental conditions for equipment
BS EN 60529:1992+A2:2013 Degrees of protection provided by enclosures (IP code)