AWS and TPWS Interface Requirements

Synopsis
This document defines the track / train and driver / machine interface requirements for the Automatic Warning System (AWS) and the Train Protection and Warning System (TPWS).

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Amended or additional parts of revised pages have been marked by a vertical black line in the adjacent margin.

**Superseded documents**

The following Railway Group Standard is superseded, either in whole or in part as indicated:

<table>
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<td>All</td>
<td>06 June 2015</td>
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GE/RT8075 issue one AWS and TPWS Interface Requirements, ceases to be in force and is withdrawn as of 06 June 2015.

**Supply**

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AWS and TPWS Interface Requirements

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AWS and TPWS Interface Requirements

Part 1 Purpose and Introduction

1.1 Purpose

1.1.1 This document mandates requirements for the functional operation, performance and application of the Automatic Warning System (AWS) and the Train Protection and Warning System (TPWS).

1.2 Introduction

1.2.1 Background

1.2.1.1 AWS is provided to give train drivers in-cab warnings of the approach to signals, reductions in permissible speed and temporary / emergency speed restrictions, and to apply the brakes in the event that a driver does not acknowledge cautionary warnings given by the system within the specified time.

1.2.1.2 TPWS is a train protection system compliant with the train protection requirements of the Railway Safety Regulations: 1999. The primary purpose of TPWS is to minimise the consequence of a train passing a TPWS fitted signal at danger and a train overspeeding at certain other locations.

1.2.2 Principles

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

1.2.2.2 AWS and TPWS are the principal warning and train protection systems which are installed on most Network Rail lines and on most rolling stock operating over them. The only exceptions are certain lines which are fitted with mechanical trainstops, lines fitted with ETCS, and trains which operate only over those lines.

1.2.2.3 The principles of operation of AWS and TPWS are set out in GE/GN8675.

1.2.3 Supporting documents

1.2.3.1 The following Rail Industry Guidance Notes support this Railway Group Standard:

GE/GN8675 Guidance on AWS and TPWS Interface Requirements

1.3 Approval and authorisation of this document

1.3.1 The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 18 September 2014.

1.3.2 This document was authorised by RSSB on 13 November 2014.
Part 2  Track / Train Interface for AWS

2.1  AWS track sub-system

2.1.1  General requirements for AWS track equipment

2.1.1.1  AWS permanent magnets, including suppressor magnets, shall be mounted on the track with their south pole uppermost.

2.1.1.2  AWS electromagnets shall be mounted on the track with their north pole uppermost.

2.1.1.3  The magnetic centres of AWS magnets shall be positioned between the running rails, within 10 mm of the track centre line.

2.1.1.4  Where AWS magnets are used in combinations, as set out in Table 7, the distance between the magnetic centres of adjacent magnets, measured longitudinally along the track centre line, shall be not less than 0.70 m and not more than 0.75 m.

2.1.1.5  The uppermost surfaces of AWS magnets shall be not more than 12 mm above rail level.

2.1.1.6  The magnetic flux densities of AWS track magnets specified in 2.1.2 and 2.1.3 for standard strength magnets and in 2.1.4 and 2.1.5 for extra strength magnets shall apply throughout the planes above the magnet defined in Figure 1 and Table 1.

**Figure 1**  Defined magnetic field planes above AWS track magnet

<table>
<thead>
<tr>
<th>Type of AWS magnet</th>
<th>Dimension A in Figure 1 (mm)</th>
<th>Dimension B in Figure 1 (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard strength (except depot test magnets)</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>Extra strength (except depot test magnets)</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Depot test magnets</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

**Table 1**  Dimensions of magnetic field planes above AWS track magnet
2.1.2 Magnetic field requirements for standard strength track equipment

2.1.2.1 The minimum magnetic flux density of the magnetic field of a standard strength AWS magnet in free air shall conform to the limits set out in Table 2 throughout the plane above the magnet shown in Figure 1.

<table>
<thead>
<tr>
<th>Height above rail level (mm)</th>
<th>Minimum flux density (mT) for standard strength magnets</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>5.0</td>
</tr>
<tr>
<td>120</td>
<td>4.1</td>
</tr>
<tr>
<td>140</td>
<td>3.4</td>
</tr>
<tr>
<td>160</td>
<td>2.8</td>
</tr>
<tr>
<td>180</td>
<td>2.3</td>
</tr>
<tr>
<td>200</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 2 Magnetic flux densities for standard strength track equipment

2.1.2.2 The minimum flux densities set out in Table 2 shall apply to:

a) Permanent magnets, including portable magnets for temporary and emergency speed restrictions.

b) Electromagnets when energised.

c) Suppressor magnets when not suppressed.

2.1.2.3 For all types of standard strength magnets, except depot test magnets, the maximum flux density at 115 mm above rail level shall be 18 mT.

2.1.2.4 The maximum flux density produced by a de-energised standard strength electromagnet at 115 mm above rail level shall be 0.7 mT.

2.1.2.5 The maximum flux density produced by a suppressed standard strength magnet at 115 mm above rail level shall be 0.7 mT.

2.1.3 Magnetic field requirements for standard strength depot test magnets

2.1.3.1 For standard strength depot test magnets (where provided) the minimum and maximum magnetic flux density of the magnetic field in free air shall conform to the limits set out in Table 3 throughout the plane above the magnet shown in Figure 1.

<table>
<thead>
<tr>
<th>Height above rail level (mm)</th>
<th>Minimum flux density (mT) for standard strength depot test magnets</th>
<th>Maximum flux density (mT) for standard strength depot test magnets</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>4.8</td>
<td>5.0</td>
</tr>
<tr>
<td>120</td>
<td>3.9</td>
<td>4.1</td>
</tr>
<tr>
<td>140</td>
<td>3.2</td>
<td>3.4</td>
</tr>
<tr>
<td>160</td>
<td>2.6</td>
<td>2.8</td>
</tr>
<tr>
<td>180</td>
<td>2.1</td>
<td>2.3</td>
</tr>
<tr>
<td>200</td>
<td>1.8</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 3 Magnetic flux densities for standard strength depot test magnets
2.1.4 Magnetic field requirements for extra strength track equipment

2.1.4.1 The minimum magnetic flux density of the magnetic field of an extra strength AWS magnet in free air shall conform to the limits set out in Table 4 throughout the plane above the magnet shown in Figure 1.

<table>
<thead>
<tr>
<th>Height above rail level (mm)</th>
<th>Minimum flux density (mT) for extra strength magnets</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>6.5</td>
</tr>
<tr>
<td>140</td>
<td>6.1</td>
</tr>
<tr>
<td>160</td>
<td>5.7</td>
</tr>
<tr>
<td>180</td>
<td>5.3</td>
</tr>
<tr>
<td>200</td>
<td>5.0</td>
</tr>
<tr>
<td>220</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Table 4 Magnetic flux densities for extra strength track equipment

2.1.4.2 The minimum flux densities set out in Table 4 apply to:

a) Permanent magnets, including portable magnets for temporary and emergency speed restrictions.

b) Electromagnets when energised.

c) Suppressor magnets when not suppressed.

2.1.4.3 For all types of extra strength magnets, except depot test magnets, the maximum flux density at 193 mm above rail level shall be 20 mT.

2.1.4.4 The maximum flux density produced by a de-energised extra strength electromagnet at 193 mm above rail level shall be 1.2 mT.

2.1.4.5 The maximum flux density produced by a suppressed extra strength magnet at 115 mm above rail level shall be 1.2 mT.

2.1.5 Magnetic field requirements for extra strength depot test magnets

2.1.5.1 For extra strength depot test magnets (where provided) the minimum and maximum magnetic flux density of the magnetic field in free air shall conform to the limits set out in Table 5 throughout the plane above the magnet shown in Figure 1.

<table>
<thead>
<tr>
<th>Height above rail level (mm)</th>
<th>Minimum flux density (mT) for extra strength depot test magnets</th>
<th>Maximum flux density (mT) for extra strength depot test magnets</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>6.2</td>
<td>6.5</td>
</tr>
<tr>
<td>140</td>
<td>5.8</td>
<td>6.1</td>
</tr>
<tr>
<td>160</td>
<td>5.4</td>
<td>5.7</td>
</tr>
<tr>
<td>180</td>
<td>5.0</td>
<td>5.3</td>
</tr>
<tr>
<td>200</td>
<td>4.8</td>
<td>5.0</td>
</tr>
<tr>
<td>220</td>
<td>4.4</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Table 5 Magnetic flux densities for extra strength depot test magnets
AWS and TPWS Interface Requirements

2.1.6 Provision of AWS track equipment – lines to be fitted

2.1.6.1 AWS shall be fitted on all signalled lines, except those where an alternative train protection system providing a level of protection equivalent to or better than that provided by AWS and TPWS is fitted and operational on the infrastructure and on all trains operating on the route.

2.1.7 Provision of AWS track equipment – equipment to be provided

2.1.7.1 On fitted lines, AWS equipment shall be provided at signals in accordance with Table 6, except where AWS gaps are permitted by the provisions of 2.1.9.1.

<table>
<thead>
<tr>
<th>Type of signal at which AWS shall be fitted</th>
<th>Exemptions from fitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>All colour light signals</td>
<td>a) Signals that have no main signalled route leading up to them (including the platform starting signal nearest to the buffer stops on bay and terminal platform lines and signals provided solely for turnback moves).</td>
</tr>
<tr>
<td></td>
<td>b) Signals that give access to running lines from non-running lines where:</td>
</tr>
<tr>
<td></td>
<td>i) Trains usually come to a stand.</td>
</tr>
<tr>
<td></td>
<td>And</td>
</tr>
<tr>
<td></td>
<td>ii) Trap points are provided to protect the running line(s).</td>
</tr>
<tr>
<td></td>
<td>c) A colour light stop signal in a block signalling area where:</td>
</tr>
<tr>
<td></td>
<td>i) The stop signals controlled by adjacent signal boxes are not fitted with AWS track equipment.</td>
</tr>
<tr>
<td></td>
<td>And either:</td>
</tr>
<tr>
<td></td>
<td>ii) This signal cannot display a cautionary aspect.</td>
</tr>
<tr>
<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>iii) If the signal displays a cautionary aspect when the signal ahead is at danger, this aspect is approach released and preceded by a distant signal displaying an ON aspect.</td>
</tr>
<tr>
<td></td>
<td>This exemption from fitment does not apply, however, where a colour light signal controls entry to a single line. In these circumstances AWS track equipment shall be provided unless the signal is exempt under (a) above.</td>
</tr>
<tr>
<td>All semaphore distant signals and distant boards</td>
<td>None</td>
</tr>
</tbody>
</table>

Table 6 Provision of AWS at signals

2.1.7.2 AWS equipment shall be provided only at the locations and for the purposes set out in this document and in GK/RT0075 and GK/RT0192.

2.1.7.3 On bi-directionally signalled lines, AWS track equipment shall be provided for signalled train movements in both directions.
2.1.7.4 Magnets, or combinations of magnets, shall be provided and configured as set out in Table 7.

<table>
<thead>
<tr>
<th>Application</th>
<th>Magnets to be provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Colour light signal not capable of displaying a green aspect.</td>
<td>Permanent magnet (south pole).</td>
</tr>
<tr>
<td>b) Semaphore distant signal fixed at caution.</td>
<td>Permanent magnet (south pole) followed, in the direction of travel, by an electromagnet (north pole).</td>
</tr>
<tr>
<td>c) Fixed distant board.</td>
<td></td>
</tr>
<tr>
<td>d) Colour light signal capable of displaying a green aspect.</td>
<td>Permanent magnet (south pole), with electromagnets (north pole) both before and after the permanent magnet. (Where either of the signals is not capable of displaying a green (or distant signal ‘off’) aspect, the electromagnet for that signal is not required.)</td>
</tr>
<tr>
<td>e) Semaphore distant signal (except those fixed at caution).</td>
<td></td>
</tr>
<tr>
<td>f) Two colour light signals or semaphore distant signals for movements in opposite directions, sharing a common set of AWS track equipment.</td>
<td></td>
</tr>
<tr>
<td>g) Warning of an approach to a reduction in permissible speed.</td>
<td>Permanent magnet (south pole).</td>
</tr>
<tr>
<td>h) Warning of an approach to a level crossing.</td>
<td></td>
</tr>
<tr>
<td>i) Warning of an approach to a temporary or emergency speed restriction (where required by GK/RT0075).</td>
<td>Permanent magnet (south pole).</td>
</tr>
</tbody>
</table>

Table 7 Configurations of AWS track magnets

2.1.7.5 Where AWS is required to be suppressed, a suppressor magnet shall be provided instead of the permanent magnet.

2.1.7.6 Standard strength AWS magnets shall be used on lines that are not DC electrified.

2.1.7.7 Extra strength AWS magnets shall be used on DC third rail electrified lines.

2.1.8 Provision of AWS track equipment – position of equipment

2.1.8.1 AWS track equipment shall be positioned not less than three seconds running time at the permissible speed before the associated signal or sign.

2.1.8.2 AWS track equipment shall be positioned 180 m (+18 m, −9 m) before the associated signal or sign, except where any of the following apply:

a) On a section of line where existing AWS track equipment at successive signals is positioned 230 m (+23 m, −11.5 m) before signals, it is permissible for new AWS track equipment also to be positioned at this distance, provided that this does not create additional risk.
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b) On bi-directionally signalled platform lines, it is permissible to position AWS track equipment at distances other than those specified above where common AWS track equipment is provided for signals applying in opposite directions, in order to achieve correct operation of the equipment for train movements.

c) Where the AWS magnet is positioned less than 180 m from the signal or sign so that the driver is able to read the associated signal aspect or sign when the audible warning is received.

d) On a non-passenger line on which permissive working is authorised, the AWS track equipment may be positioned beyond, but as close as practicable to, the signal.

e) Where infrastructure constraints prevent the installation of AWS equipment at the standard position.

f) Where an alternative position is required to meet the constraints set out in 2.1.8.3.

2.1.8.3 AWS equipment shall not be positioned:

a) Where a train is likely to come to a stand with the receiver for the active driving position over the AWS track equipment.

b) Within four seconds travelling time of any other AWS track equipment (calculated at the permissible speed), except where one or other of the sets of equipment is always suppressed for any movement over them.

c) Where AWS equipment could interfere with the correct operation of Automatic Power Control (APC) equipment, or vice versa.

d) Where the correct operation of the AWS track equipment could be jeopardised by the proximity of DC traction cables or impedance bonds. Specifically, on DC electrified lines, AWS track equipment shall not be positioned:

i) Less than 3.5 m from cross-track traction feeder cables, traction return bonds or impedance bonds.

ii) Less than 1.5 seconds travelling time (measured at the permissible speed) before cross-track traction feeder cables, traction return bonds or impedance bonds.

2.1.8.4 An SSC shall agree the position of the AWS track equipment where either:

a) The distance of the track equipment from the signal or sign is other than 180 m (+ 18 m, − 9 m).

Or

b) The AWS audible indication is received by the driver before the signal or sign becomes visible.
2.1.8.5 In considering the position of AWS track equipment, the SSC shall assess whether the positioning of the equipment will:

a) Help the driver to read the associated signal or sign safely.

And

b) Not create a risk that the driver fails to associate the audible warning with the signal or sign.

2.1.8.6 The following infrastructure features shall not be positioned between a signal or sign and its associated AWS track equipment:

a) Another main signal applicable to movements in the same direction.

b) A warning indicator for a reduction in permissible speed.

c) A warning board for a temporary or emergency speed restriction.

d) Other AWS equipment applicable to movements in the same direction.

2.1.8.7 Where a signal controls train movements from a running line not fitted with AWS track equipment to a running line that is fitted, one of the following arrangements shall apply:

a) Where there is a turnout from a through running line not fitted with AWS onto an AWS fitted line, AWS track equipment shall be provided for the stop signal controlling the movement onto the fitted line. The track equipment shall incorporate provision for suppression, and shall be positioned beyond, but as close as practicable to, the signal.

The signals that display cautionary aspects associated with the stop signal shall not be fitted with AWS.

Or

b) Where a running line not fitted with AWS converges with an AWS fitted line, the stop signal controlling movements from the unfitted line to the fitted line and any associated signals displaying cautionary aspects shall be fitted with AWS track equipment in accordance with the requirements set out in 2.1.6.

2.1.9 AWS gap areas

2.1.9.1 When an existing signalling layout incorporating an AWS gap area (a station area not fitted with AWS track equipment) is resignalled, AWS track equipment shall be provided, unless both of the following apply:

a) Permissible speeds in the unfitted area do not exceed 50 km/h (30 mph).

And

b) A risk assessment shows that absence of AWS track equipment within the gap area does not introduce an unacceptable risk.

2.1.9.2 The geographical limits of an AWS gap shall be clearly identifiable.
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2.1.9.3 Lineside signs shall be provided to indicate the commencement and termination of the AWS gap on all running lines that provide entry to or exit from the gap area as follows:

a) A 'commencement of AWS gap' lineside sign shall be provided at or beyond the last fitted signal and before the position where the AWS track equipment for the next signal would have been, had it been provided.

And

b) A 'termination of AWS gap' sign shall be provided beyond the last signal not fitted with AWS and not less than four seconds' travelling time at the permissible speed before the AWS track equipment for the first fitted signal.

2.1.10 Control of AWS track equipment

2.1.10.1 The AWS electromagnet shall be energised only when the associated colour light signal is displaying a green aspect, or when the associated semaphore distant signal is intentionally displaying the OFF aspect.

2.1.10.2 In the case of a splitting distant signal, the AWS electromagnet shall be energised if either signal colour light head is displaying a green aspect.

2.1.10.3 Where an AWS magnet is positioned beyond the signal, as set out in 2.1.8.2d), the AWS track equipment shall be controlled to provide an indication that is consistent with the aspect seen by the driver at the time of passing the signal.

2.1.10.4 Where a suppressed AWS magnet is situated beyond the signal protecting a turnout from a through unfitted line, as set out in 2.1.8.7, the magnet shall be suppressed for movements along the unfitted line.

2.1.10.5 For movements through the turnout onto the fitted line, the AWS track equipment shall be controlled to provide an indication that is consistent with the aspect seen by the driver at the time of passing the signal controlling the movement onto the fitted line.

2.1.11 Suppression of AWS track equipment

2.1.11.1 On bi-directionally signalled lines, except where AWS track equipment is effective for movements in both directions, as set out in Table 7 item f), the magnetic field of the AWS track equipment shall be suppressed for signalled movements in the direction to which the equipment does not apply, except as permitted by 2.1.11.4 and 2.1.11.5.

2.1.11.2 Suppression shall be effective from before the vehicle on which the receiver for the active driving position is mounted has reached the AWS track equipment until that vehicle has passed over the AWS track equipment.

2.1.11.3 Where a semaphore junction signal has both stop and distant arms but the distant arm(s) are not applicable to all routes, the AWS equipment shall be suppressed when the signal is cleared for a route to which the distant arm(s) is / are not applicable.

2.1.11.4 It is permissible for AWS track equipment not to be suppressed for:

a) Shunting movements on unidirectionally signalled lines.

b) Unsignalled movements.
c) Movements over AWS magnets associated with warning boards for temporary / emergency restrictions that are not applicable to the direction of movement.

2.1.11.5 On lightly used single lines it is permissible for AWS track equipment not to be suppressed for movements in the direction to which the AWS indication does not apply where this is justified by a risk assessment.

2.1.11.6 Provision or non-provision of suppression of AWS track equipment shall be applied consistently on all single line sections on an operating route.

2.1.12 AWS cancelling indicators

2.1.12.1 Where AWS track equipment is not suppressed for signalled movements in the opposite direction, as permitted by 2.1.11.4c) and 2.1.11.5, an AWS cancelling indicator shall be provided for each set of track equipment.

2.1.12.2 The AWS cancelling indicator shall be positioned:

a) 180 m (+ 18 m, – 9 m) beyond the AWS track equipment in the direction of movement to which the equipment does not apply.

And

b) Facing trains travelling in the direction to which the AWS track equipment does not apply.

2.1.12.3 The AWS cancelling indicator shall be positioned so that it is readable from the normal driving position when the train passes over the unsuppressed track equipment.

2.2 AWS train sub-system

2.2.1 Provision of trainborne AWS equipment

2.2.1.1 AWS trainborne equipment shall be fitted to all vehicles that have a driving cab, with the exception of the following types of vehicles:

a) Locomotives used exclusively for shunting purposes.

b) Vehicles that operate solely within T3 possessions.

c) Vehicles that are authorised to operate only on lines where an alternative train protection system providing a level of protection equivalent to or better than that provided by AWS and TPWS is fitted and operational on both the trains and the infrastructure.

2.2.1.2 It is permissible to suppress the operation of the AWS train sub-system when an alternative train protection system providing a level of protection equivalent to or better than that provided by AWS and TPWS is fitted and operational on the train and on the track over which the train is operating.

2.2.2 Receiver sensitivity requirements for AWS train sub-system

2.2.2.1 AWS receivers shall be capable of detecting the sequences and polarities of magnetic fields emitted by the configurations of AWS track magnets set out in Table 7.

2.2.2.2 On lines fitted with standard strength magnets, the trainborne equipment shall be capable of detecting the minimum field strengths set out in Table 8, measured in free air at the heights above rail level set out in the table and directly above the track centre line.
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<table>
<thead>
<tr>
<th>Height above rail level (mm)</th>
<th>Flux density (mT) which trainborne AWS equipment shall detect</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>4.8</td>
</tr>
<tr>
<td>120</td>
<td>3.9</td>
</tr>
<tr>
<td>140</td>
<td>3.2</td>
</tr>
<tr>
<td>160</td>
<td>2.6</td>
</tr>
<tr>
<td>180</td>
<td>2.1</td>
</tr>
<tr>
<td>200</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Table 8  Magnetic flux densities for standard strength AWS receivers

2.2.2.3 On lines fitted with extra strength magnets, the trainborne equipment shall be capable of detecting the minimum field strengths set out in Table 9, measured in free air at the heights above rail level set out in the table and directly above the track centre line.

<table>
<thead>
<tr>
<th>Height above rail level (mm)</th>
<th>Flux density (mT) which trainborne AWS equipment shall detect</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>6.2</td>
</tr>
<tr>
<td>140</td>
<td>5.8</td>
</tr>
<tr>
<td>160</td>
<td>5.4</td>
</tr>
<tr>
<td>180</td>
<td>5.0</td>
</tr>
<tr>
<td>200</td>
<td>4.8</td>
</tr>
<tr>
<td>220</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Table 9  Magnetic flux densities for extra strength AWS receivers

2.2.2.4 Trainborne AWS equipment shall not detect magnetic fields producing a flux density less than 1.5 mT at a height of 115 mm above rail level and directly above the track centre line.

2.2.2.5 AWS receivers shall be positioned so that:

a) They are within 18 m of all the driving positions in the cabs that they provide with indications.

b) The time delay experienced by the driver between passing over a track magnet and receiving the audible warning, for a given speed, is consistent for all rolling stock of the same class.

c) The trainborne AWS equipment will not respond to the magnetic fields of APC magnets.

d) So far as is practicable, the trainborne AWS equipment will not respond to extraneous magnetic fields from DC traction supply infrastructure or impedance bonds.
2.2.2.6 Each AWS equipped vehicle of an electric train that operates over both AC and DC electrified lines shall be fitted with two separate receivers, or one receiver with switchable sensitivity, with appropriate sensitivities for use on DC electrified lines, as set out in Table 9, and on other lines, as set out in Table 8.

2.2.2.7 Where switchable receiver sensitivities are provided (in accordance with 2.2.2.6), the appropriate receiver or receiver sensitivity for the line over which the train is passing shall be selected automatically.

2.2.2.8 So far as is reasonably practicable, on trains that are fitted with AWS receivers with switchable sensitivity for operation on DC electrified lines and on other lines (in accordance with 2.2.2.6), a failure of the automatic selection sub-system shall cause the receiver(s) to default to the ‘other lines’ configuration.

2.2.3 Operation of trainborne AWS equipment

2.2.3.1 The interface between the AWS and the train brake system shall enable an emergency brake application, or where available an enhanced emergency brake application, to be initiated and cancelled.

2.2.3.2 Each vehicle shall be fitted with an isolation device to enable the trainborne AWS equipment to be isolated. Requirements for the controlling device and associated indications are set out in Part 4.

2.2.3.3 The trainborne AWS equipment shall be capable of operating at train speeds up to at least the lower of:

a) The maximum permissible speed of the vehicle in which it is installed.

And

b) The maximum speed at which the AWS is required to be operational.

2.2.3.4 The trainborne AWS equipment shall be capable of operating down to a minimum speed of 5 km/h.

2.2.3.5 The trainborne AWS equipment shall respond within 100 ms to:

a) Detection of the presence of magnetic fields of the relevant flux densities set out in 2.1.2 and 2.1.4.

And

b) Operation of the caution acknowledgement device.

2.2.4 AWS functional requirements and states

2.2.4.1 The trainborne AWS equipment shall comply with the functional requirements set out in Table 10 to Table 18. The functional requirements are expressed in the form of functional states and the transitions between them.
2.2.4.2 The rows in each table have the following meanings:

<table>
<thead>
<tr>
<th>State</th>
<th>Indicates the state that the table is describing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid preceding state(s)</td>
<td>Indicates which state(s) (functional or non-functional) it is permissible for the equipment to have been in prior to entering this state.</td>
</tr>
<tr>
<td>Entry conditions</td>
<td>Indicates the conditions that shall be satisfied before this state is entered. The equipment shall also be in one of the defined valid previous states in order to enter this state.</td>
</tr>
<tr>
<td>Events on entry</td>
<td>Indicates the events that shall take place immediately upon entry into this state.</td>
</tr>
<tr>
<td>Status during state</td>
<td>Indicates the status of the equipment that shall be maintained while it is in this state.</td>
</tr>
<tr>
<td>Exit conditions</td>
<td>Indicates the conditions that shall be fulfilled before the equipment can move from this state to another one.</td>
</tr>
<tr>
<td>Next valid state(s)</td>
<td>Indicates which functional states it is permissible for the equipment to move to on leaving this state.</td>
</tr>
</tbody>
</table>

2.2.4.3 The operational ready state shall be the normal operational state of the trainborne AWS equipment on initialisation. The equipment shall return to the operational ready state after having passed over a set of AWS track magnets and, where appropriate, the driver has responded to the audible warning given in response to the track magnets.

<table>
<thead>
<tr>
<th>State</th>
<th>Operational ready state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid preceding state(s)</td>
<td>Clear signal response state, or</td>
</tr>
<tr>
<td></td>
<td>Restrictive acknowledgement state, or</td>
</tr>
<tr>
<td></td>
<td>Brake demand acknowledgement state, or</td>
</tr>
<tr>
<td></td>
<td>System isolation state.</td>
</tr>
<tr>
<td></td>
<td>The equipment also enters this state on initialisation after a self-test routine has been satisfactorily completed, as set out in 2.2.5</td>
</tr>
<tr>
<td>Entry conditions</td>
<td>See exit conditions of valid preceding states</td>
</tr>
<tr>
<td>Events on entry</td>
<td>None</td>
</tr>
<tr>
<td>Status during state</td>
<td>Equipment is capable of detecting south pole magnetic fields of AWS track equipment, and</td>
</tr>
<tr>
<td></td>
<td>Audible indicator is silent, and</td>
</tr>
<tr>
<td></td>
<td>Visual indicator is maintained in its last set indication (‘all black’ or ‘black and yellow’), and</td>
</tr>
<tr>
<td></td>
<td>No AWS brake demand is applied</td>
</tr>
<tr>
<td>Exit conditions</td>
<td>South pole of an AWS track magnet is detected</td>
</tr>
<tr>
<td>Next valid state(s)</td>
<td>Primed state</td>
</tr>
</tbody>
</table>

2.2.4.4 The trainborne AWS equipment shall enter the primed state when it has passed over the south pole of an AWS track magnet and is waiting to determine whether there is an energised electromagnet (north pole) immediately after it.
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State | Primed state
--- | ---
Valid preceding state(s) | Operational ready state
Entry conditions | South pole of an AWS track magnet is detected
Events on entry | Visual indicator changes to ‘all black’ (if it was previously at ‘black and yellow’)
Status during state | Equipment capable of detecting the north pole of an AWS track magnet,
| Audible warning indicator is silent, and
| Visual indicator is at ‘all black’, and
| No AWS brake demand is applied
Exit conditions | North pole of an AWS track magnet is detected within one second (+0.0, −0.1 seconds) of having entered the primed state (in which case the trainborne equipment moves to the clear signal response state), or
| Automatic exit occurs one second (+0.0, −0.1 seconds) after the primed state was entered, if a north pole is not detected (in which case the trainborne equipment moves to the restrictive response state). The one second period is known as the Initial Delay Period
Next valid state(s) | Clear signal response state, or
| Restrictive response state

Table 11 Primed state

2.2.4.5 The trainborne AWS equipment shall enter the clear signal response state when it has passed over AWS track equipment associated with a signal that is displaying a green aspect or a semaphore distant signal showing ‘off’.

State | Clear signal response state
--- | ---
Valid preceding state(s) | Primed state
Entry conditions | North pole of an AWS track magnet detected
Events on entry | Audible ‘clear’ indication given, as set out in 4.2.2.3
Status during state | Visual indicator maintained at ‘all black’, and
| No AWS brake demand is applied
Exit conditions | Automatic exit occurs when the audible ‘clear’ indication has finished
Next valid state(s) | Operational ready state

Table 12 Clear signal response state

2.2.4.6 The trainborne AWS equipment shall enter the restrictive response state when it has passed over AWS track equipment associated with a signal that is displaying an aspect other than green (or other than ‘off’ in the case of a semaphore distant signal), or that is associated with a warning for a reduction in permissible speed, a temporary / emergency speed restriction or the approach to a level crossing.
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<table>
<thead>
<tr>
<th>State</th>
<th>Restrictive response state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid preceding state(s)</td>
<td>Primed state</td>
</tr>
<tr>
<td>Entry conditions</td>
<td>Initial delay period expires without detecting a north pole magnet during that period</td>
</tr>
<tr>
<td>Events on entry</td>
<td>Audible warning indication given, as set out in 4.2.2.2, which continues until the equipment exits from this state</td>
</tr>
<tr>
<td>Status during state</td>
<td>Equipment capable of accepting a caution acknowledgement (by operation of the caution acknowledgement device), and Visual indicator maintained at ‘all black’, and No AWS brake demand is applied</td>
</tr>
<tr>
<td>Exit conditions</td>
<td>Caution acknowledgement device is operated within the caution acknowledgement delay period, in which case the restrictive acknowledgement state is entered, or Automatic exit occurs if the caution acknowledgement device is not operated within the caution acknowledgement delay period, in which case the brake demand non-acknowledgement state is entered</td>
</tr>
<tr>
<td>Next valid state(s)</td>
<td>Restrictive acknowledgement state, or Brake demand non-acknowledgement state</td>
</tr>
</tbody>
</table>

Table 13  Restrictive response state

2.2.4.7 The caution acknowledgement delay period shall be as follows:

a) For trains authorised to operate at speeds above 160 km/h (100 mph) and which have a braking capability less than 9% g, the caution acknowledgement delay period shall be 2.0 seconds (+/− 0.25 seconds) after entering the restrictive response state.

b) For trains authorised to operate at speeds up to and including 160 km/h (100 mph) the caution acknowledgement delay period shall be no less than 2.0 seconds (+/− 0.25 seconds) and no greater than 2.7 seconds (+/− 0.25 seconds) after entering the restrictive response state.

c) For trains authorised to operate at speeds above 160 km/h (100 mph) which have a braking capability of 9% g or greater, the caution acknowledgement delay period shall be no less than 2.0 seconds (+/− 0.25 seconds) and no greater than 2.7 seconds (+/− 0.25 seconds) after entering the restrictive response state.

2.2.4.8 The trainborne AWS equipment shall enter the restrictive acknowledgement state when a driver has acknowledged receipt of an AWS warning by operation of the caution acknowledgement device.
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State | Restrictive acknowledgement state
--- | ---
Valid preceding state(s) | Restrictive response state
Entry conditions | Driver operates the caution acknowledgement device
Events on entry | Visual indicator changes to ‘black and yellow’, and Audible warning indication is silenced
Status during state | No AWS brake demand is applied and Visual indicator maintained at ‘black and yellow’, and Audible indicator is silent
Exit conditions | Automatic exit occurs when the entry events have been completed
Next valid state(s) | Operational ready state

Table 14  Restrictive acknowledgement state

2.2.4.9 The trainborne AWS equipment shall enter the brake demand non-acknowledgement state when a driver has failed to acknowledge receipt of an AWS warning by operation of the caution acknowledgement device within the caution acknowledgement period.

State | Brake demand non-acknowledgement state
--- | ---
Valid preceding state(s) | Restrictive response state
Entry conditions | Driver fails to operate caution acknowledgement device within the caution acknowledgement period
Events on entry | AWS brake demand is initiated and maintained
Status during state | Equipment capable of accepting a caution acknowledgement (by operation of the caution acknowledgement device), and Audible warning indication continues, as set out in 4.2.2.2, and Visual indicator maintained at ‘all black’
Exit conditions | Driver operates caution acknowledgement device
Next valid state(s) | Brake demand acknowledgement state

Table 15  Brake demand non-acknowledgement state

2.2.4.10 The trainborne AWS equipment shall enter the brake demand acknowledgement state when a driver has acknowledged receipt of an AWS warning by operation of the caution acknowledgement device following the expiration of the caution acknowledgement period.
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<table>
<thead>
<tr>
<th>State</th>
<th>Brake demand acknowledgement state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid preceding state(s)</td>
<td>Brake demand non-acknowledgement state</td>
</tr>
<tr>
<td>Entry conditions</td>
<td>Driver operates the caution acknowledgement device</td>
</tr>
<tr>
<td>Events on entry</td>
<td>Visual indicator changes to ‘black and yellow’, and Audible warning indication is silenced</td>
</tr>
<tr>
<td>Status during state</td>
<td>After satisfying the conditions in 2.2.4.11, the AWS brake demand is cancelled</td>
</tr>
<tr>
<td>Exit conditions</td>
<td>Automatic exit occurs when the brake demand has been cancelled</td>
</tr>
<tr>
<td>Next valid state(s)</td>
<td>Operational ready state</td>
</tr>
</tbody>
</table>

Table 16 Brake demand acknowledgement state

2.2.4.11 The AWS brake demand shall be cancelled not less than 59 seconds after the brake demand has been initiated, and following operation of the caution acknowledgement device and the brake release action set out in Part 4.

2.2.4.12 In the suppressed state the trainborne AWS equipment shall remain operational but shall not provide any indications to the driver or initiate any brake demands.

<table>
<thead>
<tr>
<th>State</th>
<th>AWS suppressed state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid preceding state(s)</td>
<td>Any state</td>
</tr>
<tr>
<td>Entry conditions</td>
<td>AWS suppression requested by another train control system or by manual input</td>
</tr>
<tr>
<td>Events on entry</td>
<td>AWS brake demand (if it has been initiated) is maintained unless the alternative train control system has the facility to apply appropriate controls, and Audible indicator is silenced (if it was previously operative), and Visual indicator changes to default indication (if this is defined for the type of indicator), or does not change (if no default indication is defined), and System status indicator indicates that trainborne AWS equipment is suppressed</td>
</tr>
<tr>
<td>Status during state</td>
<td>No AWS brake demand is applied, and Visual indicator does not change, and Audible warning indicator is silent</td>
</tr>
<tr>
<td>Exit conditions</td>
<td>Request for AWS suppression removed</td>
</tr>
<tr>
<td>Next valid state(s)</td>
<td>Operational ready state (unless entry to an alternative state is controlled by suppressing system)</td>
</tr>
</tbody>
</table>

Table 17 AWS suppressed state

2.2.4.13 In the system isolation state the trainborne AWS equipment shall be inoperative.

Uncontrolled When Printed
Document comes into force and supersedes GERT8075 Iss 1 as of 06/06/2015.
Amendments to this document are published on RSSB Standards Catalogue http://www.rssb.co.uk/railway-group-standards
Superseded by GERT8075 Iss 3 and RIS-0775-CCS Iss 1 with effect from 03/03/2018.
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<table>
<thead>
<tr>
<th>State</th>
<th>System isolation state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid preceding state(s)</td>
<td>Any state</td>
</tr>
<tr>
<td>Entry conditions</td>
<td>System isolation device operated so as to isolate the trainborne AWS equipment</td>
</tr>
<tr>
<td>Events on entry</td>
<td>AWS brake demand is cancelled (if it has been initiated), and</td>
</tr>
<tr>
<td></td>
<td>Audible indicator is silenced (if it was previously operative), and</td>
</tr>
<tr>
<td></td>
<td>Visual indicator changes to default indication (if this is defined for the type of indicator), or does not change (if no default indication is defined), and</td>
</tr>
<tr>
<td></td>
<td>Isolation indicator indicates that trainborne AWS equipment is isolated</td>
</tr>
<tr>
<td>Status during state</td>
<td>No AWS brake demand is applied, and</td>
</tr>
<tr>
<td></td>
<td>Visual indicator does not change, and</td>
</tr>
<tr>
<td></td>
<td>Audible warning indicator is silent</td>
</tr>
<tr>
<td>Exit conditions</td>
<td>System isolation device is operated so as to restore the AWS to its functional condition</td>
</tr>
<tr>
<td>Next valid state(s)</td>
<td>Operational ready state</td>
</tr>
</tbody>
</table>

### Table 18  System isolation state

#### 2.2.5 Trainborne AWS equipment self-test capability

2.2.5.1 The trainborne AWS equipment shall have a built-in self-test routine which, as a minimum, tests the following features:

a) That the audible and visual indications operate correctly when required to do so.

And

b) That an AWS brake demand is requested when required.

2.2.5.2 The AWS power-up test routine, as set out in 4.3.1, shall be initiated whenever the train is powered up or, in the case of dual cab trains, when the driver changes cab.

2.2.5.3 An AWS self-test routine shall also be conducted automatically when a train enters a portion of line where the trainborne AWS equipment is required to be active, having previously been suppressed.

2.2.5.4 When carrying out an AWS self-test in the circumstances of 2.2.5.3, it is not necessary to test that a brake demand is requested if this has been done when the train or cab was powered up.

2.2.5.5 On successful completion of the test routine the trainborne AWS equipment shall move to the operational ready state.

2.2.5.6 Failure to complete the self-test successfully shall result in an appropriate and distinct warning being given to the driver.
2.3 AWS route compatibility assessment requirements

2.3.1 If on a route it is proposed to replace AWS track equipment of one type (standard or extra strength) by equipment of the other type, the infrastructure manager shall assess the risks of so doing, taking into account the types of AWS receivers fitted to trains that operate on the route.

2.3.2 Where route compatibility is being assessed, as set out in GE/RT8270, the AWS receiver arrangements on a train shall be assessed to determine whether they are compatible with the type of AWS track equipment on the route over which the train is to operate.

2.3.3 Where it is necessary for a train not fitted with AWS equipment to operate over an AWS fitted line, except where an alternative train protection system providing a level of protection equivalent to or better than that provided by AWS and TPWS is fitted and in use on both the trains and the infrastructure, the infrastructure manager and railway undertaking shall agree, document and implement appropriate operating procedures to ensure the safe movement of trains.
Part 3  Track / Train Interface for TPWS

3.1  TPWS track sub-system

3.1.1  Positioning of TPWS track equipment

3.1.1.1  TPWS track transmitters shall be positioned between the running rails on the longitudinal centre line of the track.

3.1.2  Magnetic field requirements of TPWS track equipment

3.1.2.1  When the track transmitters are energised, the TPWS track sub-system shall transmit the appropriate pair of frequencies set out in Tables 19 and 20 as unmodulated sinusoidal carriers, with a tolerance of ± 10 Hz.

<table>
<thead>
<tr>
<th>Frequency set</th>
<th>Arming frequency</th>
<th>Trigger frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSS frequency set A</td>
<td>64.25 kHz (f1)</td>
<td>65.25 kHz (f2)</td>
</tr>
<tr>
<td>OSS frequency set B</td>
<td>64.75 kHz (f4)</td>
<td>65.75 kHz (f5)</td>
</tr>
</tbody>
</table>

Table 19  Track transmitter frequencies for overspeed protection functionality

<table>
<thead>
<tr>
<th>Frequency set</th>
<th>Arming frequency</th>
<th>Trigger frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS frequency set A</td>
<td>66.25 kHz (f3)</td>
<td>65.25 kHz (f2)</td>
</tr>
<tr>
<td>TSS frequency set B</td>
<td>66.75 kHz (f6)</td>
<td>65.75 kHz (f5)</td>
</tr>
</tbody>
</table>

Table 20  Track transmitter frequencies for train stop functionality

3.1.2.2  The magnetic fields emitted from TSS track transmitters and standard OSS track transmitters shall comply with the magnetic field strength parameters set out in Appendices C and E.

3.1.2.3  The magnetic fields emitted from miniature OSS track transmitters shall comply with the magnetic field strength parameters set out in Appendices D and E.

3.1.2.4  The magnetic fields emitted from TSS track transmitters shall, in the area between the 90 nT zones of the two track transmitter loops shown in Appendix C, over the same height / offset profile as shown in Appendix E:

a)  Be greater than 45 nT from both track transmitters throughout the area.

b)  Not exhibit any inflection or reversal of slope of the magnetic field.

c)  Be greater than 70 nT at the point where their magnetic field strengths are equal.

3.1.2.5  It is permissible to use either sequence of track transmitter frequencies to provide the appropriate function for either direction of operation, subject to meeting the requirements of 3.1.2.6.

3.1.2.6  It is permissible to interleave or nest TSS or OSS transmitters using one set of frequencies (set A or set B) with TSS or OSS transmitters of the other set of frequencies. TSS or OSS transmitters of the same frequency set shall not be interleaved or nested.
AWS and TPWS Interface Requirements

3.1.3 Provision of TPWS track equipment

3.1.3.1 TPWS track sub-system equipment shall be provided on all passenger lines at the locations specified in 3.1.3.2 to 3.1.3.8, except where exemptions are permitted by 3.1.4.

3.1.3.2 TPWS shall be provided on passenger lines at all main stop signals and stop boards that protect crossing or converging movements with any running line or siding.

3.1.3.3 TPWS shall be provided at any main stop signal on a non-passenger line that protects a crossing of, or convergence with, a passenger line.

3.1.3.4 TPWS shall be provided at a stop signal where conflicting movements could take place in the overlap of the next stop signal ahead.

3.1.3.5 On non-track circuit block lines with a semaphore equivalent aspect sequence, TPWS shall be provided at the first home signal at the end of a block section where conflicting movements could take place within station limits ahead.

3.1.3.6 It is permissible to provide TPWS at other signals where required for mitigation of SPAD risk, as set out in GK/RT0045.

3.1.3.7 TPWS shall be provided on the approach to the buffer stop at the end of a passenger platform.

3.1.3.8 TPWS shall be provided on the approach to speed restrictions where the permitted speed on the approach is 60 mph or more and the speed restriction reduces the speed by at least one-third, except for:

a) Temporary speed restrictions in place for three months or less. And

b) Temporary speed restrictions in place for between three months and twelve months, subject to risk assessment, as set out in 3.1.4.2.

3.1.3.9 TPWS miniature loops shall be used as OSS transmitters only where the speed of trains does not exceed 40 mph.

3.1.4 Exemptions to provision of TPWS track equipment

3.1.4.1 The TPWS track sub-system is not required to be provided in the circumstances set out below:

a) Where an alternative train protection system providing a level of protection equivalent to or better than AWS and TPWS is fitted and operational on the infrastructure and on all trains operating on the route.

b) At a signal used solely for shunting purposes.

c) At a stop signal that protects only a convergence of a passenger running line with a locally operated emergency crossover.

d) At a stop signal that protects a crossing or convergence with a passenger running line, where the track layout and interlocking controls would prevent a collision at the crossing or convergence in the event of a SPAD.

e) At a stop signal that protects only a convergence with a siding that is secured out of use in accordance with GE/RT8000.
f) Where a permissible speed indicator is provided to indicate a permissible
speed that has been imposed solely to reduce the dynamic loading on track
systems from rail traffic.

g) Where the attainable speed on entry to the commencement of a speed
restriction is less than 60 mph, or less than the excessive speed defined for
the section of track.

h) Where a permissible speed indicator is provided on the approach to a
diverging junction where the risk from overspeeding on the diverging route is
mitigated by approach control of the signalling.

3.1.4.2 In the circumstances set out below, the TPWS track sub-system need be fitted
only where the results of a risk assessment show that the fitment of TPWS is
justified in order to reduce risk so far as reasonably practicable:

a) On the approach to a permissible speed indicator where, in order to prevent
unwarranted emergency brake applications on freight trains passing over the
TPWS OSS, the position of the OSS would have to be adjusted such that it
would provide no protection to any trains.

b) On the approach to a permissible speed indicator solely associated with a
plain line curve where there is a potential risk from derailment or overturning.

3.1.4.3 The TPWS track sub-system is not required to be operational in the
circumstances set out below:

a) When the track sub-system is to be disconnected, removed, replaced or
repositioned in accordance with engineering protection or possession
arrangements, as set out in GE/RT8000.

And

b) When the track sub-system is to be disconnected to facilitate other work,
provided that permission to disconnect has been obtained in accordance
with GE/RT8000.
3.1.5 Positioning of TPWS track equipment – TSS

3.1.5.1 Except where this is not practicable, TSS transmitters shall be positioned at or near the longitudinal position of the signal, as shown in Figure 2.

![Position of TSS transmitters](image)

Figure 2  Position of TSS transmitters

3.1.5.2 The distance from the centre of the TSS to the position on the track where the leading wheelset will cause the signal to be replaced to danger shall not be less than 3.5 m.

3.1.6 Positioning of TPWS track equipment – OSS

3.1.6.1 OSS transmitters shall be positioned to optimise their safety benefits, taking account of:

a) The braking performance of trains, as set out in GM/RT2045.

b) The attainable speeds of trains on the approach to the signal or other location.

c) The distance from the stop signal to the point of conflict at the crossing or convergence ahead.

d) The gradient of the line on the approach to the signal or other location.

e) The interleaving of other location OSS functions where signal OSS and TSS functions are, or will be, installed.

f) The potential for inhibition of the vehicle TPWS self-test on power-up.

g) The potential for unwarranted intervention during movements in the opposite direction on bi-directional or reversible lines.

3.1.6.2 The provision and positioning of the TPWS track sub-system shall be reviewed if a change to the infrastructure or the operational use of the railway is proposed which may affect the track layout, signal location, the attainable speed of trains, or the SPAD risk.

3.1.7 Control of TPWS track equipment

3.1.7.1 The track transmitters associated with signals shall be energised when the signal is controlled to danger.

3.1.7.2 The track transmitters provided at other locations shall always be energised when a train is passing over the transmitter on the line concerned.
3.2 TPWS train sub-system

3.2.1 Provision of trainborne TPWS equipment

3.2.1.1 The TPWS train sub-system shall be provided on all trains that operate over lines fitted with the TPWS track sub-system, except for:

a) Vehicles that operate solely in T3 possessions.

b) Shunting locomotives that are not fitted with AWS and that operate over a route which has been risk assessed to demonstrate that there is little or no risk from collision with trains on running lines.

c) Vehicles fitted with alternative train protection system(s) providing a level of protection equivalent to or better than that provided by AWS and TPWS that operate only over tracks fitted with the appropriate system(s).

3.2.1.2 The TPWS train sub-system is not required to be operational in the circumstances set out below:

a) The TPWS train sub-system may be temporarily isolated:
   i) When vehicles fitted with TPWS are working in a T3 possession.
   ii) When temporary block working is implemented and a train is required to pass signals at danger, with authority, in accordance with GE/RT8000.
   iii) On driving units with an active cab that is not at the front of the train, in accordance with GE/RT8000.

b) It is permissible to suppress the operation of the TPWS train sub-system when an alternative train protection system is fitted and operational on both the train and the track over which the train is to operate.

3.2.1.3 The TPWS receiver shall be positioned:

a) Behind the leading wheelset of the vehicle.

And

b) Within 2.3 m of the leading wheelset of the vehicle.

3.2.2 Receiver sensitivity requirements for TPWS train sub-system

3.2.2.1 The train sub-system shall be capable of detecting the magnetic fields emitted by the track sub-system, as set out in 3.1.2, when the active part of the receiver passes through the 90 nT region of the magnetic field shown in Appendix E.

3.2.2.2 The train sub-system shall respond to field strengths of 60 nT or more.

3.2.2.3 Once a magnetic field of 60 nT or more has been detected, detection shall be retained as long as the field strength remains above 30 nT, and shall be lost if the field strength falls below 10 nT.

3.2.2.4 To avoid spurious tripping during bi-directional operation, the train sub-system shall not hold detection of an arming frequency for a period greater than 150 milliseconds.

3.2.3 Operation of trainborne TPWS equipment at OSS

3.2.3.1 On detecting the presence of an OSS arming frequency as defined in Table 19, the train sub-system shall start the trigger delay timer.
AWS and TPWS Interface Requirements

3.2.3.2 The trigger delay timer shall be set to one of two timings, with an appropriate value for either:

a) Trains with a braking performance characteristic of a passenger train.

Or

b) Trains with a braking performance characteristic of a freight train.

3.2.3.3 The trigger delay timer shall be set to the appropriate value set out in Table 21.

<table>
<thead>
<tr>
<th>Set speed adjustment</th>
<th>Trigger delay timer settings (+/- 2 ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight train braking performance</td>
<td>1218 ms</td>
</tr>
<tr>
<td>Passenger train braking performance</td>
<td>974 ms</td>
</tr>
</tbody>
</table>

Table 21 Trigger delay timer settings

3.2.3.4 If the trigger delay timer reaches the trigger delay timer setting before detecting the appropriate trigger frequency, as set out in Table 19, the train sub-system shall reset and no brake application shall be made.

3.2.3.5 If the appropriate trigger frequency is detected before the trigger delay timer reaches the trigger delay timer setting, an emergency brake application, or where available an enhanced emergency brake application, shall immediately be initiated.

3.2.3.6 The train sub-system shall respond to valid OSS frequency sequences even when OSS transmitters are interleaved, as set out in 3.1.2.6. The train sub-system shall not make an OSS brake application in any other circumstance.

3.2.3.7 The brake application and the visual indication shall be maintained until:

a) At least 59 seconds have elapsed since the initiation of the brake application.

And

b) The train sub-system has received an acknowledgement from the driver.

3.2.3.8 The TPWS train sub-system shall respond correctly to valid frequencies from standard OSS transmitters at speeds from 15 mph (24 km/h) up to at least 125 mph (200 km/h) (-0 +10%).

3.2.3.9 The TPWS train sub-system shall respond correctly to valid frequencies from miniature OSS transmitters at speeds between 10 mph (16 km/h) and 40 mph (64 km/h).

3.2.4 Operation of trainborne TPWS equipment at TSS

3.2.4.1 The train sub-system shall detect the presence of a TSS arming frequency as defined in Table 19.

3.2.4.2 If, before detecting the loss of the arming frequency, the train sub-system detects the presence of the appropriate trigger frequency, an emergency brake application, or where available an enhanced emergency brake application, shall immediately be initiated.
3.2.4.3 The train sub-system shall not make a TSS brake application in any other circumstance.

3.2.4.4 The brake application and the visual indication shall be maintained until:

a) At least 59 seconds have elapsed since the initiation of the brake application.

And

b) The train sub-system has received an acknowledgement from the driver.

3.2.4.5 The TPWS train sub-system shall respond correctly to valid TSS frequencies at any speed greater than 0 mph (0 km/h) up to at least 125 mph (200 km/h) (-0 to +10%).

3.2.5 Trainborne TPWS equipment self-test

3.2.5.1 The TPWS shall perform a power-up test, as set out in 4.3.1, when the system is started, subject to awaiting initialisation of ETCS when the TPWS indications are presented by the ETCS DMI.

3.2.6 Trainborne TPWS equipment in-service monitoring

3.2.6.1 The TPWS shall undertake system monitoring while in service. System monitoring shall continue to be undertaken while the train is operating with TPWS suppressed, as set out in 3.2.1.2.

3.2.6.2 A TPWS fault that results in loss of the protection normally provided by TPWS shall be indicated as a fault, as set out in 4.3.2, but shall not apply the brakes solely due to the detection of the fault.

3.2.6.3 The in-service monitoring and fault display functions shall not disable or compromise the train stop or overspeed functionality of the TPWS, or the functionality of the AWS. Detection of a fault shall not suppress an existing brake demand.

3.2.6.4 Faults to be detected while the train is in service shall include:

a) Electrical continuity failure between the aerial and the control unit.

b) Degradation in signal transfer between the aerial and the control unit.

c) A control unit fault that could result in loss of TPWS protection.

3.2.6.5 A TPWS fault shall not be indicated solely as a result of powering up the system while the train is standing over an active TPWS loop.
AWS and TPWS Interface Requirements

Part 4 Driver / Machine Interface (DMI) for AWS and TPWS

4.1 Layout of Driver / Machine Interface (DMI)

4.1.1 AWS visual indications

4.1.1.1 An AWS visual indicator shall be provided in each driving cab, either as a separate indicator unit or incorporated into an integrated DMI (see Appendix G).

4.1.1.2 The AWS visual indicator shall be capable of providing two indications, ‘all black’ and ‘black and yellow’ (described in the Rule Book as the ‘normal’ and ‘warning’ indications respectively), in the form shown in Appendix A.

4.1.1.3 The AWS indications shall meet all the following requirements:

a) The indicator shall be circular, and shall have between eight and 10 narrow segments, with colours and size as depicted in Appendix A.

b) The indicator shall be in the field of vision of the driver when looking at the track ahead from the driving position(s) to which it applies.

c) The indications provided by the indicator shall be clearly visible from the driving position(s) to which the indicator applies, in all conditions of cab illumination.

d) Where duplicate indicators are provided in the same driving cab, they shall be synchronised in their operation.

4.1.2 AWS controls

4.1.2.1 An AWS caution acknowledgement device shall be provided in each driving cab.

4.1.2.2 The AWS caution acknowledgement device shall be in the form of a physical button, located where the driver can easily operate it when seated at the active driving position, but so that it is not operable from any other driving position.

4.1.2.3 It shall not be possible for a driver to give a caution acknowledgement to the trainborne AWS equipment by either:

a) Permanently operating the caution acknowledgement device.

Or

b) Operating the caution acknowledgement device before the restrictive response state is entered.

4.1.3 TPWS indications and controls

4.1.3.1 The TPWS Driver Machine Interface (DMI) shall be designed in accordance with the requirements set out in Appendix F when the TPWS DMI is provided as a separate group of physical control devices and indications which is not integrated into an ETCS DMI, and in Appendix G when TPWS indications and controls are integrated into the ETCS DMI.

4.1.3.2 A visual indication that the train sub-system has initiated a TPWS brake application shall be presented to the driver.

4.1.3.3 The visual indication shall distinguish between brake demands caused by TPWS TSS, TPWS OSS, and failure to acknowledge an AWS warning.
AWS and TPWS Interface
Requirements

4.1.3.4 The visual indication shall be a primary instrument, the design and positioning of which shall be in accordance with the requirements set out in GM/RT2161.

4.1.3.5 The train sub-system shall not permit the driver to use the train stop override or TPWS temporary isolation facilities to cancel a TPWS brake application.

4.1.3.6 A facility to override the train stop function shall be provided to allow the driver to pass a signal at danger without TPWS initiating a brake application. The override facility shall be positioned in the primary control area of the active driving cab.

4.1.3.7 When the train stop override facility has been operated, it shall remain active until either:
   a) One active TSS has been passed.
   Or
   b) Up to 60 seconds have elapsed.

4.1.3.8 Continuous operation of the train stop override facility shall not extend the active time of the override facility.

4.1.4 Isolation of AWS and TPWS

4.1.4.1 A facility shall be provided to fully isolate the AWS and TPWS train sub-systems (for example, in the event of equipment failure). The isolation device shall meet the requirements set out in GM/RT2185.

4.1.4.2 It shall be possible to isolate the trainborne AWS equipment independently of the isolation of TPWS equipment.

4.1.4.3 A facility shall be provided to allow temporary isolation of the TPWS train sub-system.

4.1.4.4 The TPWS temporary isolation device shall not be within reach of the driver from the normal driving position.

4.1.4.5 The driver shall be provided with a prominent visual indication that a temporary isolation has been effected. The visual indication shall be visible to the driver from the normal driving position.

4.2 Operation of Driver / Machine Interface (DMI)

4.2.1 Brake demand visual indications

4.2.1.1 When a cab is made operational, any override or temporary isolations previously applied to the train sub-system shall be removed automatically and any TPWS train sub-system faults shall be indicated to the driver.

4.2.1.2 Following the successful completion of the power-up test (see 4.3.1), all brake demand indicators shall be extinguished until AWS or TPWS initiates a brake demand.

4.2.1.3 The visual indicator for a SPAD brake demand shall flash when the TPWS aerial at the front of the train passes over an active TSS and a brake demand is initiated.

4.2.1.4 The visual indicator for an overspeed brake demand shall flash when the TPWS aerial at the front of the train passes over an active OSS and a brake demand is initiated.
AWS and TPWS Interface Requirements

4.2.1.5 The visual indicator for an AWS brake demand shall flash when a brake demand is initiated following an AWS caution warning that has not been acknowledged within the caution acknowledgement period.

4.2.1.6 The flashing brake demand visual indication shall change to steady when the driver has acknowledged the appropriate alert.

4.2.1.7 The brake demand indicators shall display the indications as shown in the state transition diagram in Appendix B. Transitions between indication states shall occur in accordance with the conditions shown in Appendix B.

4.2.1.8 When the TPWS train sub-system is suppressed, the TPWS DMI indicators (other than the fault indicator) shall be extinguished.

4.2.1.9 When the TPWS train sub-system is suppressed, the system shall continue to undertake in-service monitoring, as set out in 4.3.2, and any TPWS train sub-system faults shall be indicated to the driver.

4.2.2 AWS audible indications

4.2.2.1 Each driving cab shall be fitted with an AWS audible indicator that is capable of providing a ‘warning’ indication and a ‘clear’ indication. These two indications shall:

a) Be distinguishable from all other audible indications in the cab.

b) Have a sound level at least 10 dB above the expected ambient noise level, subject to a minimum of 65 dBA and a maximum of 95 dBA, at a distance of 1 m from the front of the equipment, measured as installed in the driving cab.

c) Be audible from all applicable driving positions and in all driving conditions.

4.2.2.2 The ‘warning’ indication shall be a steady alarm / horn with a frequency of 800 Hz (with a tolerance of +/- 20 Hz). The duration of the ‘warning’ indication is determined by the driver’s response to the indication, as set out in Table 13.

4.2.2.3 The ‘clear’ indication shall be a bell or simulated chime tone with a frequency of 1200 Hz (with a tolerance of +/- 30 Hz) and a duration of 0.5 to 1.5 seconds.

4.2.3 TPWS audible indications

4.2.3.1 There shall be separate and distinct audible alerts to inform the driver of brake demands due to:

a) Operation of the TSS (SPAD audible alert).

And

b) Operation of the OSS (overspeed audible alert).

4.2.3.2 The audible alerts for SPAD and overspeed events shall be speech messages, which shall be preceded by a short priming sound.

4.2.3.3 The speech message for a SPAD audible alert shall be:

‘SPAD alert, contact the signaller’.

4.2.3.4 The speech message for an overspeed audible alert shall be:

‘Overspeed, contact the signaller’.

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GE/RT8075
Issue Two
Date March 2015

Uncontrolled When Printed
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Amendments to this document are published on RSSB Standards Catalogue http://www.rssb.co.uk/railway-group-standards
Superseded by GERT8075 Iss 3 and RIS-0775-CCS Iss 1 with effect from 03/03/2018
AWS and TPWS Interface
Requirements

4.2.3.5 The TPWS audible alerts shall be implemented using the sound files included in Appendix H.

4.2.3.6 Once activated, the speech message shall be repeated, without the priming tone, with an interval of three seconds between the end of one announcement and the beginning of the next announcement, until acknowledged (see 4.2.4).

4.2.3.7 When the TPWS train sub-system initiates a TSS brake demand after it has initiated an OSS brake demand, the overspeed speech message shall be immediately terminated and replaced by the SPAD speech message.

4.2.3.8 Except in the circumstances set out in 4.2.3.7, at least one complete cycle of the speech message shall be played.

4.2.3.9 It shall not be possible for two or more TPWS speech messages to sound simultaneously.

4.2.3.10 It shall not be possible for any TPWS speech message and pre-announcement priming tone to sound simultaneously.

4.2.3.11 TPWS audible alerts shall not affect the operation of AWS audible indications.

4.2.3.12 If the alert has not been acknowledged 60 seconds after the brakes have been applied, the volume of the speech message shall be reduced by 6 dB.

4.2.4 Acknowledgment of visual and audible alerts

4.2.4.1 A SPAD alert shall be acknowledged by pressing and releasing the SPAD acknowledgement device on the TPWS DMI.

4.2.4.2 An overspeed alert shall be acknowledged by pressing and releasing the overspeed acknowledgement device on the TPWS DMI.

4.2.4.3 The visual alert shall change from flashing to steady immediately on detection of acknowledgement.

4.2.4.4 The audible alert shall continue, if necessary, to complete the first cycle of the speech message, as set out in 4.2.3.8, and shall then be silenced.

4.2.4.5 An AWS caution shall be acknowledged using the AWS caution acknowledgement device.

4.2.4.6 Acknowledgement of the AWS caution shall silence the AWS caution audible indication (horn) and change the AWS visual indicator to black and yellow.

4.2.4.7 Acknowledgement of the AWS caution shall, if an AWS brake demand has been initiated, change the AWS brake demand visual indication from flashing to steady.

4.2.4.8 It shall not be possible to acknowledge an AWS caution (whether or not a brake demand has been initiated) using the acknowledgement device associated with the AWS brake demand indicator on the TPWS DMI.

4.2.4.9 Operation of the AWS caution acknowledgement device following a TSS or OSS brake application shall not acknowledge the SPAD or overspeed alert.

4.2.5 Brake release

4.2.5.1 Following a brake application due to a TSS, OSS or AWS brake demand, the brakes shall not be released until the train has received the correct brake release action from the driver.
4.2.5.2 Following a brake application due to a TSS, OSS or AWS brake demand, the brakes shall not be released if the driver powers the cab down and back up again.

4.2.5.3 A brake release action shall only be effective if:

a) It is initiated at least 59 seconds after the initiation of the brake application.

And

b) All brake demand alerts have been acknowledged.

4.2.5.4 Following a brake application due to a TSS brake demand, the release of the brakes shall require both the SPAD acknowledgement device and the brake release control to be operated.

4.2.5.5 Following a brake application due to an OSS brake demand, the release of the brakes shall require both the overspeed acknowledgement device and the brake release control to be operated.

4.2.5.6 Following a brake application due to a failure to acknowledge an AWS caution warning within the caution acknowledgement period, the release of the brakes shall require both the AWS brake demand acknowledgement device and the brake release control to be operated.

4.2.5.7 When both an overspeed and an AWS brake demand have occurred, and the overspeed and AWS brake demand indicators are both illuminated, the brakes shall be released by operating the overspeed acknowledgement device together with the brake release control. Release of the brakes in this way shall clear all brake demand indications on the DMI panel.

4.2.5.8 When both an overspeed and an AWS brake demand have occurred, and the overspeed and AWS brake demand indicators are both illuminated, pressing and releasing the AWS brake demand acknowledgement device, together with the brake release control, shall extinguish the AWS brake demand indicator but shall not release the brakes. The OSS brake demand indicator shall remain lit.

4.2.6 Temporary isolation, train stop override and fault indicator

4.2.6.1 The temporary isolation indicator shall illuminate to steady (‘on’) when the TPWS is temporarily isolated.

4.2.6.2 Following a power-up test, the fault indicator shall not be illuminated unless a TPWS or AWS fault has been detected.

4.2.6.3 The fault indicator shall flash when a fault has been detected with the TPWS or AWS system, either during the power-up test or while the train is in service.

4.2.6.4 The train stop override indicator shall indicate to the driver when the TPWS train stop override has been activated.

4.2.6.5 Following a power-up test, the train stop override indicator shall not be illuminated until the train stop override function is activated.

4.2.6.6 The train stop override indicator shall illuminate to steady (‘on’) when the TPWS train stop override is active.
4.3 Fault detection

4.3.1 Power-up test

4.3.1.1 The AWS and TPWS power-up test shall incorporate the following operations:

a) Within 0.5 seconds of the power-up test commencing, all the TPWS DMI indicators shall illuminate simultaneously and the AWS visual indicator shall display black and yellow if not already doing so, and then change to display all black.

b) The AWS horn shall sound.

c) Upon acknowledgement of the AWS horn by pressing and releasing the AWS caution acknowledgement device, the AWS visual indicator shall change to black and yellow, the AWS horn shall cease to sound and the AWS bell shall sound for 0.5 second + 0.5/-0 second.

4.3.1.2 If the AWS horn is not effectively acknowledged within 30 seconds by pressing and releasing the AWS caution acknowledgement device, the AWS horn shall cease to sound after 30 seconds. This shall be indicated as a system fault, as set out in 4.3.1.8.

4.3.1.3 During the power-up test, the TPWS system shall initiate a brake demand.

4.3.1.4 A TPWS or AWS fault detected during the power-up test shall cause the system to maintain the brake demand.

4.3.1.5 On successful completion of the power-up test, all the TPWS DMI indicators will be extinguished (except in the circumstances set out in 4.3.1.10) and an audible announcement shall be sounded in the cab.

4.3.1.6 The audible announcement shall comprise the speech message:

‘TPWS and AWS operational’,

which shall be implemented using the sound file included in Appendix H.

4.3.1.7 The ‘TPWS and AWS operational’ speech message shall not be preceded by a priming sound.

4.3.1.8 Any TPWS or AWS fault detected by the system shall be indicated to the driver by flashing the fault indicator and all other indicators shall be extinguished.

4.3.1.9 The system shall maintain the brake demand until:

a) Any fault detected by the system has been cleared.

And

b) There has been a successful power-up test following powering down and powering up.

4.3.1.10 If the cab was previously powered down with a TSS, OSS or AWS brake demand displayed:

a) The brakes shall remain applied following completion of the power-up test.

b) Any brake demand indications on the TPWS DMI that were illuminated before the cab was powered down shall be illuminated steadily following completion of the power-up test.
AWS and TPWS Interface Requirements

4.3.2 In-service monitoring

4.3.2.1 Detection of a fault that results in loss of the protection normally provided by TPWS shall cause the fault indicator to flash.

4.3.2.2 The fault indicator shall flash until either the system is able to confirm that the detected fault has been rectified, or the flashing indication is suppressed as the result of a brake demand or temporary isolation, as set out in 4.3.2.3.

4.3.2.3 The visual indication of a detected fault through the flashing of the fault indicator on the DMI shall be suppressed automatically whenever a brake demand indicator on the TPWS DMI is illuminated. Once the brake has been released and the brake demand indicator extinguished, the fault indicator shall again flash.

4.3.2.4 Where the temporary isolation indicator is combined with the fault indicator on the DMI, the visual indication of a detected fault through the flashing of the fault indicator shall be suppressed when the system is isolated by operation of the temporary isolation switch. When the temporary isolation is removed, the fault indicator shall again flash.

4.4 Output requirements

4.4.1 Outputs for on-train data recording

4.4.1.1 In addition to the on-train data recording requirements set out in GM/RT2472, AWS and TPWS shall supply suitable and sufficient outputs to facilitate connection to the on-train data recorder, to enable the status of each of the TPWS DMI functions to be recorded.

4.4.2 Output to vigilance system

4.4.2.1 An output shall be provided from the AWS acknowledgement device to reset the driver vigilance system when an AWS warning has been acknowledged.
Part 5 System Availability and Integrity

5.1 AWS and TPWS equipment

5.1.1 AWS and TPWS equipment shall be designed, operated and maintained to have a level of availability that is as high as reasonably practicable, and shall, as a minimum, meet the following:

a) The train sub-system shall have an availability, measured on a ‘per fleet, per year’ basis, of not less than 99.9%.

b) The AWS track sub-system shall have an availability, measured on an ‘AWS population, per year’ basis, of not less than 99.9%.

c) The TPWS track sub-system shall have an availability, measured on a ‘TPWS population, per year’ basis, of not less than 99.9%.
AWS and TPWS Interface
Requirements

Part 6 Application of this document

6.1 Application – infrastructure managers

6.1.1 Scope

6.1.1.1 The requirements of 2.1, 2.3, 3.1 and Part 5 of this document apply to all new infrastructure equipment used for the provision of AWS and TPWS.

6.1.1.2 Compliance with the requirements of this document relating to inspection, maintenance and in-service condition of infrastructure is mandatory, whether or not the infrastructure concerned is the subject of a designation, as set out above.

6.1.1.3 Action to bring existing AWS and TPWS infrastructure equipment into compliance with the requirements of this document is not required.

6.1.1.4 When lineside signalling on a line that is not currently fitted with AWS is modified, AWS shall be provided unless either:

   a) The line is exempt from the requirement for AWS fitment, as set out in 2.1.6.1.

   Or

   b) A cost benefit analysis shows that provision of AWS is not justified.

6.1.2 Exclusions from scope

6.1.2.1 There are no exclusions from the scope specified in 6.1.1 for infrastructure managers.

6.1.3 General compliance date for infrastructure managers

6.1.3.1 This Railway Group Standard comes into force and is to be complied with from 06 June 2015.

6.1.3.2 After the compliance date, or the date by which compliance is achieved, if earlier, infrastructure managers are to maintain compliance with the requirements set out in this Railway Group Standard. 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.

6.1.4 Exceptions to general compliance date

6.1.4.1 There are no exceptions to the general compliance date specified in 6.1.3 for infrastructure managers.

6.2 Application – railway undertakings

6.2.1 Scope

6.2.1.1 The requirements of 2.2, 2.3, 3.2 and Parts 4 and 5 of this document apply to all new and upgraded AWS and TPWS equipment fitted to vehicles.

6.2.1.2 Action to bring AWS and TPWS equipment on existing vehicles into compliance with the requirements of this document is not required.

6.2.1.3 Where AWS or TPWS equipment fitted to a vehicle is subject to alteration and the nature of the alteration provides a reasonable opportunity to bring the vehicle into conformity, then the requirements of this document applicable to the alteration shall apply.
Railway Group Standard
GE/RT8075
Issue Two
Date March 2015

AWS and TPWS Interface
Requirements

6.2.2 Exclusions from scope

6.2.2.1 There are no exclusions from the scope specified in 6.2.1 for railway undertakings.

6.2.3 General compliance date for railway undertakings

6.2.3.1 This Railway Group Standard comes into force and is to be complied with from 06 June 2015.

6.2.3.2 After the compliance date, or the date by which compliance is achieved, if earlier, railway undertakings are to maintain compliance with the requirements set out in this Railway Group Standard. 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.

6.2.4 Exceptions to general compliance date

6.2.4.1 There are no exceptions to the general compliance date specified in 6.2.3 for railway undertakings.

6.3 Health and safety responsibilities

6.3.1 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  AWS Visual Indicator

The content of this appendix is mandatory.

Segments (yellow or black)   Background black

General Layout

Minimum number of segments: 8
Maximum number of segments: 10

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<tr>
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<td>18 °</td>
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Figure A.1   AWS visual indicator
Appendix B  TPWS Visual Indicator State Transition Diagram

The content of this appendix is mandatory.

Notes:
- OSS brake demand following TSS brake demand has no effect
- AWS brake demand following TSS brake demand has no effect on visual indications
- Brake release requires brake release action, as set out in 4.2.5
- Test sequences, isolation, override and fault conditions are not included in this diagram
Appendix C  Field Strength Diagram for TPWS Track Sub-System Standard Loop Installations

The content of this appendix is mandatory.

Indicates the volume where the magnetic field strength is undefined

For dimension ‘d’ and detail of the 90 nT section, see Appendix E

Volume where the magnetic field strength is >90 nT

All dimensions in mm

Field strength is measured in free space and shown as rms values

Indicates the volume where the magnetic field strength is undefined

For dimension ‘h’ and detail of the >90 nT section see Appendix E
Appendix D  Field Strength Diagram for TPWS Track Sub-System Miniature Loop Installations

The content of this appendix is mandatory.

![Diagram of field strength](image)

**Plan View**

- **Volume where the magnetic field strength is >90 nT**
- **<10 nT**
- **<30 nT**

**Indicates the volume where the magnetic field strength is undefined**

**For dimension ‘d’ and detail of the >90 nT section, see Appendix E**

**Section A-A through track centre line**

**Indicates the volume where the magnetic field strength is undefined**

**For dimension ‘h’ and detail of the >90 nT section see Appendix E**

**All dimensions in mm**

- Field strength is measured in free space and shown as rms values.
Appendix E  Field Strength for TPWS Track Sub-System
Installations through Section B-B of Appendices C and D

The content of this appendix is mandatory.

E.1 Figure E.1 shows the height (h) above rail level at different distances (d) either side of the track centre line, showing where the minimum field strength requirements must be met. Other detail is omitted.

Figure E.1  Field strength for TPWS track sub-system installations through section B-B of Appendices C and D
Appendix F  Driver / Machine Interface for AWS and TPWS – Design Requirements for Non-integrated DMI

The content of this appendix is mandatory.

F.1 Introduction

F.1.1 This appendix contains detailed requirements for the TPWS Driver Machine Interface (DMI) when this is provided as a separate group of physical control devices (pushbuttons) and indications which is not integrated into an ETCS DMI.

F.1.2 Where a vehicle is fitted with TPWS but not AWS, the DMI shall incorporate only the controls and indications required for TPWS.

F.2 TPWS DMI appearance

F.2.1 General layout

F.2.1.1 The TPWS DMI is a primary control.

F.2.1.2 Figure F.1 shows the general arrangement of the TPWS DMI. A dimensioned diagram is shown at Figure F.2.

![Diagram of TPWS DMI](image)

Figure F.1 General arrangement of TPWS DMI
F.2.1.3 Each brake demand indication shall be combined with the associated acknowledgement device in the form of an indicator / pushbutton.

F.2.1.4 From top to bottom the SPAD, overspeed and AWS indicator / pushbuttons shall be aligned in that order about a common vertical axis on the left side of the panel. The three indicator / pushbuttons shall be equally spaced vertically with a tolerance of ± 1 mm.

F.2.1.5 From left to right the overspeed indicator / pushbutton, temporary isolation / fault indicator, train stop override indicator / pushbutton and brake release pushbutton shall be aligned in that order about a common horizontal axis in the centre of the panel. The overspeed indicator / pushbutton, temporary isolation / fault indicator, train stop override indicator / pushbutton and brake release pushbutton shall be equally spaced to within a tolerance of ± 1 mm.

F.2.1.6 The TPWS DMI panel shall be delineated as a separate group of controls.

F.2.1.7 The distance between the centres of the brake release pushbutton and the overspeed indicator shall not exceed 200 mm. The distance between the centres of the SPAD indicator and the AWS indicator shall not exceed 120 mm. The visual indicators / pushbuttons shall be spaced to avoid inadvertent operation of a pushbutton while operating the indicator / pushbutton next to it.

F.2.1.8 When illuminated, the indicators shall be detectable in all lighting conditions.

F.2.2 Brake demand indicators

F.2.2.1 The three visual brake demand indicators (SPAD, overspeed and AWS) shall be circular and the minimum diameter of each shall be 10 mm.

F.2.2.2 The three brake demand indicators shall also function as pushbuttons and shall depress by at least 2 mm when pressed.
F.2.2.3 If the brake demand indicators / pushbuttons are less than 20 mm in diameter they shall protrude above the surface of the panel by a distance which is greater than the operational stroke.

F.2.2.4 The visual indicator for a SPAD shall be red (nominally Pantone 186C).

F.2.2.5 The visual indicators for an overspeed and for an AWS brake demand shall be yellow (nominally Pantone Yellow C).

F.2.2.6 When required to display a flashing indication, the brake demand indicator shall flash at a frequency of 2 Hz ± 0.25 Hz with a 50% ± 5% duty cycle.

F.2.3 Temporary isolation / fault indicator

F.2.3.1 The temporary isolation / fault indicator shall be circular, coloured yellow (nominally Pantone Yellow C), shall have a minimum lens diameter of 18 mm, and shall not protrude above the surrounding bezel.

F.2.3.2 The flash rate to indicate a fault shall be 2 Hz ± 0.25 Hz with a 50% ± 5% duty cycle.

F.2.4 Train stop override indicator / pushbutton

F.2.4.1 The train stop override indicator / pushbutton shall be square and coloured yellow (nominally Pantone Yellow C) and shall have a minimum lens width of 17 mm.

F.2.4.2 The train stop override indicator / pushbutton shall not protrude above the surrounding bezel.

F.2.4.3 The train stop override indicator / pushbutton shall depress by at least 2 mm when pressed.

F.2.5 Brake release button

F.2.5.1 The brake release button shall be circular with a minimum diameter of 18 mm excluding any bezel, and shall be coloured black.

F.2.5.2 The brake release button shall depress by at least 2 mm when pressed.

F.2.5.3 There shall be a cover which protects the brake release button. The cover shall be sprung so that it automatically returns to its covering position when resistance is removed. The spring tension shall not be so great that the cover is difficult to operate using one hand. The cover shall not create a nipping hazard. The cover shall not be easily removed by the driver.

F.3 Labelling of TPWS DMI

F.3.1 The visual indicators shall be labelled ‘SPAD’, ‘OVERSPEED’ and ‘AWS’ to identify the cause of the brake demand. It is permissible for the ‘OVERSPEED’ label to be shown over two rows.

F.3.2 The labelling of the SPAD, overspeed and AWS indicators shall be centred about a common vertical axis set to the left of the indicators to which they refer and shall be centred vertically with the applicable indicator centre.

F.3.3 The brake release button shall be labelled as shown below over two rows:

‘BRAKE
RELEASE’
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Requirements

F.3.4 The temporary isolation / fault indicator shall be labelled as shown below over three rows:

‘TEMPORARY
ISOLATION/
FAULT’

F.3.5 The train stop override indicator / pushbutton shall be labelled as shown below over two rows:

‘TRAIN STOP
OVERRIDE’

F.3.6 The labelling of the temporary isolation / fault indicator, train stop override indicator / pushbutton and brake release button shall be centred above the centre of the corresponding indicator / pushbutton, and the rows of each label shall be vertically aligned.

F.3.7 The character height of the labelling shall be a minimum of 5 mm and, when viewed from the driving position, shall subtend as a minimum a visual angle of 15 minutes.

F.3.8 Labelling shall be:

a) Permanent and durable.

b) Selected for maximum contrast against the panel background.

c) In capitals and in a sans serif font.

F.4 Operation of pushbuttons

F.4.1 Where 4.2.5 requires operation of two control devices together, this shall require both the pushbuttons concerned to be pressed simultaneously and then both released.

F.5 Pushbutton resistance

F.5.1 Pushbutton resistance on all buttons on a TPWS DMI panel shall be consistent and shall be within the range 2.8 to 15 newtons.

F.6 Pushbutton / switch confirmatory action

F.6.1 Pushbuttons / switches shall provide audible and tactile feedback to the driver.
Appendix G  Driver / Machine Interface for AWS and TPWS – Design Requirements for DMI Integrated with ETCS

The content of this appendix is mandatory.

G.1 This appendix sets out requirements for the design of the TPWS Driver Machine Interface (DMI) when it is integrated with the ERTMS/ETCS DMI.

G.2 The AWS caution acknowledgement device, as set out in 4.1.2.2, shall not be incorporated into the ETCS DMI.

G.3 Where AWS and TPWS controls and indications are incorporated into the ETCS DMI, the layout of the control devices and indications shall provide the same facilities as set out in Appendix F, adapted as necessary to meet the constraints of the ETCS DMI specification.

G.4 The AWS and TPWS indications and control devices shall be logically grouped and clearly identified.

G.5 AWS and TPWS indications shall be clearly visible to the driver in all lighting conditions.

G.6 Where 4.2.5 requires operation of two control devices together but the design of the DMI does not permit recognition of two simultaneous control inputs, it is permissible to achieve the function by operating the two controls sequentially.
Appendix H  TPWS Audible Alert Sound Files

The content of this appendix is mandatory.

H.1  SPAD alert

H.1.1  The SPAD audible alert (see 4.2.3.3) shall be:

Tone plus SPAD.wav

H.2  Overspeed alert

H.2.1  The overspeed audible alert (see 4.2.3.4) shall be:

Tone plus Overspeed.wav

H.3  Self-test announcement

H.3.1  The audible announcement on successful completion of the power-up test (see 4.3.1.6) shall be:

TPWS AWS.wav
Definitions and Abbreviations

Arming frequency
A frequency generated by the TPWS track sub-system which, when detected by the vehicle, arms the train sub-system.

AWS
Automatic Warning System.

Availability
The ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are present. (Source BS EN 50129:2003.)

DC electrified lines
Lines equipped with DC electrification, whether or not the line is also equipped with AC electrification.

Driver machine interface (DMI)
The driver machine interface provides indications to the driver of the system status, as well as allowing the driver to control selected system functions.

Driving position
The normal position from which the driver controls the train, by operating the primary controls, as set out in GM/RT2161. The active driving position is the position being used by the driver to drive the train.

Excessive speed
With reference to provision of TPWS on the approach to speed restrictions, a speed exceeding the overspeed margin above which derailment risk is considered to require mitigation.

Interleaving
Interleaving is the term used where the arming or trigger transmitter of one pair of TPWS track transmitters is positioned between a different pair of TPWS track transmitters.

Nesting
Nesting is the term used where one pair of TPWS track transmitters is positioned in between a different pair of TPWS track transmitters.

Overspeed system (OSS)
The overspeed system (OSS) (also referred to as the overspeed sensor system) is a TPWS facility whose function is to initiate a brake application on a train that approaches a signal showing a danger aspect, or other location, at excessive speed.

Running line
A line as shown in Table A of the Sectional Appendix as a passenger line or as a non-passenger line.

Set speed
Set speed is the minimum speed at which a brake application is initiated when a train passes over the track elements of an active OSS.

SPAD
Signal passed at danger.
AWS and TPWS Interface Requirements

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Date March 2015

Suppression (AWS and TPWS trainborne sub-systems)
A state of the trainborne sub-system where it is does not provide operational outputs to the driver or initiate brake demands, for example when an alternative train control system is in use and AWS indications and TPWS interventions are not required. The system is still active in monitoring its status and may indicate fault conditions.

Suppression (AWS magnets)
The application of an opposing magnetic field to an AWS permanent magnet to prevent the detection of the permanent magnet when a train is not required to receive an AWS indication.

TPWS
Train Protection and Warning System.

TPWS Miniature Loop
A TPWS transmitter loop smaller than the standard loop, which is used at OSS installations on the approach to buffer stops and certain other locations where speeds are low.

TPWS Standard Loop
A TPWS transmitter loop of standard dimensions, which is used at all TSS installations and at most OSS installations, except on the approach to buffer stops.

TPWS temporary isolation switch
A switch provided in the cab whereby the TPWS can be temporarily isolated.

Track sub-system
The TPWS track sub-system comprises the components mounted on the track or at the trackside that are used to provide the train stop system (TSS) and OSS functionality.

Train stop override
The facility that allows a train to pass a signal at danger without invoking a brake demand caused by the train stop system (TSS).

Train stop system (TSS)
The train stop system (TSS) is a TPWS facility whose function is to initiate a brake application on a train that passes a signal at danger without authority.

Train sub-system
The TPWS train sub-system comprises the components mounted on vehicles that are used to provide TSS and OSS functionality.

Trigger delay
The pre-set period timed by the train sub-system and initiated by detection of an OSS arming frequency.

Trigger frequency
A frequency generated by the TPWS track sub-system which, when detected by the vehicle, triggers the train sub-system.

Vehicle
For the purposes of this document the term vehicle is used to define that part of a train which is fitted with the AWS and TPWS equipment, where ‘train’ has the same meaning as in section 83(1) of the Railways Act 1993.
AWS and TPWS Interface Requirements

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

Railway Group Standards

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