Track Circuit Assister
Configuration for Rail Vehicles

Synopsis
This Standard mandates where TCAs shall be fitted onto a vehicle and how they shall be set up. It also contains the requirements for testing a TCA.

This document contains requirements that are amended under the Railway Group Standards Code (Issue Three) as a small scale change. Reference to the amended requirements is made in the 'Issue Record'. All other parts of the document are unchanged from the previous issue.

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Rail Safety and Standards Board
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# Track Circuit Assister Configuration for Rail Vehicles

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Part A

A1 Issue record

<table>
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<tr>
<td>One</td>
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<td></td>
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<td>Two</td>
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<td>Small scale change amendment – addition of clause B6.3</td>
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Amended or additional parts of revised pages have been marked by a vertical black line in the adjacent margin.

A2 Implementation of this document

The publication date of this document is 01 August 2009.

This document comes into force on 03 October 2009.

The dates by which compliance with the requirements of this document is to be achieved are set out in Part B2. Where those dates are later than the date on which this document comes into force, this is to give Railway Group members additional time to plan and commence implementation so as to achieve full compliance by the dates set out in Part B2.

This document supersedes the following Railway Group Standard, either in whole or in part as indicated:

<table>
<thead>
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<th>Railway Group Standard</th>
<th>Issue No.</th>
<th>Title</th>
<th>RGS sections superseded by this document</th>
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<tr>
<td>GMRT2477</td>
<td>1</td>
<td>TCA Configuration for Rail Vehicles</td>
<td>All sections</td>
<td>03 October 2009 (document withdrawn as of this date)</td>
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A3 Scope of Railway Group Standards

The overall scope of Railway Group Standards is set out the Railway Group Standards Code.

A4 Deleted

No longer relevant.

A5 Health and safety responsibilities

In issuing this document, RSSB makes no warranties, express or implied, that compliance with all or any documents published by RSSB is sufficient on its own to ensure safe systems of work or operation. Each user is reminded of its own responsibilities to ensure health and safety at work and its individual duties under health and safety legislation.

A6 Technical content

The technical content of this document was approved by Rolling Stock Standards Committee on 05 June 2009.
A7 Supply

The authoritative version of this document is available at www.rgsonline.co.uk. Uncontrolled copies of this document can be obtained from Communications, RSSB, Block 2 Angel Square, 1 Torrens Street, London EC1V 1NY, telephone 020 3142 5400 or e-mail enquiries@rssb.co.uk. Other Standards and associated documents can also be viewed at www.rgsonline.co.uk.
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Part B

B1 Purpose

This Standard mandates the requirements for where and how TCAs shall be fitted onto a vehicle if they are needed and how they shall be configured during commissioning.

B2 Application of this document

B2.1 To whom the requirements apply

This document contains requirements that are applicable to railway undertakings.

B2.2 Compliance requirements

The requirements of this document apply to all TCAs on vehicles, whether new or altered.

The requirements of this document apply to all new equipment used for TCAs.

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

This Railway Group Standard comes into force and is to be complied with from 03 October 2009.

After the compliance dates 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, authorisation not to comply should be sought in accordance with the Railway Group Standards Code.

B2.3 Supporting documents

The following documents support this Standard:

a) GM/GN2576 – Guidance on Vehicle Requirements for Reliable Track Circuit Operation.

b) GM/RT2476 – On-Track Machine Requirements for Demonstrating the Reliable Operation of Track Circuits.

B3 Definitions

Assisted wheelsets
Wheelsets whose track circuit operation is assisted by a TCA, that is, the two wheelsets immediately adjacent to a TCA.

Leading vehicle
A vehicle permitted to operate at the head of a train. Unpowered vehicles which are used at the head of a train only when following the rules for propelling movements are excluded.

Leading wheelset
The first wheelset of a train.

Normal railhead condition
A railhead which presents either a clean steel surface with contamination no more severe than light unrolled rust (as would be expected to appear after 36 hours in damp conditions with no traffic), or moderate rolled rust (as would be expected after the passage of a number of trains following several days with little or no traffic). This condition excludes newly laid rail or heavier rust, leaf mulch, or other severe contamination which, if discovered, would require remedial action to be taken.
Normal wheel running surface condition
A wheel running surface which presents either a clean steel surface with contamination no more severe than light or moderate rust (as would be expected to appear after the vehicle has been stationary for several days in damp conditions). This condition excludes heavier rust, leaf mulch, or other severe contamination which, if discovered, would require remedial action to be taken.

TCA
A TCA is a track circuit assister. Typically, it consists of a control unit (installed in the vehicle), an aerial and associated tuning unit (mounted between a pair of wheelsets, close to the rails), and associated cabling and power supplies. A TCA assists the operation of track circuits by the wheelsets immediately adjacent to the aerial, in the presence of moderate rust contamination of the railhead.

TCAID
A TCAID (TCA interference detector) detects the signal which is emitted by a TCA and conducted along the rails and it then operates the track circuit independently of the train by applying a short circuit across the rails.

Trailing vehicle
A vehicle permitted to operate as the last vehicle of a train.

Trailing wheelset
The last wheelset of a train.

Wheelset
A pair of rail wheels mounted on an axle.

B4 Introduction
The requirements of this Standard are applicable to all rail vehicles on which a TCA is fitted, whereas GM/RT2476 defines the mandatory requirements for demonstrating that an on-track machine will operate track circuits reliably.

Where TCA fitment is required, this Standard mandates the configuration of such a TCA. It also mandates the requirements for setting the operating parameters of each TCA correctly during its commissioning, in order to provide both a satisfactory improvement in track circuit performance, and correct operation of TCAIDs, without creating any additional risk to safety. This Standard mandates how these parameters are to be demonstrated to be correct.

B5 General principles

B5.1 TCA fitment
A TCA is fitted between a pair of wheelsets on a vehicle. It assists the operation of a track circuit by raising the effective track circuit rail-to-rail voltage at the wheelsets either side of the TCA; this enables a low voltage track circuit to operate as effectively as a higher voltage type. A TCA does not provide any assistance to other wheelsets and the assistance it does provide is interrupted as the assisted wheelsets pass over an insulated rail joint or insulating railhead contamination such as dry leaf film.

Except as stated below, where TCA fitment is required, sufficient TCAs shall be fitted to ensure that, as a minimum:

a) when the vehicle requiring TCA fitment is a leading vehicle in a train formation, the leading pair of wheelsets is fitted with a TCA

b) when the vehicle requiring TCA fitment is a trailing vehicle in a train formation, the trailing pair of wheelsets is fitted with a TCA.

Where the above cannot be achieved, it is permissible to fit the TCA between any other adjacent pair of wheelsets on the vehicle, for example between two adjacent bogies (see clause B6.2).
B5.2 TCA Operating parameters
When a TCA is fitted to a vehicle, it shall provide an adequate level of track circuit assistance, shall meet the applicable electromagnetic compatibility requirements and shall not cause injury to staff or public. It shall provide an adequate output to operate TCAIDs, but it is not necessary to carry out any tests specifically for this function, as this capability is inherent in the specified parameters. Detailed requirements are set out in sections B6 and B7 of this document.

B6 Requirements for TCA fitment

B6.1 General requirements
Each TCA shall be installed, configured, and set up to provide satisfactory track circuit performance, without creating any additional risk to safety.

B6.2 Location of TCA aerial on vehicle
Except as stated below, TCA aerials shall be fitted between the leading pair of wheelsets on any leading vehicle and the trailing pair of wheelsets on any trailing vehicle. Only where physical constraints exist is it permissible to fit TCAs between another pair of wheelsets on the same vehicle (for example, between two adjacent bogies).

In the case of a vehicle which is capable of operating independently (that is, to operate as a leading and trailing vehicle simultaneously) if it has more than two wheelsets, except as stated below, it shall be fitted with two TCAs to meet the requirements for both leading and trailing vehicles. Only where physical constraints exist, shall a single TCA be fitted.

There is no requirement to fit TCAs on intermediate vehicles unless operational experience shows this to be necessary; a track circuit failure under the centre of a moving train is an operational nuisance rather than a direct safety issue and thus represents a low risk, provided that detection of leading and trailing vehicles can be assured.

B6.3 Electrical feeding arrangement of TCAs
On multiple units where more than one TCA is provided, each TCA shall have its electric supply independently protected by feeding each TCA from a separate circuit breaker.

B7 Requirements for TCA operating parameters

B7.1 Emission level requirements
The requirements for the operating frequency and energy radiated from all parts of a TCA installation are set out in GE/RT8015. In addition, the TCA installation shall meet the limits set out in EN 55011.

B7.2 TCA operating frequency range
The permitted frequency range when the vehicle is stationary shall be 165 ± 3 kHz.

The permitted frequency range when the vehicle is moving shall be 165 ± 5 kHz.

B7.3 TCA output level
The minimum permitted rail-to-rail voltage measured across a single insulated joint situated between the assisted wheelsets, with all wheels of the assisted wheelsets in good electrical contact with the rails, shall be 7.1 Vrms (20 Vpp). The TCA shall be designed to provide a nominal rail-to-rail voltage of 8.8 Vrms (25 Vpp) measured across a single insulated joint situated between the assisted wheelsets, with all wheels of the assisted wheelsets in electrical contact with the rails.
The maximum rail-to-rail voltage under all wheel/rail insulation configurations shall be 10.6 V$_{rms}$ (30 V$_{p-p}$).

The output level shall be constrained between the maximum and minimum under all states of wheel wear or suspension levels; it is permissible to achieve this by adjusting the aerial height.

### B7.4 Monitoring system indication level

If the output level of any TCA fitted to the vehicle falls below 70% of the nominal level for more than seven seconds, an indication shall be provided to the driver indicating a TCA fault. The indication shall clear when the output level returns above 80% of the nominal level. The monitor shall detect a reduction in output level at the aerial tuning unit, such that in addition to detecting a failure within the control unit, any failure of the connecting cable causing a reduction in output shall be detected.

## B8 Requirements for demonstrating TCA operating parameters

### B8.1 Frequency measurement

For the purposes of frequency measurement a test track shall be provided, the track base of which shall either be conventionally ballasted and shall not have steel sleepers or shall be an elevated workshop track. The rail surface and wheel surface shall be clean and bright where the wheels are to be in contact with the rails.

The vehicle shall be placed on the test track with both assisted wheelsets of the TCA under test on sections of rail which are continuous between the two wheels.

A frequency meter shall be connected to the aerial terminals on the tuning unit, or a hand-held aerial current tester shall be used. In order to meet the requirement of this Standard, the frequency shall be within the range specified for a stationary vehicle in clause B7.2. Consideration shall be given to the effects of any switches and crossings or rail-built buffer stops on the test track that have the potential to affect the testing arrangements.

### B8.2 Output level measurement

The TCA output shall be set up by one of two methods: open circuit voltage measurement or rail current measurement; it is not necessary to use both methods.

For vehicles where the TCA is not fitted on a bogie, Method 1 in clause B8.2.1 shall be used to set up the TCA. Method 2 in clause B8.2.2 is applicable only to bogie vehicles where the TCA aerial is fitted between the wheelsets of a two-axle bogie.

#### B8.2.1 Method 1: open circuit voltage measurement

A test track shall be provided with continuous welded (or bonded) plain line and with an insulated rail joint in one rail only and not fitted with a track circuit, whether operating or otherwise. The track base shall be either conventionally ballasted and shall not have steel sleepers or shall be an elevated workshop track. The rail surface and wheel surface shall be clean and bright where the wheels are to be in contact with the rails. Consideration shall be given to the effects of any switches and crossings or rail-built buffer stops on the test track that have the potential to affect the testing arrangements.

The vehicle shall be placed on the test track with one of the assisted wheelsets adjacent to the insulated joint, with the joint on the TCA aerial side of the wheelset. All other sections of rail between the assisted wheelsets shall be continuous between the two wheels throughout the test. A battery-powered oscilloscope or other suitable device capable of measuring voltage at the TCA operating frequency shall be connected to the rails on each side of the insulated joint and the vehicle moved slowly until the second assisted wheelset is adjacent...
to the insulated joint. The test cables shall be no more than 2 m in length and shall not pass under the bogie or aerial. The position at which highest voltage was measured shall be noted, the vehicle returned to that position and the voltage recorded.

The recorded voltage shall be within the range stated in clause B7.3.

**B8.2.2 Method 2: rail current measurement**

A test track with continuous welded (or bonded) plain line shall be used for this measurement. The track base shall be either conventionally ballasted and shall not have steel sleepers or shall be an elevated workshop track (without sleepers or cross-ties). The rail surface and wheel surface shall be clean and bright where the wheels are to be in contact with the rails.

The vehicle shall be placed on the test track with both assisted wheelsets of the TCA under test on sections of rail which are continuous between the two wheels.

A calibrated rail current meter shall be wrapped around one rail between the assisted wheelsets. The current at the TCA operating frequency shall not exceed $3 \, A_{\text{rms}}$ and shall not be less than $2 \, A_{\text{rms}}$. 
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References

Railway Group Standards and other Railway Group Documents

RGSC 01
The Railway Group Standards Code

GE/RT8015
Electromagnetic Compatibility between Railway and Infrastructure

The Catalogue of Railway Group Standards and the Railway Group Standards CD-ROM give the current issue number and status of documents published by RSSB.

Other References

BS EN 55011: 1991
Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.