

Mechanical Trainstop Systems

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Synopsis

This document defines the functional requirements for mechanical trainstop systems and the requirements relating to their use on both track and trains.

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Mechanical Trainstop

Part A

Issue Record

This document will be updated when necessary by distribution of a complete replacement.

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

Issue	Date	Comments
One	February 2000	Initial Issue. This document replaces GK/RT0017.

Responsibilities

Railway Group Standards are mandatory on all members of the Railway Group * and apply to all relevant activities that fall into the scope of each individual's Railway Safety Case. If any of those activities are performed by a contractor, the contractor's obligation in respect of Railway Group Standards is determined by the terms of the contract between the respective parties. Where a contractor is a duty holder of a Railway Safety Case then Railway Group Standards apply directly to the activities described in the Safety Case.

* The Railway Group comprises Railtrack and the duty holders of the Railway Safety Cases accepted by Railtrack.

Compliance

The provisions in this document are to be complied with for design and implementation work undertaken on a scheme for which the Signalling Scheme Plan is first approved, or altered and subsequently re-approved, on or after 1st June 2000.

The provisions in this document are to be complied with for new rolling stock for which the contract is let on or after 1st June 2000.

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Supply

Controlled and uncontrolled copies of this document may be obtained from the Industry Safety Liaison Dept, Safety and Standards Directorate, Railtrack PLC, Railtrack House, DP01, Euston Square, London, NW1 2EE.

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Part B

1 Purpose

The purpose of this document is to define:

- the functional requirements for Mechanical Trainstop Systems, and
- the requirements relating to their use on Railtrack-controlled infrastructure and on trains operating over that infrastructure.

2 Scope

The overall scope of Railway Group Standards is as specified in Appendix A of [GA/RT6001](#).

Specifically the content of this document applies to all Mechanical Trainstop Systems (including both track and vehicle sub-systems) and the associated signalling systems.

This document does not address the requirements for deciding whether a particular line should be fitted with trainstops. See Railway Group Standard [GK/RT0078](#).

Full compliance with the requirements for new installations of Mechanical Trainstop Systems provides a means of meeting SI 1999 No. 2244, The Railway Safety Regulations 1999.

It is not the intention of this document to define sub-systems which guarantee inter-operability with trainstop systems required by other infrastructure controllers.

3 Definitions

Effective (Trainstop)

The status of a trainstop such that it will initiate an Irrevocable Brake Application on a train passing the trainstop.

Ineffective (Trainstop)

The status of a trainstop such that it will not initiate any brake application on a train passing the trainstop.

Irrevocable Brake Application

An emergency brake application (or enhanced emergency brake application where available) initiated by the trainstop system, that cannot be released by the driver until the train is stopped or nearly stopped.

Overlap

The section of line beyond a stop signal that must be unoccupied and, when necessary, locked before and during a signalled running movement on the approach to the signal at danger.

Mechanical Trainstop System

A system involving both a track sub-system (known as trainstops) and a vehicle sub-system (known as tripcocks) which mechanically interface with each other to initiate an Irrevocable Brake Application on the train.

Speed Restriction

A permitted speed other than the maximum permitted line speed. For the purposes of this document, a temporary Speed Restriction which will be in place for 3 months or more shall be treated as a permanent Speed Restriction and protected accordingly.

Tripcock Tester

A track-based sub-system for proving that a tripcock on a train is positioned correctly.

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4 System Description

4.1

The Mechanical Trainstop System is a means of controlling the risk of:

- a train passing a signal at danger;
- a train approaching a buffer stop at an excessive speed;
- a train approaching a Speed Restriction at excessive speed.

4.2

The Mechanical Trainstop System operates on the principle of a mechanical interface between the track sub-system (the trainstop) and the vehicle sub-system (the tripcock). When the trainstop arm is in its Effective position, the tripcock arm on a passing train strikes it. This initiates an Irrevocable Brake Application on the train and the train is brought to a stand, or nearly to a stand. When the trainstop arm is in its Ineffective position, the tripcock is unaffected.

4.3

The trainstop arm moves to its Ineffective position when the associated signal shows a proceed aspect or, in the case of a speed control application (eg. on the approach to buffer stops), when the speed of the approaching train is determined to be sufficiently low. In all other circumstances the trainstop arm remains in its Effective position for trains approaching it in the normal direction of travel.

4.4

The length of the Overlap beyond the signal is sufficient to ensure that unauthorised movements past the signal are brought to a stand within the Overlap when the Irrevocable Brake Application occurs. In the case of trainstops on the approach to buffer stops, the distance beyond the trainstop is sufficient to bring the train to a stand short of the buffer stops.

4.5

A Tripcock Tester sub-system is also provided, the purpose of which is to indicate to the driver that the tripcock is correctly positioned. Trains are not permitted to enter the trainstop protected area without the tripcock correctly positioned unless an agreed additional operational procedure is implemented.

5 Responsibilities of The Infrastructure Controller and Train Operators

5.1 Track Sub-system and Tripcock Tester Sub-system

The Infrastructure Controller shall ensure that the design, provision, operation and maintenance of the track sub system and the Tripcock Tester sub-system and their control by and interfaces to the signalling system meet the requirements of this document.

5.2 Vehicle Sub-system

Train operators shall ensure that the design, provision, operation and maintenance of the vehicle sub-system and its control of the braking system meet the requirements of this document. Verification that the vehicle equipment meets the requirements of this document shall form part of the Engineering Acceptance process.

5.3 Procedures

The Infrastructure Controller shall agree with all train operators the procedures for operation over the trainstop fitted line, as listed in clause 12.1.

6 Criteria for Fitment

6.1 Criteria for Fitment of Trainstops

On a line where a Mechanical Trainstop System is the selected method of meeting the train protection requirements of the Railway Safety Regulations 1999 and/or Railway Group Standard [GK/RT0078](#), trainstops shall be provided in the following circumstances:

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6.1.1 Mandatory Fitment

For new installations, trainstops shall be provided:

- at all main signals capable of displaying a stop aspect, except those which protect plain line only; and
- at all signals which control access to the line fitted with trainstops, unless another suitable form of protection is provided (eg. trap points); and
- for speed control on the approach to all terminal and bay platforms; and
- to enforce a lower Speed Restriction where the linespeed on the approach is 60mph or more and the reduction in speed is one third or more of the permitted line speed on the approach.

On lines which, at 30 January 2000, were used by trains operated by London Underground Ltd, trainstops shall be provided:

- at all signals capable of displaying a stop aspect; and
- at all signals which control access to the line fitted with trainstops, unless another suitable form of protection is provided (eg. trap points); and
- for speed control on the approach to all terminal and bay platforms.

On other lines fitted with trainstops prior to 30 January 2000, the criteria for fitment shall be the same as for new installations.

6.1.2 Fitment Based on Risk Assessment

Trainstops shall also be provided at other locations on lines within the scope of 6.1.1, where an assessment of the risks demonstrate it to be necessary.

Specific situations for consideration include:

- a) stop signals which protect plain line but have a level crossing within the route beyond them;
- b) a fixed trainstop immediately before the stopping point at terminal and bay platforms
- c) stop signals protecting plain line where the severity of a rear end collision could be particularly serious, for example:
 - where mixed traffic types operate (eg. metro/light rail and freight trains); or
 - in tunnels; or
 - where trains beyond the signal are most likely to be stationary, (eg. at stations)

6.2 Criteria for Fitment on Trains

On a line where a Mechanical Trainstop System is the selected method of meeting the train protection requirements of the Railway Safety Regulations 1999 and/or Railway Group Standard [GK/RT0078](#), then all trains using the route shall be fitted with operational vehicle sub-systems.

7 Provision and Operation of Trainstops

7.1

The trainstop shall be positioned on the outside of the right hand running rail in the direction of travel. The parameters and position of the trainstop (in relation to the rail) in both its Effective and Ineffective positions shall be as shown in Appendix B of this document. Other than as permitted by Appendix B, trainstops shall be installed so that no part of the trackside equipment infringes the clearances required in Railway Group Standard [GC/RT5204](#).

7.2

The longitudinal position of the trainstop (along the track), and its control by the signalling system, shall be such as to ensure that the Irrevocable Brake Application is initiated as soon as practicable after an unauthorised movement has occurred or, in the case of a speed control application, an overspeed condition has been detected.

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7.3

A signal shall not be permitted to clear for a movement up to a signal at danger (or up to buffer stops) unless the trainstop at that signal, and any other trainstops leading up to it, are in the Effective position.

7.4

The trainstop arm shall move to the Ineffective position in the following circumstances:

- when the associated signal is cleared; or
- in the case of a trainstop provided for speed control purposes, when it has been determined that the speed of the approaching train is sufficiently low; or
- when necessary to allow a train to pass over the trainstop in the opposite direction to that for which the trainstop is provided.

7.5

A signal shall not be permitted to show a proceed aspect until the associated trainstop arm has been proven to be in the Ineffective position.

7.6

The trainstop arm shall return to the Effective position under the following circumstances:

- as soon as practicable after the train has passed the trainstop; or
- if the associated signal is replaced to danger ahead of the train; or
- if there is a loss of power or control to the trainstop equipment.

7.7

A signal shall not be indicated to the signaller as being 'at danger' unless the associated trainstop is in the Effective position, except when the trainstop has been lowered to allow a train to pass in the opposite direction to that for which the trainstop is provided.

7.8

The Overlap beyond a signal at which a trainstop is provided shall be of sufficient length for a train travelling at the permissible speed (or the maximum attainable speed, where this is lower) to stop within the length of the Overlap when the Irrevocable Brake Application is initiated.

Where attainable speed has been used to determine the required Overlap length, the details shall be recorded on the Signalling Scheme Plan.

Where necessary, additional trainstops shall be provided on the approach to the signal for speed control purposes that, together with the trainstop at the signal, achieve the objective of stopping a train within the Overlap.

7.9

The installation of the trackside equipment on electrified lines shall maintain the electrical clearances defined in HS(G)153/4 HM Railway Inspectorate - Railway Safety Principles and Guidance Part 2, Section C, Guidance on electric traction systems and [GM/TT0101](#) Clearance Requirements for Electrified Lines and T&RS.

7.10

It is permissible to provide a means to secure a trainstop in its Ineffective position during engineering works or when emergency working arrangements are implemented by the Infrastructure Controller.

7.11

The track sub-system, and the controls and indications within the signalling system, shall be designed so that the risk of a failure is as low as is reasonably practicable whereby a trainstop could be commanded to move to, or remain in, its Ineffective position when it should be in its Effective position.

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8 Provision and Operation of Tripcocks

8.1

Vehicles to which the fitment criteria of clause 6.2 apply shall have a tripcock fitted to correspond to each driving position. The tripcock for each driving position shall be located to the outside of the right hand running rail in the direction of travel. The position of the tripcock relative to each driving position shall be such that the tripcock is activated as soon as practicable after the leading driving cab passes the trainstop equipment.

8.2

The tripcock shall be positioned in accordance with the requirements of [GM/RT2149](#), and shall be mechanically operated by a trainstop in its Effective position but not in its Ineffective position. (Trainstop positions are as shown in Appendix B of this document.)

8.3

Operation of the tripcock shall initiate an Irrevocable Brake Application. Where the traction power control is independent of the brake application, the activation of the tripcock shall also shut off the traction power.

8.4

A visual indication that the system has initiated a brake application shall be presented to the driver.

8.5

The brake application and visual indication shall be maintained until:

- the train is stopped or nearly stopped; and
- the system has been reset by the driver using a reset device in the cab.

8.6

The driver's reset device shall not be capable of performing any function other than that required for the tripcock sub-system.

8.7

It is permissible to provide facilities to isolate the vehicle sub-system, eg. for:

- dealing with failure conditions;
- making intermediate tripcocks inactive when multiple units or locomotives are coupled together.

The isolation facilities shall not be capable of being operated from the driving position, and shall be designed to minimise the risk of error during use.

A visual indication shall be provided to the driver at the driving position that the equipment is isolated.

8.8

The risk of an unsafe failure of the vehicle sub-system shall be as low as reasonably practicable, except where such a failure is indicated to the driver and the associated procedures to be applied adequately mitigate the effects of the failure.

8.9

The operation of the tripcock sub-system shall be recorded on the on-train data recorder, where fitted.

9 Provision and Operation of Tripcock Testers

9.1

The Tripcock Tester shall be track based and shall be independent of the operation of both the trainstop equipment and the train-borne equipment.

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9.2

The Infrastructure Controller and the train operator(s) shall jointly agree the number and positions of Tripcock Testers to be provided on the approaches to trainstop fitted lines and on each line, taking into account:

- any other arrangements for checking/proving the integrity of the tripcocks (eg. checks before entering service, maintenance arrangements, vehicle sub-systems for proving the tripcock is correctly aligned and not isolated);
- the volume and mix of traffic on the route;
- the number of trainstops on the route;
- the hazards associated with the particular locations where trainstops are provided.

9.3

For each Tripcock Tester, an appropriate stop signal shall be maintained at danger until the tester has proved that the tripcock on the train is in the correct position or until the operational procedures for dealing with trains with failed equipment have been implemented.

9.4

A trackside indication shall be provided for the driver to advise whether or not the tripcock test has been successful. The form of this indication shall not be capable of being confused with any other signal or indication that the driver may encounter.

9.5

The operation of the Tripcock Tester shall not cause the vehicle sub-system to change its state.

Where the Tripcock Tester is a device which mechanically interfaces with the tripcock on the train, the Infrastructure Controller and train operator(s) shall agree the force to be exerted by the tripcock necessary to activate the Tripcock Tester, such that the tripcock on the train is not activated by the Tripcock Tester. This force shall be compatible with the requirement for a tripcock to be activated by a trainstop (see clause 8.2).

9.6

That part of the Tripcock Tester that interfaces with the tripcock on the train shall be positioned so as to meet the requirements of clauses 7.1 and 7.9 of this document.

10 Operational States of Track sub-system

10.1 Defined states

The track sub-system shall be capable of operating in the defined states described below, and of changing state only when the specified conditions are fulfilled.

No other states are permitted.

10.2 Ineffective State

The track sub-system shall enter this state only when commanded to do so by the signalling system. In this state the system shall:

- not initiate a brake application on any passing vehicle;
- provide the signalling system with an indication that the trainstop is in this state.

10.3 Effective State

The track sub-system shall always enter and remain in this state except when the signalling system requires it to be in the Ineffective state. In the Effective state the trainstop shall:

- initiate an Irrevocable Brake Application on any passing vehicle which is fitted with an operational vehicle sub-system;

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- provide the signalling system with an indication that the trainstop is in this state.

The transition time of the trainstop from the Ineffective state to the Effective states shall be as short as practicable, and in any case not less than two seconds.

11 Operational States of Vehicle Sub-system

11.1 Defined States

The vehicle sub-system shall be capable of operating in the defined states described below, and of changing state only when the specified conditions are fulfilled. See Appendix A.

No other states are permitted.

11.2 Operationally Ready State

When the vehicle driving position is operative the associated vehicle sub-system shall be in its operationally ready state. In this state the sub-system shall be capable of detecting a trainstop in its effective position.

11.3 Activated State

When the vehicle sub-system is in its operationally ready state and detects a trainstop in its Effective position it shall enter its activated state. In this state the sub-system shall:

- initiate and maintain an emergency (including enhanced emergency where available) brake application;
- initiate and maintain a traction power shut off demand where not inherent in the brake application;
- provide a visual indication to the driver that a trainstop brake application has been initiated.

The transition time of the vehicle sub-system from the operationally ready state to the activated states shall be as short as practicable.

11.4 Reset Availability State

When the vehicle sub-system is in its activated state and the train is stopped or nearly stopped it shall enter its reset availability state. In this state the sub-system shall:

- continue to ensure the brake application is maintained;
- continue to ensure a traction power shut off demand is maintained where not inherent in the brake application;
- continue to provide a visual indication to the driver that a trainstop brake application has been initiated;
- be capable of being reset by the driver.

11.5 Reset State

When the vehicle sub-system is in its reset availability state and the driver has operated the reset device, it shall enter its reset state. In this state the sub-system shall:

- cancel the trainstop brake application;
- cancel the traction power shut off demand where not inherent in the brake application;
- cancel the visual indication to the driver;
- Return to the operationally ready state after fulfilling these requirements.

11.6 System Isolation State

The vehicle sub-system shall enter this state when the sub-system is isolated by the driver. In this state the sub-system shall:

- prevent/cancel a trainstop brake application;

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- prevent/cancel a trainstop-initiated traction power shut off demand;
- provide a visual indication at the driving position to show the system is isolated;
- be capable of returning to the operationally ready state when the isolation is removed.

12 Procedures

12.1

The Infrastructure Controller and train operators shall agree, document and implement procedures to ensure that the safety integrity of the trainstop system is maintained during train operations. The procedures shall address:

- trains entering service on a trainstop fitted line;
- trains moving from an unfitted to a fitted line;
- trains reversing direction;
- trains dividing to form two or more separate trains;
- trains joining;
- operation during failures of track and vehicle sub-systems;
- use of vehicle sub-system isolation facilities;
- use of trainstop isolation facilities.

12.2

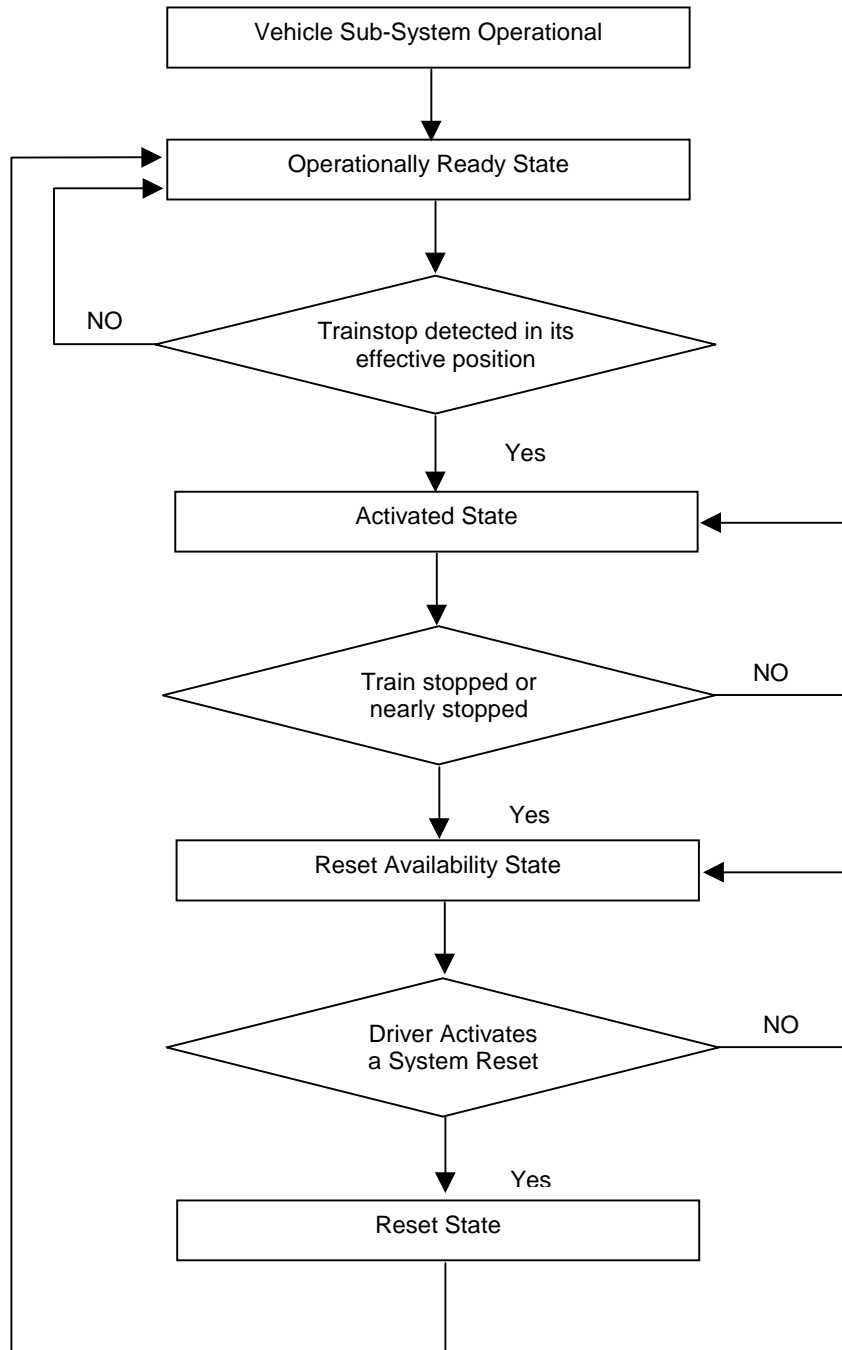
Maintenance of the trackside equipment shall meet the requirements of [GK/RT0170](#), and maintenance of the vehicle sub-system shall meet the requirements of [GM/RT2004](#).

12.3

Reporting and investigation of trackside and vehicle sub-system failures shall be in accordance with [GM/RT2250](#) and [GK/RT0106](#).

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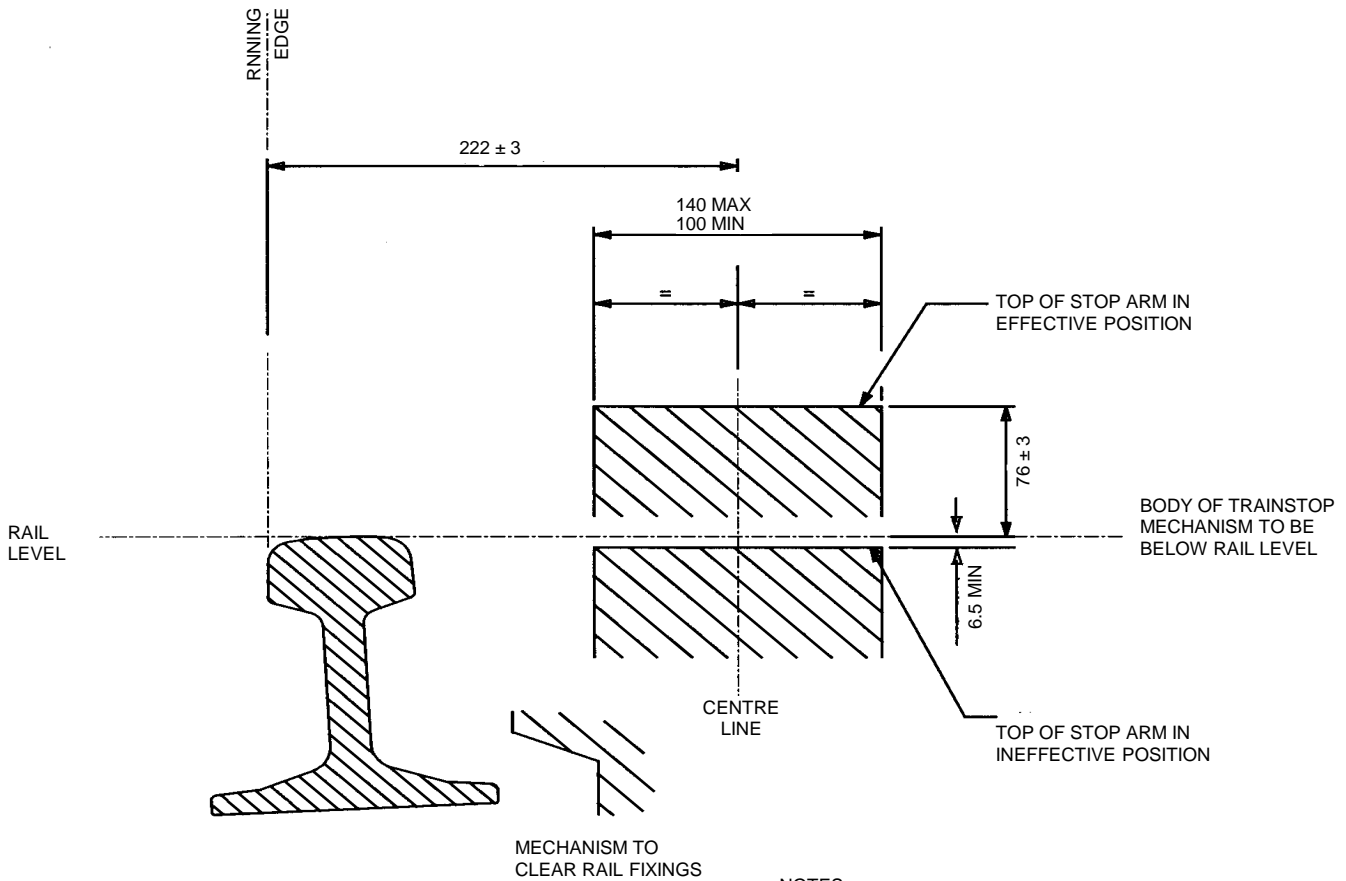
Appendix A Vehicle Sub-System Flow Chart



Note: The System Isolation State is not shown

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Appendix B Mechanical Trainstop Parameters



NOTES:

1. WITH THE EXCEPTION OF THE STOP ARM IN ITS EFFECTIVE POSITION, NO PART OF THE MECHANISM SHALL INFRINGE THE STRUCTURE GAUGE.
2. VIEW IS IN THE DIRECTION OF TRAVEL OF THE TRAIN.
3. EQUIPMENT CAN BE USED WITH RAIL PROFILES OTHER THAN THAT SHOWN.
4. ALL DIMENSIONS IN MILLIMETRES.

Mechanical Trainstop Systems

References

- GA/RT6001** Railway Group Standards Change Procedures
- GC/RT5204** Structure Gauging and Clearances
- GK/RT0078** Overrun Protection and Mitigation
- GK/RT0106** Management of Safety Related Failures of Signalling and Operational Telecommunications Systems
- GK/RT0170** Asset Management for the Safety of Signalling and Operational Telecommunications Systems and Equipment
- GM/RT2004** Requirements for Rail Vehicle Maintenance
- GM/RT2149** Kinematic Gauging Requirements for Railway Vehicles
- GM/RT2250** Safety Performance Monitoring and Defect Reporting of Rail Vehicles and Plant and Machinery
- GM/TT0101** Clearance Requirements for Electrified Lines and T&RS
-
- SI 1999 No. 2244** The Railway Safety Regulations 1999
- HS(G)153/4** Health & Safety Executive HM Railway Inspectorate – Railway Safety Principles and Guidance Part 2, Section C, Guidance on electric traction systems

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