RAIL SAFETY AND STANDARDS BOARD

Rail Industry Standard
RIS-7707-INS | Issue One | December 2023

Switches and Crossings

This document sets out requirements and guidance for new, renewed, and upgraded switches and crossings (S&C) to provide for identification and safe operation.

Published by **Rail Safety and Standards Board**

Rail Industry Standard
RIS-7707-INS
Issue: One
Date: December 2023

Switches and Crossings

Synopsis

This document sets out requirements and guidance for new, renewed, and upgraded switches and crossings (S&C) to provide for identification and safe operation.

Published by RSSB

Issue record

Issue	Date	Comments
One	December 2023	Original document.

Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GCRT5021 issue five	4.1, 4.2, 4.3, 4.5, 4.6, 5.1.2, and E1.1	December 2023

Supply

The authoritative version of this document is available at www.rssb.co.uk/standards-catalogue. Enquiries on this document can be submitted through the RSSB Customer Self-Service Portal https://customer-portal.rssb.co.uk/

Contents

Part 1 Purpose and Introduction

1.1 Purpose

1.1.1 This document contains requirements and guidance which can be used for new, renewed, and upgraded switches and crossings (S&C).

1.1.2 The requirements are additional to those set out in the Infrastructure (INF) National Technical Specification Notice (NTSN) and National Technical Rules (NTR) set out in GCRT5021. As these requirements do not meet the criteria for NTR as set out in the Railway Group Standards (RGS) Code and relevant legislation, they are included in this Rail Industry Standard (RIS).

1.1.3 This document can be adopted by infrastructure managers (IMs) under their respective safety management system or when specifying products and services.

1.2 Related requirements in other documents

1.2.1 The following Railway Group Standards contain requirements that are relevant to the scope of this document:

a) GCRT5021 Track System Requirements sets out requirements for track geometry, track systems, and track components to provide for the safe guidance and support of rail vehicles.
b) GMRT2466 Railway Wheelsets sets out requirements for the design, manufacture, and maintenance of wheelsets and their components.

1.3 Supporting documents

1.3.1 The following Rail Industry Standards and Guidance Notes support this RIS:

a) GIGN7608 Guidance on the Infrastructure Technical Specification for Interoperability gives guidance on interpreting the requirements of the Infrastructure Technical Specification for Interoperability 2014 (INF TSI), Commission Regulation (EU) No. 1299/2014 for application to the GB mainline railway.
b) RIS-0733-CCS Lineside Operational Signs sets out requirements and guidance for the application of the lineside operational signs published in the RSSB catalogue, and the process to be followed when a new design or a change of use of a lineside operational sign is proposed. It also contains the index of signs published in the RSSB standards catalogue.
c) RIS-0009-CCS Identification of Signalling and Related Equipment sets out the principles for ensuring that signalling and related assets are uniquely identified.

1.4 Application of this document

1.4.1 Compliance requirements and dates have not been specified because these are the subject of internal procedures or contract conditions.

1.4.2 If you plan to do something that does not comply with a requirement in this RIS, you can ask a Standards Committee to comment on your proposed alternative. If you

want a Standards Committee to do this, please submit your deviation application form to RSSB. You can find advice and guidance on using alternative requirements on RSSB's website www.rssb.co.uk.

1.5 Health and safety responsibilities

1.5.1 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.

1.6 Structure of this document

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

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

1.7 Approval and authorisation of this document

1.7.1 The content of this document was approved by Infrastructure Standards Committee on 19 September 2023.

1.7.2 This document was authorised by RSSB on 27 October 2023.

Part 2 Identification of points

2.1 Point identity

2.1.1 Point identity that is unique to the controlling signal box or signaller's workstation shall be provided for:

a) Worked points, unworked points, train-operated points, and swing nose crossings that are detected in the signalling system; and,
b) Unworked points in running lines that are not detected in the signalling system.

2.1.2 Points worked by lever frame shall be identified by the lever number.

2.1.3 Point identity requirements set out in *2.1.1* and *2.1.2* shall apply to derailers and scotch blocks.

Rationale

G 2.1.4 Point identity allows the following communications to be accurate:

- Description of the location of a train between signallers and drivers; and
- Point setting requirements between signallers and points operator or route-setting agent when moving and securing points by hand.

G 2.1.5 The application of a defined identity for infrastructure assets, including junctions and distinct groups of points controlled or detected by the signalling interlocking, is set out in RIS-0009-CCS.

G 2.1.6 Point identities are part of a framework of asset identities provided to drivers and other operational personnel to relate locations and lineside equipment to sectional appendices, operating notices, timetables, and other operational publications for route learning and fault reporting purposes.

Guidance

G 2.1.7 RIS-0733-CCS defines points identification plates as lineside safety signs for infrastructure managers. Application rules for point identification plates are set out in RIS-0009-CCS.

G 2.1.8 Derailers and scotch blocks, when operated by an external command, are classified as points for the purposes of this document.

2.2 Point identification plates

2.2.1 Where a point identity is required, all associated point ends shall have point identification plates.

2.2.2 Point identification plates shall display:

a) The point identity and any unique suffix; and,
b) A signal box or locality code prefix, where necessary to distinguish between adjacent operating locations.

2.2.3 Point identification plates shall be fixed to a bearer, as close as practicable to the toes of the points, oriented so that it can be read when passing over the points in the facing direction.

2.2.4 At point ends with a normally closed switch rail, the point identification plate shall be fixed nearer to the switch rail that is closed when the points are in the normal position.

2.2.5 Where it is not possible to fix the point identification plate nearer to the switch rail that is closed when the points are in the normal position, the point identification plate shall incorporate an arrow pointing to the switch rail that is closed when the points are in the normal position.

2.2.6 At point ends without a normally closed switch rail, the point identification plate shall incorporate an arrow pointing in the direction of operation for the normal position.

2.2.7 Swing nose crossing identification plates shall:

a) Be fixed to a bearer next to the normally closed flangeway, adjacent to the crossing nose; and,
b) Incorporate an arrow pointing in the direction of operation for the normal position.

Rationale

G 2.2.8 Point identification plates enable the associated points to be clearly and unambiguously identified.

G 2.2.9 The information conveyed in the point identification plate to the points operator or route-setting agent enables confirmation that the points are set in a particular position when moving and securing points by hand.

G 2.2.10 A signal box or locality code prefix can avoid confusion where points controlled from different interlockings are adjacent to each other.

Guidance

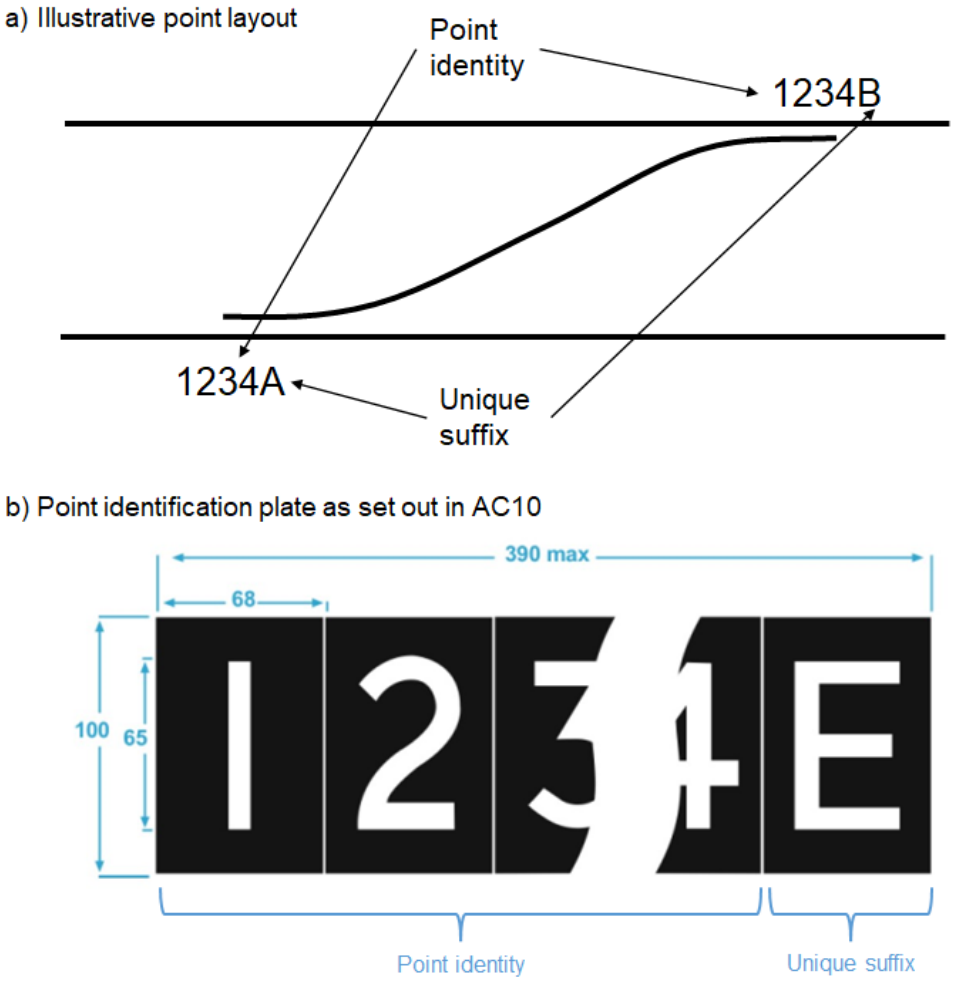

Figure 1: Point identity example

G 2.2.11 It is good practice to install lineside safety sign AC10 as shown in Figure *1* b) for point identification plates. AC10 provides alternative presentations for the typeface used in point identification plates, referred to as presentation A or presentation B. The alternative presentation styles are provided for different bearer types, both are considered good practice and are acceptable for use. Design details for AC10 sign can be found on RSSB's website.

G 2.2.12 Trap points with a single normally open switch rail is an example of a point end without a normally closed switch rail.

G 2.2.13 Points with two or more ends that are operated by the same interlocking element are identified by a common identity and a unique suffix for each end, as shown in Figure *1* a). Each signal box has a convention for the allocation of suffixes. The suffixes for new layouts increment alphabetically in the down direction to help with the locating of points. Where existing layouts are modified, established conventions for points numbering, prefixes, and suffixes are generally followed to maintain consistency of operation.

Part 3 Point operating equipment, train-operated points and limits of wear and damage

3.1 Facing point locking

3.1.1 Worked points shall have a facing point lock, other than as set out in *3.1.2*.

3.1.2 It is permissible to omit the facing point lock on worked points which are:

a) Trailing points in mechanically worked installations where it can be demonstrated that the risk of derailment is negligible; and,
b) Points in sidings.

3.1.3 Train-operated points with a maximum facing speed greater than 15 mph shall have a facing point lock.

3.1.4 Facing point locks shall not engage when the conditions set out in Table *1* are met.

System	Condition to be measured	Location of measurement	Gap (mm)
Switches	The gap between the closed switch rail and its associated stock rail	At the centre of the first slide chair or baseplate	≥3.5
Switch diamond	The gap between the closed switch rail and its wing rail	At the centre of the first slide chair or baseplate	≥3.5
Swing nose crossing	The gap between the closed swing nose crossing vee and its wing rail	At the crossing vee	≥3.5

Table 1: Settings for facing point locks

Rationale

G 3.1.5 Facing point locks secure the switch rail within 3.5 mm of the stock rail to prevent damage to the switch and maintain flangeway during the passage of a train in the facing direction.

G 3.1.6 Facing point locks mitigate the risk of derailment on the movable parts of the switch.

Guidance

G 3.1.7 A facing point lock mechanism holds the switch rails securely in the required position. The facing point lock is an integral part of most modern point operating equipment.

G 3.1.8 From a safety perspective, the gap between the closed switch rail or crossing vee and its associated stock or wing rail needs to be as small as possible. In practice, tolerance has to be applied otherwise small movements or incorrect adjustment of the points could lead to the point lock not engaging. Consequently, the detection would indicate that the points were not locked, and the train would not be signalled to proceed; a common cause of points failures. Adjustment of switches for gaps above 3.5 mm will lead to the facing point lock failing to engage.

3.2 Detection

3.2.1 Worked points shall be provided with detection that proves:

a) The point end is set in the correct normal or reverse position;
b) The facing point lock (where provided) is engaged;
c) The closed switch rail is adjacent to the associated stock rail along the length of the switch; and,
d) The open switch rail has moved to a position that provides the required flangeway along the length of the switch rail.

3.2.2 For mechanically controlled worked points which are designed to be used exclusively in the trailing direction and all associated signals are mechanically controlled it is permissible to omit detection.

3.2.3 Unworked points shall be provided with detection where a signalled route on a running line leads over them in a facing direction.

3.2.4 Train-operated points shall be provided with detection for facing movements in the normal position.

3.2.5 Out-of-use points on running lines shall be provided with detection unless the moveable elements are restrained by a secure physical device designed for the purpose.

3.2.6 Low-speed trapping protection devices, such as derailers, shall be provided with detection that proves the device is set in the normal or reverse position.

Rationale

G 3.2.7 Detection proves that the points are set and secured in the correct position before movement authority is given to a train.

G 3.2.8 Detection is a mitigation for the risk of derailment at switches.

Guidance

G 3.2.9 The requirement to detect out-of-use points in running lines is consistent with Network Rail practice. GERT8000 Handbook 4 sets out requirements for securing out-of-use switches, switch diamonds, and swing nose crossings in running lines.

G 3.2.10 Detection helps mitigate the hazard posed by obstructions between the switch rail and stock rail, such as ballast or other debris, preventing the switch rail from fully closing against its associated stock rail that could lead to switch tip damage or derailment.

G 3.2.11 In situations where the points are not required to move between trains, it cannot be assumed that the points are in the correct position. Continuous detection checks and reports the position of the non-mechanically worked points prior to every movement authority being given. It is acceptable for some mechanically worked points, typically where operated by a mid-section ground frame, that the detection system does not prove locking and detection after every movement.

G 3.2.12 To allow for the small movements and vibration caused by the passage of trains, it is good practice to provide up to 5 mm tolerance in setting the detection of points.

G 3.2.13 It is good practice for detection to be provided and a points management plan to be in place for out-of-use points in running lines. Where detection is not provided and points are restrained by a secure physical device, the points management plan manages the risk of the secure physical device being replaced after removal.

3.3 Train-operated points

3.3.1 Train-operated points shall be designed so that all moveable track components are secure during the passage of trains in the facing direction.

3.3.2 On train-operated points, failure to move sufficiently under a trailing move to allow safe passage of trains shall not result in a derailment.

3.3.3 Failure of a train-operated point to return to the normal position and be secured after the passage of a train shall result in the loss of detection.

Rationale

G 3.3.4 These requirements enable train movements over train-operated points to be made in a safe manner and helps mitigate train derailment.

G 3.3.5 If the points are not in the correct position after the passage of a train, detection is not given, and the train operator must carry out procedures for securing the points for a facing train movement.

Guidance

G 3.3.6 These requirements apply to the use of train-operated points on running lines but excludes run back, catch, and spring points which are only traversed in the trailing direction.

G 3.3.7 Facing point lock and detection requirements are set out in *3.1* and *3.2* respectively.

3.4 Guidance on limits of wear and damage

Guidance

G 3.4.1 The limits of wear and damage to switches, switch diamonds, and swing nose crossings installed in the running lines are defined so that the limits are compatible with the dimensional limits for wheels and wheelsets as set out in GMRT2466 and when points are secured out-of-use because of an immediate risk of derailment.

G 3.4.2 The definition of limits of wear and damage are considered to be included in the appropriate geometrical design values decided by the infrastructure manager as set out in the INF NTSN (4.2.5.1).

G 3.4.3 The INF NTSN (4.2.8.6) sets out immediate action limits for S&C that are compatible with the geometrical characteristics of railway wheelsets.

G 3.4.4 Limits of wear and damage are used to identify when maintenance is appropriate.

G 3.4.5 The condition and profile of the rails at switches significantly affect the derailment risk, especially in a facing move. The following circumstances are considered when defining the limits of wear and damage to manage the risk of derailment.

a) Where the stock rail and switch rail are both sideworn, particularly where the angle of sidewear on the switch rail is flatter than that on the stock rail.
b) Where a sideworn stock rail is associated with an infrequently used switch rail.
c) Where head wear on the stock rail reduces the difference in height between the stock rail and the switch rail.
d) Where there is damage to the blade of the switch rail, particularly within 2 m of the switch toe.
e) Where a switch rail develops a sharp gauge corner profile or edge, particularly when associated with austenitic manganese steel and heat-treated steel.

Definitions

bearer	A transverse beam that provides vertical and lateral support to S&C, usually cut from hardwood or softwood or made of steel or pre–stressed concrete.
catch points	Points provided for derailing a vehicle running back on a gradient in the wrong direction.
crossing	A cast or fabricated portion of the track layout which enables the rails of the two tracks to cross each other, while still providing support and guidance for smooth passage of the vehicle's wheels.
derailer	A device attached to a rail that will, when in its effective position, cause the derailment of a vehicle. It is used to guard against unauthorised movements.
detection	The proof (electrical or mechanical) that points or signals have responded correctly to any control command.
external command	An instruction sent to the point operating mechanism by the interlocking to move the point ends to the normal or reverse position.
facing points (FP)	Points where train movements can be routed towards different lines, irrespective of whether or not they constitute part of a diverging junction.
facing point lock (FPL)	Equipment fitted to facing points to secure the points in the correct position for the passage of trains.
flangeway	The gap provided to permit the passage of the wheel flanges of rail vehicles, for example between a check rail and a running rail.
hand points	Points which are worked manually by an adjacent independent lever.
interlocking	A general term applied to the setting and releasing of Signals and Points to prevent unsafe conditions arising; also the equipment which performs this function.
obtuse crossing	An assembly to permit the passage of wheel flanges where two rails intersect at an obtuse angle.
out-of-use points	Points not in use, either newly laid in, awaiting commissioning, temporarily decommissioned or awaiting removal.
permissible speed	The authorised maximum speed over a section of line, either for all trains or (where differential or enhanced permissible speeds are applied) for specific types of trains, as set out in the Sectional Appendix.
point end	An item with a movable track component forming one element in a set of points. For the purpose of this document, the term includes a set of switches, one half of a set of switch diamonds, a swing nose crossing, all forms of trap points, a derailer or a scotch block.

points	A group of one or more point ends which are operated together by a common external command and may be aligned to one of two positions, normal or reverse, according to the train movement required.
scotch block	A device attached to a rail that will, when in its effective position, prevent the movement of stationary vehicles.
swing nose crossing	A common crossing in which the crossing vee can move laterally to close the flangeway to one or other of the wing rails to provide continuous support to wheelsets. This type of crossing does not require the use of check rails. A swing nose crossing counts as one point end.
switch diamond	A set of switch diamonds consists of two obtuse crossings in which the obtuse point rails are replaced by switch rails and a check rail is not required. A set of switch diamonds counts as two point ends.
switch toe	The end of the switch rail that is traversed first by a vehicle negotiating the switch in the facing direction.
switches and crossings (S&C)	Sometimes points and crossings. All the ironwork associated with a set of points. It covers switch toes, switch rails, heels of switch rails, closure rails, stock rails, crossings and check rails.
through route and turnout route in S&C	In most S&C the through route is the one that carries the majority of traffic and is usually the route through which permissible speed remains unchanged. The turnout route is typically the one that carries less traffic and usually has a permissible speed substantially lower than that of the through route.
train-operated points	Points which are designed for use in running lines with facing movements in the normal position only. They are operated by the passage of trains in the trailing reverse direction. They are restored to the normal position by the point operating mechanism after the passage of each train (compare with 'worked points'). 'Hydro-pneumatic self restored points' are a type of train operated points.
trap or catch points	Facing points provided at an exit from a siding or converging line to de–rail an unauthorised movement, thus protecting the adjacent running line.
unworked points	Points not controlled by the signalling system, other than train operated points. Hand points, runaway catch points and spring operated points (usually only used as trap or catch points) are examples of unworked points.
worked points	Points which are controlled by the signalling system.

References

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

RGSC 01	Railway Group Standards Code
RGSC 02	Standards Manual

Documents referenced in the text

Railway Group Standards

GCRT5021	Track System Requirements
GMRT2466	Railway Wheelsets

RSSB documents

GIGN7608	Guidance on the Infrastructure Technical Specification for Interoperability
RIS-0009-CCS	Identification of Signalling and Related Equipment
RIS-0733-CCS	Lineside Operational Signs
Sign AC10	Points Identification Plates

Other references

INF NTSN	Infrastructure National Technical Specification Notice