

Information for users

The following document:

NR/L3/TRK/4004
Issue 2

has had changes made to it, most recently, with effect from **14 September 2015**.

Instructions for use

It is essential that you first read and understand each letter of instruction pertaining to the standard before proceeding to use the standard. You must then apply the requirements of each letter to the standard.

NR/BS/LI/283	Issue 2	14 September 2015	Proceed to letter ►
NR/BS/LI/340	Issue 1	7 January 2015	Proceed to letter ►
NR/L3/TRK/4004	Issue 2	05 March 2011	Proceed to standard ►

For further information, please contact:

[IHS Customer Support](#)

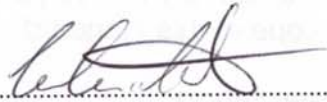
Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

Level 3

Switch and crossing assemblies

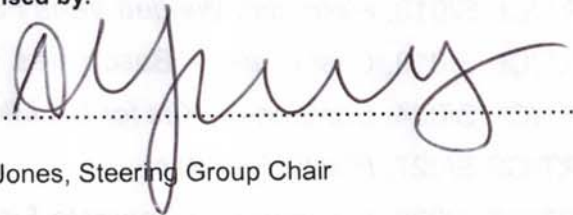
Endorsement and Authorisation

Endorsed by:



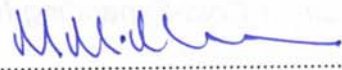
Geoff South, Working Group Chair

Authorised by:



Andy Jones, Steering Group Chair

Accepted for issue by:



Mick McManus, National Standards Manager

This document is the property of Network Rail. It shall not be reproduced in whole or part nor disclosed to a third party without the written permission of Network Rail.

© Copyright 2011 Network Rail.

Uncontrolled copy once printed from its electronic source.

Published and Issued by Network Rail, Kings Place, 90 York Way, London. N1 9AG.

NetworkRail



Documents

Document Sharing Hub

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

Issue record

Issue	Date	Comments
1	September 1996	Published as RT/CE/S/004. Superseded BR1211. It was renumbered NR/SP/TRK/004 in 2004.
2	March 2011	Revised. Renumbered to NR/L3/TRK/4004.

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 4th June 2011.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

RT/CE/S/008, *Saw and Disc Cutting and Drilling of Rail.*

RT/CE/S/012, *Cast Austenitic Manganese Steel Crossings.*

RT/CE/S/013, *Eletroslag Welded Vees For Part-Welded Crossing.*

RT/CE/S/019, *Cast Chairs – Baseplates and Blocks.*

RT/CE/S/024, *Component Kits for BR Mk111 4- and 6- hole Glued Insulated Joints.*

RT/CS/S/027, *Plastic Ferrules.*

RT/CS/S/028, *Insulators for Concrete Sleepers with Pandrol Shoulders.*

RT/CE/S/030, *Concrete Sleepers and Bearers.*

RT/CE/S/050, *Process for Cold-Expanding New Fishbolt Holes by the Split Sleeve Method.*

RT/CE/S/052, *Rail and Baseplate Pads.*

RT/CE/S/061, *Pearlitic Rails.*

RT/CE/S/064, *Assembly of BR MkIII 4- and 6-hole insulated joints.*

RT/CE/S/131, *Flash-welded rails – crossings, switch rails and transition rails.*

NR/GN/SIG/11772, *Supplementary Point Drives and Detection.*

NR/L2/ELP/40045, *Electric Point Heating.*

NR/L2/TRK/2102, *Design and Construction of Track.*

NR/L2/TRK/2049, *Track Design Handbook.*

NR/SP/ELP/21104, *Design & Installation of Electric Track Equipment for DC Electrified Lines.*

NR/SP/ELP/21107, *Bolted Running Rail Connections for Traction Bonding on AC and DC Electrified Lines.*

NR/SP/TRK/029, *Wood Sleepers and Bearers and Longitudinal Timbers*

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

RE/PW drawings. See Track Standards Drawing CD.

TEF 3216, *Switch and crossing layout inspection*.

Disclaimer

In issuing this document for its stated purpose, Network Rail makes no warranties, express or implied, that compliance with all or any documents it issues is sufficient on its own to ensure safe systems of work or operation. Users are reminded of their own duties under health and safety legislation.

Supply

Copies of documents are available electronically, within Network Rail's organisation. Hard copies of this document may be available to Network Rail people on request to the relevant controlled publication distributor. Other organisations may obtain copies of this document from IHS. Tel: 01344 328039.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

Contents

1 Purpose	5
2 Scope	5
3 Definitions	5
4 Materials	5
5 Manufacture and assembly	8
6 Design requirements for non-standard layouts	17
7 Detailed layout drawings	19
8 Staging/commissioning requirements	19
9 Point operating equipment	19
10 Layout assembly and inspection	20
11 Despatch	22
Appendix A Glossary	23
Appendix B Tolerances for gauges, machining and assembly	34
Figure 1 – Full depth vertical slide baseplates approved method	14
Figure B.1 – Switches – Section through switch and stock (1)	37
Figure B.2 – Top planing of switch (reference plane to head) (2)	37
Figure B.3 – Switches – Top machining of switch (reference plane to foot)	37
Figure B.4 – Switches - Switch assembly (plan)	38
Figure B.5 – Crossings (plan) – Common	38
Figure B.6 – Crossings (plan) – Check rail	38
Figure B.7 – Crossings (plan) – Obtuse	39
Figure B.8 – Crossings (sections) – Point and splice rails	39
Figure B.9 – Crossings (sections) – Nose of crossing	40
Table 1a) – Approved materials specifications	6
Table 1b) – Approved materials specifications (<i>concluded</i>)	7
Table 2 – Heating of rail steel to assist bending	10
Table 3 – Torque requirements for high-tensile bolts	12
Table 4 – Toe openings	14
Table B.1 – General tolerances	34
Table B.2 – Layout tolerances	35
Table B.3 – Switch tolerances (with stretcher bars fitted)	36
Table B.4 – Drilled holes	36
Table B.5 – Rails twisted in press	36
Table B.6 – Gauges and templates	36

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

1 Purpose

This standard specifies requirements for the manufacture and assembly of switches and crossings (S&C).

2 Scope

This Network Rail standard specifies the requirements for the design and manufacture of switch and crossing units and (S&C) assemblies. It also specifies those components to be used in the manufacturing process and methods of application.

This standard applies to the manufacture and despatch of new S&C for use in Network Rail controlled infrastructure. It also applies to trial assemblies where these are required by the purchaser.

3 Definitions

Terms and definitions used in this standard are provided in a glossary in Appendix A. Other terms and definitions relating to S&C are also provided in Appendix A.

4 Materials

4.1 General

All materials shall conform to the relevant specifications and minimum requirements (where specified) in Table 1, or be specifically approved by the Network Rail Professional Head (Track). All proprietary components shall be subject to approval by the Network Rail Professional Head (Track).

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

Materials	Specifications		Minimum requirements
Baseplates and blocks	RT/CE/S/019		Flake graphite cast iron, Grade 250, or as otherwise specified
Baseplate pads	RT/CE/S/052		
Bearer tie assemblies	RE/PW/2280 RE/PW/2286	RE/PW/2281 RE/PW/2287	
Bolts	RE/PW/044 RE/PW/257 RE/PW/157 RE/PW/548	RE/PW/615 RE/PW/004 RE/PW/263	
Cast austenitic manganese steel crossings	RT/CE/S/012		
Chairs	RT/CE/S/019		Flake graphite cast iron, Grade 250, or as otherwise specified
Concrete sleepers/bearers	RT/CE/S/030		
Dry slide baseplates	RE/PW/691 RE/PW/738	RE/PW/809 RE/PW/811	
Ferrules	RT/CE/S/027		
Fishplates	RE/PW/003 RE/PW/011 RE/PW/033 RE/PW/082 RE/PW/110 RE/PW/111 RE/PW/145 RE/PW/154 RE/PW/156	RE/PW/176 RE/PW/258 RE/PW/261 RE/PW/264 RE/PW/265 RE/PW/519 RE/PW/546 RE/PW/547 RE/PW/861	

Table 1a) – Approved materials specifications

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

Materials	Specifications		Minimum requirements
Glued insulated rail joints	RT/CE/S/024 RT/CE/S/064 (relates to the BR Mk III joint - where other Network Rail-approved joints are used the manufacturer's assembly instructions shall be followed) RE/PW/268 NR/L2/TRK/2102		
Hardwood timber sleepers/bearers	NR/SP/TRK/029		
Insulators	RT/CE/S/028		
Normal Grade or Grade "A" rail	RT/CE/S/061		
Rail (section and steel grade)			As in the contract or order
Rail pads	RT/CE/S/052		Lipped EVA or as specified
Screws	RE/PW/043 RE/PW/184	RE/PW/762 RE/PW/517	
Stretcher bars	RE/PW/118 RE/PW/721 RE/PW/741 RE/PW/823	RE/PW/720 RE/PW/740 RE/PW/814 RE/PW/824	
Part-welded vees	RT/CE/S/013		

Table 1b) – Approved materials specifications (*concluded*)

4.2 Rail

Rail shall be new.

The rail section shall be BS95RBH, CEN56E1 or CEN60E2.

CEN54E1A1 and CEN60E2A1 shall be used for shallow depth switches as required.

CEN33 rail shall be used for check rails where required. Other sections may be used if specifically approved by Network Rail Professional Head (Track).

Rail grade shall be 260 unless specified otherwise.

4.3 Switches and crossings

Switches, adjustment switches, fabricated and part fabricated crossings shall conform to the relevant RE/PW drawings.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

Cast austenitic manganese crossings shall conform to RT/CE/S/012. Crossing footprints for standard layouts shall conform to the relevant RE/PW drawing.

Crossing footprints for non-standard layouts shall follow the design principles for standard crossings.

Extension rails welded on to cast manganese crossings shall conform to the relevant RE/PW drawing or, if specially ordered, shall conform to the requirements of NR/L2/TRK/2102.

4.4 Castings

Cast products shall conform to RT/CE/S/019 and the relevant RE/PW drawing.

4.5 Quality Assurance and manufacturing procedures

All materials, assemblies and layouts shall conform to the specified requirements and maintain inspection and test certificates.

Certificates of conformity shall be supplied for switches, crossings, bearers and layouts. Sets of certificates shall be supplied for layouts. Certificates shall be supplied on request for all other components.

Quality plans and manufacturing procedures shall be submitted to Network Rail when required.

Network Rail or its contractors shall have access at all reasonable times to those parts of the works engaged on a contract or order from Network Rail or its contractors. Either of these parties shall be at liberty to witness the manufacture at any stage.

NOTE This will normally be by prior arrangement.

4.6 Variations from specification

Variations from this specification shall be recorded and action taken to have them rectified or, if appropriate, approved in writing by Network Rail.

Applications for non-compliance shall be submitted to Network Rail (National Delivery Service) for approval by Network Rail Professional Head (Track).

5 Manufacture and assembly

5.1 Approval

Components and assemblies shall be manufactured by a Network Rail-approved S&C manufacturer.

Significant changes in process, plant or location shall be subject to written approval.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

5.2 Avoidance of damage

No part of the assembly shall be bruised or otherwise damaged during any handling, manufacturing or assembly operation.

5.3 Handling

Switch and crossing units shall be lifted using suitable Network Rail-approved lifting beams or multi-legged slings. The need for special lifting beams and slings to achieve correct and safe handling of assemblies shall be determined. These shall be designed, tested and supplied where necessary.

The correct number and position of lifting points for the assembly to be lifted shall be ascertained prior to a lift taking place.

NOTE This should be done by calculation of known weights or if this is not possible, by a trial lift of the assembly and adjusting the lifting points so that the weight carried by the lifting equipment is in balance prior to the full lift taking place.

There shall be a minimum of two lifting points within the machined area of switches, switch assemblies and crossings, with additional lifting points as necessary to adequately support the sub-assembly.

Lifting points, centre of gravity, and weights on assemblies and large components shall be marked. Rails shall be lifted with the railhead uppermost. Single point lifting is not permitted on single rails over six metres long.

Any chains used as part of the lifting equipment shall not come into contact with any part of the assembly being lifted. Appropriate webbing slings shall be used as an interface between the lifting equipment and the assembly.

5.4 Machining and fabrication

All S&C assemblies and layouts shall be machined and fabricated strictly to the components/layout drawings and other contract/order requirements. They shall be manufactured and assembled to the tolerances specified in Appendix B.

The method of holding rails and components during manufacture and the method of machining shall be such that the finished machined face shall follow the designed alignment.

5.5 Templates and gauges

Templates and gauges used in the machining and assembly of components, also marking templates, shall be subject to a minimum 12-monthly calibration check. A record of such checks shall be maintained together with records of any reworking of gauge faces. Accuracy and fitness for use shall be maintained throughout the intervening 12-month period.

Where marking templates are used, there shall be a corresponding internal/external gauge to check the finished operation.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

5.6 Cutting of rails

Rails cut to length shall be cold-cut square across the section, to the tolerances specified in RT/CE/S/061. No part of a rail shall be flame cut. All burrs shall be removed.

Rail ends which are to be cut to length on site or joined by welding shall not be drilled for fishplates unless specified for "back-hole drilled".

External closure rails shall be cut to the lengths specified on the contract/order or drawing supplied by Network Rail or the site contractor acting on its behalf.

Internal closure rails shall be cut to fit the appropriate space to give expansion gaps of 6 mm width (at a rail temperature of 20°C) at each rail joint for jointed layouts or without gaps for tight joints and welded layouts unless specified otherwise.

Adjustment switch rails shall not be less than 4.5 m long overall unless authorised by Network Rail.

5.7 Rail bending

Every endeavour shall be made to remove machining marks, particularly those indenting the surface in a transverse plane, around the point where a bend (set) is to be made.

If a bend (set) is to be applied to a rail which has had the foot machined, the corners created by the machining shall have a 6 mm minimum radius applied on the outside of the bend in such a manner that any marks produced in applying the radius are in a longitudinal direction.

All rails shall be heated where the distance between the press blocks is to be 600 mm or under, or the angle of set is to be more than 6°.

Grade of rail steel	Temperature range
Normal Grade	300°C to 350°C
Wear-Resisting Grade A (260)	
MHT & MHH Premium grade steel	

Table 2 – Heating of rail steel to assist bending

In order to achieve adequate preheating throughout the whole section, the heating process shall be applied gradually and without interruption to at least 350 mm each side of the point of bending until the required temperature has been reached as shown in Table 2. No part of the rail shall exceed 525°C.

Following bending, preheated rails shall be allowed to cool in air whilst supported clear of the ground or table. They shall not be quenched by any means, nor placed upon a cold floor whilst cooling.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

5.8 Rail curving

Rails for curves sharper than 500 m radius shall be subject to a Network Rail-approved pre-curving process.

Rails shall be pressed or rolled by contact at the web or contact over the full rail section.

Confirmation of radii shall be undertaken by overlapping versines or by the use of radius boards of no less than two metres in length.

5.9 Forgings and transition rails

The tolerance for rail head horizontal and vertical alignment for forgings (switches and transition rails) shall be as for flash-welded rails, as specified in RT/CE/S/131.

5.10 Rail drilling

All holes shall be drilled in accordance with RT/CE/S/008. Fishbolt holes shall be cold expanded as specified in RT/CE/S/050.

No holes additional to those specified on Network Rail standard drawings shall be introduced into the rail to aid the machining process without Network Rail approval.

No holes other than bond holes shall be plugged.

5.11 Rail feet location and rail inclination

The underside transverse flatness of the rails at bearer positions shall be in the same plane within 1 mm. Inclined rails shall be inclined between 1 in 18 and 1 in 22 to the vertical.

5.12 Fishplates

Only tight jointed fishplates to RE/PW/258 (or insulated fishplates without an expansion gap) shall be used where a fishplated joint is required to connect a cast monobloc crossing to plain rail or jointed rails within S&C in CWR.

Incorrect rail heights on cast crossings shall not be corrected by the use of lift fishplates.

5.13 Branding marks

Branding marks on the rails which will be covered by stretcher bar brackets, block faces or glued insulated joints shall be removed by an approved grinding process unless the component concerned incorporates rail branding relief.

Branding shall also be removed if it will impede the fit of the head of the bolt, or washer, to the web.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

5.14 Blocks

Spacing blocks shall be ground or machined as necessary to give the correct fit against the webs of the rails and give the specified distance between running edges, inclination, offset, angle or flangeway between the rails.

A resin filler (approved by Network Rail), mixed and used in accordance with the suppliers instructions, shall be applied to the contact faces between the blocks and the rail (except jaw blocks and slide baseplate distance blocks), or as detailed on the standard drawings.

Before the resin is applied, the mating surfaces shall be prepared in accordance with the suppliers instructions. When the bolts have been tightened, surplus resin shall be removed.

NOTE The use of resin does not eliminate the necessity for metal contact between the rail and blocks.

5.15 Bolts

All bolts shall be to the approved standards shown in Table 3, be of the correct length and fitted with the correct washers, nut(s) or collar as specified and installed as indicated on the relevant RE/PW drawing. All high-tensile bolts used shall be torqued to the measurements in Table 3 unless shown otherwise on RE/PW drawings or in Network Rail standards. Calibrated torque spanners or wrenches shall be used.

Type	Grade	N·m	lb–ft
M20	4.6	85	65
M20	8.8	250	185
M24	8.8	880	650
M27 ^a	8.8	880	650
^a Other than fishbolts (which are to be torqued to 1020 N·m (750 lb–ft)).			

Table 3 – Torque requirements for high-tensile bolts

All bolts shall be fully tightened with an appropriate tool. If self-locking nuts are not specified in Network Rail RE/PW drawings, an approved thread-locking compound shall be used.

Fastenings (that do not need to be disassembled for transportation) shall be fully tightened on assembly to the required torque. The nuts on such fastenings shall be painted green to indicate that they are at the required torque.

NOTE Fastenings that must be removed for transportation need not be fully tightened on initial assembly unless it is necessary to prove operation.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

5.16 Switches

5.16.1 General

Switches shall be factory assembled and inspected prior to release on a suitable flat assembly or inspection bed.

When in the closed position, with the stock rail to the correct alignment, the switch rail shall bear evenly against the stock rail throughout the length of the head machining and against the distance blocks without external aid as specified in Appendix B.

5.16.2 Switches without additional drives

Switches which are not to be provided with additional drives shall at their specified toe opening open naturally to the specified minimum distance at the heel of the head machining with the stock rail at the correct alignment, without external aid.

5.16.3 Soleplates

A soleplate or steel bearer, according to the type of switch drive mechanism, shall be provided at the toe position. Stretcher bars and soleplates shall be insulated as necessary to meet signalling requirements.

5.16.4 Stretcher bars

The number of stretcher bars (or approved equivalent) in standard switch designs shall accord with the relevant standard drawings. There shall be at least two.

5.16.5 Anti-creep monitors

Half sets of switches fitted with ball and claw (anti-creep monitors) shall have the ball and claw adjusted so that it is in its centre position when the switch toes are in the correct position.

5.16.6 Switch securing device

On layouts, each pair of switches shall be supplied where specified on RE/PW drawings with two switch securing block assemblies (see drawing RE/PW/759) mounted on the baseplate (without padlock) and wired securely to the unit.

Ref:	NR/L3/TRK/4004
Issue:	2
Date:	5 th March 2011
Compliance date:	4 th June 2011

5.16.7 Toe clearances

Toe openings at switches and switch diamonds prior to the fitting of the point operating equipment shall be within the ranges specified in Table 4.

Method of operation	Switches	Switch diamonds
All rail sections, lever or motor operated	102 mm to 120 mm	102 mm to 120 mm
All rail sections, clamp lock operated	105 mm to 110 mm	85 mm to 90 mm

Table 4 – Toe openings

Toe openings after the fitting of point operating equipment shall conform to NR/GN/SIG/11772.

5.17 Baseplates

Baseplates on timber shall be within 10 mm of any specified longitudinal position. Baseplates on concrete bearers shall be positioned in accordance with the relevant RE/PW drawing.

Where check rails exist opposite crossings, the baseplates shall fit against the *inside* foot of the check rail. Elsewhere, the *outer* foot of the rail shall be tight against the stop on the baseplate.

The first slide baseplate of a switch shall be ground along its outer edge to give the correct fit against the soleplate stop. An approved method of achieving this for Full Depth Vertical slide baseplates is shown in Figure 1.

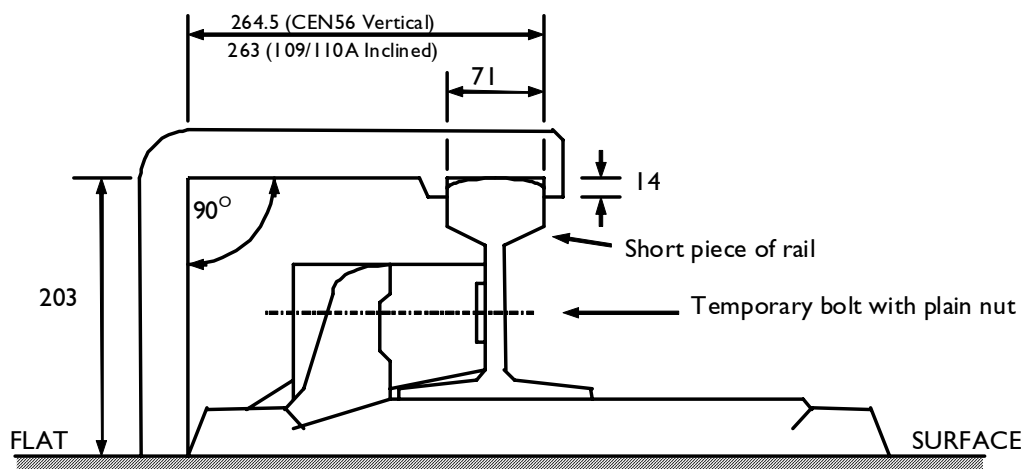


Figure 1 – Full depth vertical slide baseplates approved method