

Specification

T0435

Track: Manufacture, assembly and handling of junctionwork

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1 Purpose

The purpose of this specification is to specify requirements for the manufacture and assembly of points and crossings (P&C).

2 Scope

- 2.1 This specification specifies the requirements for the manufacture of points and crossing units and assemblies. It also specifies those components to be used in the manufacturing process and methods of application.
- 2.2 This standard applies to the manufacture and dispatch of new P&C for use in LU-controlled infrastructure. It also applies to trial or test panel assemblies where these are required by the purchaser.

3 Requirements

3.1 General

Authorised and designated equipment specifically designed, manufactured and provided for the task shall be used for assembly, handling, loading and transporting junctionwork.

Cranes and other lifting plant and equipment shall be inspected and certificated, and checked before use at the start of each daily shift, in accordance with BS 7121.

3.2 Materials

3.2.1 Approval

All materials shall conform to the relevant specifications listed in S1157 or be specifically approved by LU Head of Track Engineering. All proprietary components shall be approved via the LU Approved Products Register.

3.2.2 Rail

3.2.2.1 Rail shall be new, grade R260 (as defined in EN 13674) unless specified otherwise.

3.2.2.2 The rail section (as defined in EN 13674) for FB P&C shall be:

- a) 56E1 for stock and switch rails in vertical full-depth P&C;
- b) 56E1 for stock rails and 54E1A1 for switch rails in shallow-depth P&C.

3.2.2.3 The rail section for BH P&C shall be 95RBH as defined in BS 11.

3.2.2.4 BB54M shallow depth switch designs are to be used in place of the RE/PW shallow depth switch range.

3.2.2.5 Check rails in FB assemblies shall be 33C1 or 56E1 according to the design.

3.2.3 Switches

- 3.2.3.1 Switches (including adjustment switches) shall conform to the relevant RE/PW, SRE or LU drawings.
- 3.2.3.2 For shallow-depth switch rail designs refer to the BB54M range.
- 3.2.3.3 For full-depth AV, BV and DV switch rail designs refer to BB56M range. For full-depth CV, EV and FV switch rail designs refer to RE/PW drawings.
- 3.2.3.4 All FB switches shall incorporate foot relief.

3.2.4 Crossings

- 3.2.4.1 Part-fabricated and fabricated crossings shall conform to the relevant RE/PW, SRE or LU drawings.
- 3.2.4.2 Crossing footprints for non-standard layouts shall follow the design principles for standard crossings.
- 3.2.4.3 The lengths of extension rails welded on to cast manganese crossings shall conform to S1157.
- 3.2.4.4 Cast products shall conform to T0400 and the relevant RE/PW drawing.

3.2.5 Bearers

- 3.2.5.1 The preferred bearer material is concrete, followed by composite, then hardwood.
- 3.2.5.2 Timber bearers used in P&C assemblies shall be hardwood. Softwood bearers shall not be used without the permission of the LU Head of Track Engineering.
- 3.2.5.3 Hollow bearers may be used to accommodate point operating mechanisms and are subject to individual product acceptance by LU Head of Track Engineering.

3.3 Manufacture and assembly

3.3.1 Approval

- 3.3.1.1 Components and assemblies shall be manufactured by an LU-approved P&C manufacturer.
- 3.3.1.2 Significant changes in process, plant or location shall be subject to written approval.

3.3.2 Handling

- 3.3.2.1 Where possible all items shall be loaded using mechanical handling equipment; manual handling shall be reduced as far as possible.
- 3.3.2.2 Materials and components shall be handled so that they are not damaged in any way and that safety of personnel is not endangered.
- 3.3.2.3 For handling guidance on concrete bearers refer to Technical Guidance HOE-TRK-GDN-2012-0096.

- 3.3.2.4 For handling guidance on composite/synthetic bearers refer to Technical Bulletin HOE-TRK-TB-2015-354.
- 3.3.2.5 Point and crossing units shall be lifted using suitable LU-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.
- 3.3.2.6 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.

- 3.3.2.7 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.
- 3.3.2.8 Lifting points, centre of gravity, and weights on assemblies and large components such as cast crossings shall be marked. Rails shall be lifted with the railhead uppermost. Single point lifting is not permitted on single rails over 6m long.
- 3.3.2.9 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.

3.3.3 Machining and fabrication

- 3.3.3.1 All P&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 Attachment 2.
- 3.3.3.2 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.

3.3.4 Templates and gauges

- 3.3.4.1 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.
- 3.3.4.2 Where marking templates are used, there shall be a corresponding internal/external gauge to check the finished operation.

3.3.5 Cutting of rails

- 3.3.5.1 Rails cut to length shall be cold-cut square across the section, to within 0.6mm (as shown in EN 13674). No part of a rail shall be flame cut. All burrs shall be removed.

- 3.3.5.2 Rail ends which are to be cut to length on site or joined by welding shall not be drilled for fishplates unless specified as "back-hole drilled".
- 3.3.5.3 External closure rails shall be cut to the lengths specified on the contract/order or drawing supplied by LU or the site contractor acting on LU's behalf.
- 3.3.5.4 Internal closure rails shall be cut to fit the appropriate space to give expansion gaps of 6 mm width (at a rail temperature of 20C) at each rail joint for jointed layouts or without gaps for tight joints and welded layouts unless specified otherwise.
- 3.3.5.5 Adjustment switch rails shall not be less than 4.5m long overall unless authorised by LU.

3.3.6 Rail bending

- 3.3.6.1 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.
- 3.3.6.2 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 6mm 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.
- 3.3.6.3 All rails shall be heated to between 300C and 350C where the distance between the press blocks is to be 600mm or under, or the angle of set is to be more than 6°.
- 3.3.6.4 In order to achieve adequate preheating throughout the whole section, the heating process shall be applied gradually and without interruption to at least 350mm each side of the point of bending until the required temperature has been reached. No part of the rail shall exceed 525C.
- 3.3.6.5 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.

3.3.7 Rail curving

- 3.3.7.1 Flatbottom rails for curves sharper than 300m radius and bullhead rails for curves sharper than 200m radius shall be pre-curved. The pre-curving process shall involve the rails being pressed or rolled by contact at the web or contact over the full rail section and shall be subject to LU's approval.
- 3.3.7.2 Confirmation of radii shall be undertaken by overlapping versines or by the use of radius boards of no less than 2m in length.
- 3.3.7.3 The pre-curving of switch rails for switch to stock rail fit is to be checked for any switch bias or spring by conducting the Free Switch and Spring Test in Attachment 4.

3.3.8 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 T0431.

3.3.9 Rail drilling

- 3.3.9.1 All holes shall be drilled in accordance with S1157 and in the positions shown on drawings. Fishbolt holes shall be cold expanded as specified in S1157.
- 3.3.9.2 No holes additional to those specified on LU standard drawings shall be introduced into the rail to aid the machining process without LU approval.
- 3.3.9.3 No holes other than bond holes shall be plugged.

3.3.10 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.

3.3.11 Fishplates and insulated rail joints

- 3.3.11.1 Only tight-jointed fishplates to RE/PW/258 or insulated joints shall be used where a fishplated joint is required to connect a cast monobloc crossing to abutting rail.
- 3.3.11.2 Incorrect rail heights on cast crossings shall not be corrected by the use of lift fishplates.
- 3.3.11.3 The maximum allowable gap within a dry insulated rail joint or tight rail joint is 0.5mm.
- 3.3.11.4 The maximum allowable gap within Brecknell Willis conductor rail pinned joints is 2mm.
- 3.3.11.5 The maximum allowable gap on check rails or abutting check rail to cast crossings is 6mm when jointed. Where designs are not jointed a maximum gap of 25mm is permitted.

3.3.12 Branding marks

- 3.3.12.1 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.
- 3.3.12.2 Branding shall also be removed if it will impede the fit of the head of the bolt, or washer, to the web.

3.3.13 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.

3.3.14 Bolts

- 3.3.14.1 All bolts shall be to the approved standards shown in Table 1, 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

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torqued to the values in Table 1 unless shown otherwise on RE/PW drawings or in LU standards. Calibrated torque spanners or wrenches shall be used.

Table 1 – Torque requirements for high-tensile bolts		
Type	Grade (as defined in EN ISO 898-1)	Nm
M20	4.6	85
M20	8.8	250
M24	8.8	880
M27 (1)	8.8	880
M20 (2)	10.9	520
M27 (2)	10.9	1020
28.5mm (1 1/8 in) (2)	10.9	1020
(1) Other than tight-joint fishbolts (which are to be torqued to 1020 Nm)		
(2) For Tenconi insulated joints		

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

3.3.14.3 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.

3.3.15 Switches

3.3.15.1 General

3.3.15.1.1 Switches shall be factory-assembled. Prior to release they shall be inspected on a suitable flat assembly or inspection bed.

3.3.15.1.2 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 Attachment 2.

3.3.15.2 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 end of planing with the stock rail at the correct alignment, without external aid.

3.3.15.3 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.

3.3.15.4 Stretcher bars

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

3.3.15.5 Anti-creep monitors (ball and claw)

Half sets of switches fitted with a ball and claw anti-creep monitor shall be assembled with the ball centred within the claw (further adjustment may be required at site installation, depending on the rail temperature).

3.3.15.6 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 S1159.

3.3.16 Baseplates

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

3.3.16.2 Where check rails exist opposite crossings, the baseplates shall fit against the four-foot side of the check rail. Elsewhere, the outer foot of the running rail shall be tight against the stop on the baseplate.

3.3.16.3 The first slide baseplate of a switch shall be ground along its outer edge to give the correct fit against the soleplate stop. The gap between the welded gauge stop and the baseplate after the point machine has been installed shall be no greater than 1mm.

3.3.16.4 The switch and stock rail shall bear evenly on all the slide baseplates (due allowance being made for baseplate camber) when placed on a plane surface. Maximum gap allowable is 2mm.

3.3.16.5 During assembly and inspection roller baseplates shall be adjusted so that the roller chassis is in the correct lateral position with the rollers set for 2mm of lift. Rollers shall be reset to zero for transportation by tilting wagon.

3.3.17 Rail fastenings

3.3.17.1 Rail fastenings that do not need to be removed for transportation shall be installed to their correct position with an approved installation tool on assembly. Vossloh screws shall be tightened to the correct torque with calibrated equipment.

3.3.17.2 Rail foot clamps that do not need to be disassembled for transportation shall be tightened to the correct torque. The nuts on such fastenings shall be painted green to indicate that they are at the required torque.

3.3.17.3 Calibrated torque spanners or wrenches shall be used.

3.3.18 Bearers – handling and preparation

3.3.18.1 Concrete

- 3.3.18.1.1 Bearers shall be handled in accordance LU guidance notes to avoid damage to edges. Any bearer with exposed reinforcement shall be rejected.
- 3.3.18.1.2 Damaged bearers deemed repairable shall only be repaired by the bearer manufacturer in accordance with his approved repair procedure.
- 3.3.18.1.3 Concrete bearers shall not normally be drilled post-manufacture to accept rail or baseplate fastenings. Where drilling is required, it is permitted only where the work has been assessed by the bearer manufacturer and undertaken by him or his approved suppliers.
- 3.3.18.1.4 Where shoulders or fastening inserts have been glued in, post-manufacture “pull out” tests shall be conducted prior to the despatch of the layout in accordance with the bearer manufacturer’s work instructions.
- 3.3.18.1.5 Concrete bearers may be drilled post-manufacture for signalling equipment or other attachments, subject to the use of:
- a) a template approved by the bearer manufacturer;
 - b) a method of drilling approved by the bearer manufacturer that will not cause damage to the bearer or reinforcing strands;
 - c) fastenings which will not crack or shatter the concrete.
- 3.3.18.1.6 All inserts for baseplate screws shall have drain holes and shall be cleared of debris prior to the insertion of screws. Unused or empty screw holes shall be capped prior to despatch.
- 3.3.18.1.7 Where gauge-holding stops are required to fix the rail at common crossings, they shall be installed using Vossloh screws and flanged ferrules (see drawings RE/PW/542 and RE/PW/763).
- 3.3.18.1.8 Vossloh screws for concrete bearer layouts shall be torqued to the values specified in RE/PW/184 and RE/PW/762.

3.3.18.2 Timber and composite

- 3.3.18.2.1 Bearers shall be stacked/stored in a manner to prevent damage, distortion and deterioration; they shall be supported clear of the ground and each layer separated at regular intervals by dunnage. The sawn ends of timber bearers shall be sealed with a suitable sealer approved by the bearer supplier.
- 3.3.18.2.2 Coach screw holes for baseplates and full-depth cast crossings shall be bored vertically with a 19mm auger (in hardwood; the diameter to be as recommended by the supplier in the case of composite material) right through the bearer and centrally through the baseplate hole. Shavings shall be cleaned off before the baseplate is screwed down.

- 3.3.18.2.3 The end of a timber bearer shall normally be not less than 570mm from the nearest running edge (615mm where conductor rail is to be fitted). The minimum dimension from the edge of a baseplate or chair to the end of a timber bearer is 150mm. Equivalent dimensions for composite bearers shall be as recommended by the bearer supplier.
- 3.3.18.2.4 Holes for coach screws shall normally be drilled no closer than 50mm to the edge of the bearer.
- 3.3.18.2.5 Tapered ferrules for use in timber shall be driven carefully into the baseplate with the top left protruding 6mm above the boss of the baseplates. Coachscrews shall not be screwed down in such a way as to crush the ferrule.

3.3.18.3 Hollow bearers

- 3.3.18.3.1 Hollow bearers shall be assembled in accordance with the manufacturer's instructions.
- 3.3.18.3.2 Hollow sleepers may be used for cable management in plain line associated with P&C. Their position within a layout will be indicated on the drawing.

3.3.19 Configuration of bearers in layouts

- 3.3.19.1 Bearer spacing in layouts covered by standard drawings shall accord with the relevant drawing.
- 3.3.19.2 For non-standard layouts, the following requirements additionally apply:
- bearer positions shown on standard drawings for turnouts, crossovers, diamonds and junctions shall be used wherever possible so that baseplates secured by bolted connections to the running rails can be located centrally on the bearers;
 - baseplates on bearers shall be positioned as far as practicable along the centreline of the bearer;
 - the distance from the running edge to the end of a bearer may be reduced to 300mm where obstructions such as drainage manholes exist. However, this shortening will result in not being able to support the positive conductor rail.
 - two consecutive concrete bearers, or one timber bearer, may be gapped in a four-foot location provided the adjacent bearers in that four-foot maintain gauge;
 - bearers supporting crossing noses shall not be gapped in the adjacent four-foot;
 - interlacing or longitudinal joining of shorter than appropriate timber bearers is not permitted;
 - bearers shall normally be at right angles to the main or through track and be at a nominal spacing of 710 mm for vertical P&C;
 - individual bearers shall not be more than 750mm centres nor less than 550 mm centres from an adjacent bearer, except where required to accommodate trainstops;
 - bearers under obtuse crossings shall be positioned at right angles to the centre-line of the diamond;

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- j. the nominal distance between opposite bearer ends should be 75mm and never less than 50mm to allow ballast movement. Where this distance is reduced to increase bearer length a pad shall be installed onto each bearer end and the gap between the pads shall not exceed 10mm;
- k. where layouts are curved, see clause 3.3.21 for how bearers are to be configured.

3.3.20 Joining of bearers

Approved tie plates, with or without an integral conductor rail insulator support spigot, are available for joining concrete bearers. Bearers so joined are not regarded as being “gapped” and are subject to the following requirements:

- a) the bearers shall have shear plates cast within the bearer end;
- b) bearers joined with a Network Rail-type tie plate (RE/PW/2286 (long) or RE/PW/2287(short)) may be used consecutively without limit;
- c) bearers joined with the LU-type tie plate (HOE-TRK-DRG-2015-0436) may also be used without limit except that they shall not be used within two bearers of crossing noses or plated joints.

3.3.21 Adjustments for curvature

3.3.21.1 General

When applying through curvature to P&C, the following principal dimensions shall be maintained:

- a) the toe to nose dimension along the track centre-line;
- b) lengths of switch and stock rails;
- c) crossing leg lengths;
- d) stagger across obtuse crossings or switch diamonds in diamonds. Rail lengths other than (b) and (c) may be adjusted to suit.

3.3.21.2 Fanning of bearers – turnout

Where a standard design of turnout is to be installed on a regular curve, standard bearers shall be used as far as practicable. Bearers shall be fanned relative to the through rail connecting the toe to the nose.

3.3.21.3 Fanning of bearers – crossover

Through bearers shall first be positioned to suit crossing noses then fanned relative to the centre-line of the track interval. Other bearers shall normally be fanned relative to the through rail connecting the toe to the nose.

3.3.21.4 Rail bending – non-standard designs

Finite element analysis shall be carried out on non-standard designs where it is necessary to both bend the rails and apply foot relief machining. The results of the analysis shall be passed to LU Head of Track Engineering for approval prior to manufacture.