

Supplement Notice

Information for users

The attached standard:

RT/CE/S/012

Issue 2

has essential supplementary information

Instructions for use

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

Proceed to supplement ►**I have read & understand the supplement.
Proceed to standard ►**

Ref	NR/SP/TRK/012
Issue	2
Date	February 2002

Cast Austenitic Manganese Steel Crossings (formerly RT/CE/S/012)

This temporary front sheet facilitates change to the new Network Rail Standards referencing nomenclature.

The Ref above will be formally allocated to this standard when it is next changed in the meantime the contents, date and issue number of this Network Rail Standard are UNCHANGED and with immediate effect it should be referred to as “(new ref) formerly (old ref)”.

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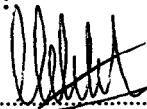
RAILTRACK

COMPANY SPECIFICATION

CAST AUSTENITIC MANGANESE STEEL CROSSINGS

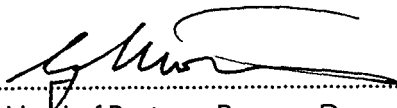
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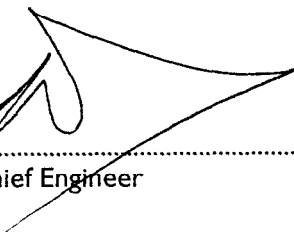
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Summary

This specification defines Railtrack's criteria for the approval of designs of cast austenitic manganese steel crossings and for control of the manufacturing process. It also specifies the documentation that the supplier shall provide describing the recommended handling and maintenance of the product.

Issue record

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

Owing to the substantial restructuring of this specification, this Issue has no margin bars.

Issue	Date	Comments
1	Dec 1997	Supersedes BR I24 and BR I206
2	Feb 2002	Addition of design and process approval, and handling and maintenance requirements

Responsibilities

This specification shall be complied with by all persons responsible for the manufacture, supply, purchase and installation of cast austenitic manganese steel crossings for use in Railtrack's permanent way.

Implementation

The provisions of this specification are mandatory and apply from February 2002.

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Supply

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1 PURPOSE

To ensure the structural integrity, longevity and functionality of cast austenitic crossings installed in Railtrack's infrastructure.

2 SCOPE

This specification covers common and obtuse cast austenitic manganese crossings designed to be welded to plain, pearlitic rails of the CEN 60E1 (UIC60) profile and suitable for 30 tonne axle loads and to crossings designed to be either welded or bolted to rails of the CEN 56E1 (113A) profile and suitable for 25.5 tonne axle loads. It applies to both conventional and explosively hardened crossings. Swing nose crossings are not covered.

The specification is in three parts. Part A defines Railtrack's criteria for the approval of designs for cast austenitic manganese crossings and for the approval of the production process. Part B sets out Railtrack's requirements for production control and part C specifies the information to be supplied to Purchasers and others by the manufacturer or their agent to ensure that, as far as is reasonably practicable, crossings are correctly handled and maintained.

3 DEFINITIONS

Semi-fabricated vee A crossing in which a cast nose-piece is welded to pearlitic or austenitic manganese steel rail legs and to which the wing rails are attached by multi-groove locking pins, tension controlled bolts or similar devices. (Also referred to as part fabricated vees).

Cast centre block crossing A crossing, the nose(s) and throat (knuckle) of which are made as one casting. The leg ends are attached by welding and the non-load carrying wing rails by multi-groove locking pins, tension controlled bolts or similar devices.

Monobloc crossing A crossing, all the components of which (vees, wing rails, legs etc.), up to the joints to plain rail, are cast as one piece.

Welded crossing A crossing, the leg ends of which terminate with lengths of pearlitic rail so that the crossing may be welded into track using standard procedures. The pearlitic rails are attached to the casting at the factory using procedures involving the use of a special insert between the casting and the rails.

Bolted crossing A crossing designed to be attached to the adjacent plain rail using a fish-plated connection.

4 QUALITY SYSTEMS

The company (or companies) responsible for the design and manufacture of the crossing shall operate independently approved and audited quality systems conforming to the requirements of EN ISO 9001:2000

CAST AUSTENITIC MANGANESE STEEL CROSSINGS

Note: If the design office holds a certificate of compliance with EN ISO 9001:1994, and the company responsible for the manufacture of the crossing a certificate of compliance with EN ISO 9002: 1994, these will be accepted as fulfilling the requirements of this clause until the certificates expire.

PART A DESIGN AND PROCESS APPROVAL

A.1 PURPOSE

The purpose of the requirements given in this part is

- to define the approved products (**A.2**, **A.3**)
- to ensure that the method of manufacture will minimize the risk of failure from internal defects(**A.4**)
- to minimize the risk of fatigue failure from the base of the crossing (**A.5**)
- to control, so far as is practicable, the impact loads in the transfer area (**A.6**) with a view to minimizing both rolling contact fatigue damage and the risk of fatigue failure from the foot.
- in weldable crossings, to minimize the risk of fatigue failure at or near the weld (**A.7**)
- to ensure that proven procedures exist for repair (**A.8**).

A.2 CASTING GROUPS

For the purposes of design and process approval, the approval of one crossing design in each of the following groups shall be deemed to cover all crossings within that group, including explosively hardened crossings, subject to the conditions below.

- for hardened crossings, details of the hardening process shall be documented for Railtrack's endorsement (**A.4**) and
- if there are differences in the geometry of the finished crossings in the transfer area, compliance with the requirements of **A.5** and **A.6** shall be separately demonstrated for both un-hardened and hardened crossings.

Note: Currently there is little experience of the performance of explosively hardened crossings under British operating conditions. The scope of their approval may therefore limit the number that may be supplied for installation in Railtrack's network until more experience has been obtained.

Common Crossings; groupings	Up to 1 in 16; 56E1 and 113A compatible	1 in 16 and above; 56E1 and 113A compatible	Up to 1 in 15.75; RT60 series	1 in 15.75 and above; RT60 series
Semi fabricated steel vees	56C1	56C2		
Cast centre blocks	56C3	56C4		
Bolted monoblocs	56C5	56C6		
Welded monoblocs	56C7	56C8	60C7	60C8

Obtuse Crossings; groupings	56E1 and 113A compatible	RT60 series
Semi-fabricated steel vees	56T1	
Cast Centre Blocks	56T2	
Bolted monoblocs	56T3	
Welded monoblocs	56T4	60T4

A.3 GEOMETRY

The geometry of the crossing shall comply with the requirements of the relevant RE/PW drawing, as specified by Railtrack, within the tolerances given in Fig.1 and with the requirements tabulated below

Requirement	56E1/ 113A compatible crossings	RT60 series crossings
Minimum depth of metal beneath the wheel contact areas (mm)	30	40
Minimum sidewall thickness (mm)	18	25
Minimum thickness of internal webs (mm)	18	20

Production drawings, which shall include those feature of the finished crossing which are present to aid metal flow during casting, shall be submitted to Railtrack for endorsement. These shall demonstrate compliance with the requirements given above.

The endorsed drawings shall be held at the Manufacturer's works and shall be available at all reasonable times for inspection by representatives of the Purchaser and of Railtrack.

A.4 METHOD OF MANUFACTURE

Before proceeding with production, the suitability of the pattern design, mould preparation procedures, casting conditions and heat treatment procedures shall be demonstrated by producing prototype castings from each group.

The prototype black casting shall be assessed using the inspection methods and acceptance criteria stipulated in Part B of this specification. Any defects found which fall outside the acceptance standards given, other than superficial defects not exceeding 5mm in depth, shall be eliminated by alteration to the production methods until a casting to the specified standard has been produced.

Once a casting has been produced which meets these requirements without recourse to repair, two more shall be produced and subject to the full range of inspection methods stipulated in Part B, including radiography, and shall be demonstrated to meet the acceptance criteria given above.

Once three satisfactory castings of a specific group have been produced, the manufacturing procedures used shall be submitted to Railtrack for endorsement. These procedures shall be documented in sufficient detail as to enable Railtrack or the Purchaser to confirm that they are being adhered to, including the procedures needed to fulfil the requirements of Part B. The endorsed documents shall be held at the Manufacturer's works and shall be available at all reasonable times for inspection by representatives of the Purchaser and of Railtrack.

Once endorsed, the process of manufacture shall not be changed without Railtrack's written approval.

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Note: Prototype crossings that, following repair if necessary, meet the requirements of **A.3**, **A.5**, **A.6** and **A.7** and all the requirements of **Part B** may be supplied for installation in Railtrack's infrastructure.

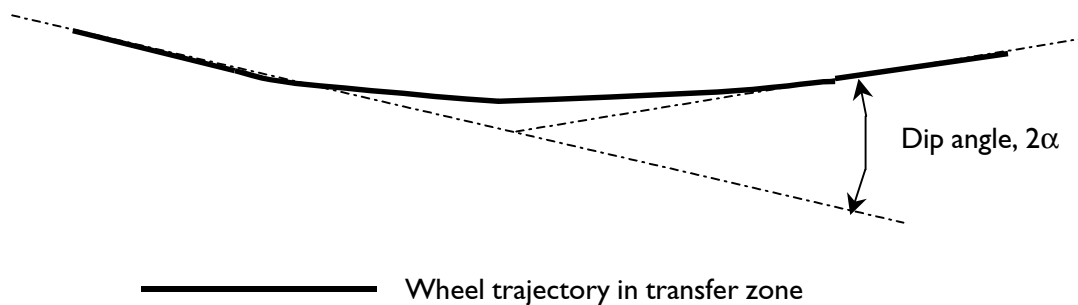
A.5 FATIGUE LIFE

For cast centre block and monobloc crossings, the requirements of Appendix I shall be complied with.

A.6 WHEEL TRANSFER

For cast centre block and monobloc crossings, the dip angle (see below) associated with wheel transfer shall not exceed 10mrad. for the cases of a P8 wheel profile with (a) the wheel centred on the approach rail for straight through running (b) the wheel positioned so that the opposite wheel of the wheelset is in flange contact with the check rail when the vehicle is curving through the crossing.

Note: Assume nominal values for the track gauge and flangeway width.

**A.7 LEG END WELD INTEGRITY**

The applicant for approval shall demonstrate that the procedure for the attachment of legs by flash butt welding complies with the requirements of RT/CE/S/001 Issue 2: 1998 with the following modifications:-

Appendix A Both load and ram displacement shall be recorded. Where fracture does not occur at the maximum load, this shall also be noted.

The maximum load sustained shall not be less than 750kN for 56EI and 890kN for 60EI. The deflection at the maximum load shall be not less than 25mm for 56EI and 17mm for 60EI.

Appendix B (i) Fatigue testing shall be undertaken on testpieces incorporating a joint between grade 260 pearlitic rail and a cast AMS rail length of the same profile. The cast rail section shall be prepared so that its external surfaces are in the same condition as those of the crossings' cast leg end sections. The weld shall be finished in the same manner as will be used for crossing production. Separate tests are required for welds to 56EI and to 60EI rails.

(ii) The inner span (W) shall be greater than 450mm.

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(iii) Acceptance shall be on the basis of a value of 'm' not less than 150MPa and a value of 's' not greater than 15 MPa. In all instances failure shall be in the cast section of the test piece, outside the heat affected zone.

Re-approval of the welding process. 5 years after the welding procedure has been approved, re-approval shall be sought, supported by the full set of test data required for Process Approval by RT/CE/S/001 Issue 2: 1998.

A.8 REPAIR METHODS

The procedures to be used for both shop and site repairs shall be submitted to Railtrack for approval. Welding procedures shall be supported by the results of procedure approval trials undertaken by at least two welders.

A.9 DOCUMENTATION

The applicant for approval shall submit

- A statement of the groups for which approval is sought (**A.2**)
- Production drawings demonstrating compliance with **A.3**
- Test results that demonstrate that three consecutive castings from a specified group have met the requirements of Part B (clause **A.4**)
- A detailed description of the manufacturing process (clause **A.4**)
- Where required, calculations demonstrating compliance with **A.5** and **A.6**
- Test results demonstrating compliance with **A.7**
- Repair procedures (**A.8**)

CAST AUSTENITIC MANGANESE STEEL CROSSINGS**PART B PRODUCTION CONTROL****B.1 PURPOSE**

The purpose of the requirements of this part of the standard are to ensure that the crossings delivered for service can be expected to deliver consistently the performance demonstrated during Design and Process Approval.

B.2 LIQUID CHEMISTRY

Liquid chemistry shall be within the following limits.

Element	Wt %
Carbon	0.95/1.3
Silicon	0.65 max.
Manganese	*11.5/14.0
Phosphorus	0.050 max.
Sulphur	0.030 max.
Nickel	1.75 max.
Molybdenum	0.75 max.
Chromium	0.50 max.
Copper	0.30 max.
Aluminium	0.045 max.

* Manganese shall not be less than 10 times the carbon content.

Other alloying elements shall not be deliberately added. The total percentage of unspecified elements shall not exceed 1%.

A record shall be maintained giving the composition of the specified elements of each cast.

B.3 HEAT TREATMENT AND MICROSTRUCTURE

All castings shall be water-quenched from a temperature of not less than 1050°C.

Once per melt per heat treatment batch, castings shall be shown to be free of embrittlement due to carbides by one of the following methods.

- automatic image analysis on micrographs at a magnification of $\times 100$. The sample examined shall be taken from the casting at a position near the bottom of the flange way
- an impact bend test in accordance with UIC 860-0, 2nd edition, clause 2.5
- other mechanical tests subject to approval by Railtrack.

B.4 INSPECTION**B.4.1 Geometry**

Dimensional checks shall be carried out to ensure that all crossings supplied are within the tolerances shown on the approved drawings.

B.4.2 Visual Inspection

All surfaces of the crossing shall be examined. Staff undertaking inspection shall be qualified to EN 473:2000 level 2.

Note: Equivalent ASNT qualifications will be accepted whilst certificates valid on 1st Feb. 2002 remain current.

The eyesight of staff shall be checked and, if necessary, corrected annually. The light level during inspection shall not be less than 350lx.

For visual inspection purposes the casting shall be sub-divided as shown below

	Top 25mm ⁽¹⁾	Bottom 25mm	Remainder
The leg ends up to a point 0.75m from the joint with plain rail and the length of the crossing within ± 0.75 m of the pick up points	A1	A2	A3
The remainder of the crossing	B1	B2	B3

Note 1. Zones A1 and B1 exclude check rails and the apron.

The surface finish of the machined surfaces shall be better than $6.3\mu\text{m } R_a$ for wheel contact areas and $12.5\mu\text{m } R_a$ elsewhere. Machined surfaces shall be free of visible defects.

The surface finish of the as-cast surfaces shall be assessed in accordance with EN 1370:1997 and shall be no worse than that specified below.

Inspection Zone	A1	A2	A3	B1	B2	B3
Surface Finish	A2	A2	A3	A2	A2	A4

Discontinuities on the as-cast surfaces shall be assessed in accordance with EN 12454:1998. The surface discontinuity Severity Levels shall be no worse than those specified below.

Note. For information, the relevant SCRATA comparators are shown in brackets.

Inspection Zone	A1	A2	A3 ^(2,3)	B1	B2	B3
Surface Inclusions	1 (B1)	1 (B1)	3 (B4)	1 (B1)	2 (B2)	4 (B5)
Gas Porosity	1 (C2)	1 (C2)	3 (C3)	1 (C2)	2 (C1)	4 (C4)
Laps and Cold shuts	2 (D1)	1 (D1)	3 (D2)	3 (D2)	2 (D1)	4 (D5)
Scabs	3 (E3)	3 (E3)	4 (E5)	3 (E3)	3 (E3)	4 ((E5)
Inserts ⁽¹⁾ , Cracks and hot tears ⁽¹⁾ , Cutting marks ^(1,4)	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
Welds	1 (J1)	1 (J1)	1 (J1)	1 (J1)	1 (J1)	1 (J1)

Notes

1. n.p. indicates not permitted.
2. Areas where fish bolt holes are to be drilled shall be free from visible defects.
3. All defects that might interfere with fishplate fit are to be removed.
4. Cutting marks are not permitted whether made by gas, arc or mechanical means

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B.4.3 Dye Penetrant Inspection

Liquid penetrant examination shall be undertaken in accordance with EN 571-1:1997 after machining. The classification of the product family used, as defined by EN 571-1:1997, shall be II,C,d – 2.

Staff undertaking inspection shall be qualified to EN 473:2000 level 2.

Note: Equivalent ASNT qualifications will be accepted whilst certificates valid on 31st. Jan. 2002 remain current.

The eyesight of staff shall be checked and, if necessary, corrected annually.

All castings are to be inspected. The areas to be examined comprise the machined surfaces on the top of the crossing as follows:-

- (1) lengths of 400mm centred on the changes of section
- (2) on the vee or vees, a length of 400mm extending back from the crossing nose(s) plus the adjacent wing rails
- (3) a length of 400mm in the throat (knuckle) area, extending from the tip of the nose

The maximum dimension of any linear defect indication shall not exceed 5mm.

B.4.4 Radiography**B.4.4.1 Frequency of testing**

When process approval has been given, 1 in every 3 castings manufactured from each group shall be radiographed.

If any radiographed casting fails to meet the requirements of this clause, the manufacturer shall

- Investigate the cause of the defect(s)
- Gain Railtrack's written approval for action to remove the cause of the defect(s)
- Implement the approved change to the production process

All castings from the group affected shall be radiographed until three successive castings meet the requirements of **B.4.4.3**. The frequency of testing may then be relaxed to 1 in 3.

If 10 successive radiographed castings from one group meet the requirements of **B.4.4.3**, testing may be relaxed to 1 in 30 castings from that group.

B.4.4.2 Method of test

Radiography shall be undertaken in accordance with the requirements of EN 444:1994 class A, verified in accordance with EN 462-3:1997 by the use of wire type Image Quality Indicators. Staff undertaking radiography shall be qualified to EN 473:2000 level 2.

Note: Equivalent ASNT qualifications will be accepted whilst certificates valid on 31st. Jan. 2002 remain current.