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CRN CP 251

Specifications

Turnouts

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Version 1.1	January 2022	TfNSW template applied
Version 2.0	January 2022	First full UGLRL release

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1. Scope and application

This Specification details the approved material components, applicable manufacturing tolerances and processes necessary for the manufacture of turnout and special trackwork components for use in Country Regional Network (CRN) track infrastructure.

Specifications contained within this publication are generally secondary specifications, which shall be read in conjunction with the relevant Standards, drawings and other documents that form the complete specification for the particular work.

References to primary specifications are provided where appropriate. Also refer to CRN Engineering standard CRN CS 250 “Turnouts and Special Trackwork” for details of approved track components and the schedule of approved proprietary products.

2. References

2.1. Australian and International Standards

AS 1085.1 – Steel Rails

AS 1085.7 – Spring washers

AS 1252 – High strength steel bolts with associated nuts and washers for structural engineering

AS 1442 – Carbon Steel and Carbon Manganese Steels

AS 1554.1 – Welding of steel structures

AS 1554.5 – Welding of Steel Structures subject to High Levels of Fatigue Loading

AS 1830 – Iron castings-Gray cast iron

AS 1831 – Ductile cast iron

AS 1832 – Iron castings-Malleable cast iron

AS 2074 – Steel castings

AS 3678 – Structural steel – Hot-rolled plates, floorplates and slabs

AS 3679.1 – Structural steel – Hot-rolled bars and sections.

Unless otherwise specified, all references relate to the latest standard versions, including amendments and relevant superseding standards.

2.2. CRN documents

CRN CS 220 – Rail and Rail Joints

CRN CS 250 – Turnouts and Special Trackwork

2.3. Other references

Nil

2.4. Definitions and abbreviations

Approval Where referred to within this specification approval means approval of the Principal Track and Civil Engineer

Prefabricated turnout consists of the following:

- Two (2) switch and stockrail assemblies, one left hand and one right hand, with each switch and matching stockrail fastened together at the heel end. Connected to the stockrail over the length of the switch is a series of baseplates and switch stops.
- One (1) 'V' crossing complete with baseplates.
- Two (2) checkrail units comprising checkrails, checkrail carriers, baseplates and fastenings

  The components are linked together by straight and curved infill rails (closure rails).

3. Material specification

Unless nominated otherwise on drawings, all components shall be manufactured from the following materials:

3.1. Iron castings

Grey Iron Castings shall conform to AS 1830/T260 (T250).

All ductile iron castings shall conform to AS 1831/500-7 (Grade 400/250/12).

All malleable iron castings shall conform to AS 1832/B300-6 (Grade B350/200/10).

3.2. Steel castings

All steel castings shall conform to AS 2074 Grade C-3 and, where specified in the design, Carbon Steel Casting, Low Alloy Steel Casting, High Alloy Steel Casting.

3.3. Washers

Cast Washers (headlock, tapered and flat), to be Cast Steel in conformity with AS 2074 Grade C-3.

Spring Washers shall conform to AS 1085.7.

Flat Structural Steel Washers shall conform to AS 1252.

3.4. Manganese steel castings

A crossing in which the “V” is fully or partly fabricated from cast austenitic manganese steel (i.e. as an RBM crossing, built up (compound) or cast solid crossing which may or may not have legs welded to the casting) shall conform to AS 2074/H1A.

Where specified by the contract, austenitic manganese steel crossings shall be explosively hardened to have a hardness within the range 350 to 415 HB on all top surfaces and for a minimum of 20mm down the flangeways.

3.5. Rolled steel

All steel plates, bars and sections shall conform to AS 3678 and AS 3679.1, Grade 250.

3.6. Bolts and nuts

All bolts or equivalent fastening systems shall be in accordance with the relevant current Australian Standard Specification for High Strength Steel Bolts as indicated on the Drawings.

These include Sections 2 (Bolts) and 3 (Nuts) of AS 1252.

3.7. Rivets

Rivets shall be manufactured from bars and shall conform to AS3679, Grade 250 or AS 1442.

3.8. Rails

Rails shall be flat bottom sections as required by AS 1085.1.

Head Hardened rails shall conform to AS 1085.1.

Asymmetric switchblades shall conform to the requirements of AS 1085.1

Checkrails (guard rails) are made of the guard rail profile of AS 1085.1 with a minimum hardness of 261 HB to AS 1085.1.

3.9. Epoxy

All epoxy or other bonding materials used shall be as indicated on the relevant drawings. Alternate materials may be used where approved.

Where no specification is given, the materials used shall be the best of their respective kinds and subject to approval.

4. Manufacturing process

4.1. Welding

Welding is not permitted other than where shown on drawings.

Where a crossing technology involves any welding process, it shall be demonstrated that the mechanical properties in all heat affected zones are within 10% of the parent metal, and that the metallurgical structure remains unaffected.

Where welding involves austenitic manganese steel, it shall be demonstrated that precipitation of carbides and the formation of internal microcracking has not occurred.

All welding shall be in accordance with the Structural Steel Welding code AS 1554.1-SP – Welding of Structures, or AS 1554.5 – Welding of Steel Structures subject to High Levels of Fatigue Loading, as appropriate.

Aluminothermic welding of rails (where required) shall be in accordance with the requirements of CRN Engineering Standard CRN CS 220 “Rail and Rail Joints”.

4.2. Hardening

Certain wearing surfaces of components manufactured from plain carbon rail shall be hardened where shown on the drawings.

The hardening method employed by the Manufacturer shall be approved before the process is commenced.

Surface hardness shall be as specified in AS 1085.1

4.3. Drilling

The location of all holes shall be measured from the datum location shown on the design drawings.

All drilled holes shall be accurately drilled to jigs, templates and/or gauges conforming to the centres and dimensions shown on the drawings. All drilling burrs must be removed. Holes shall be 3mm larger than the bolt specified, unless otherwise shown on the drawings.

Rolling brands must be removed from rails prior to jig drilling where such rolling brands will contact the jig location or reference faces on chocks, etc. All castings required to be jig drilled shall be dressed to size before being jig drilled.

Holes must not be plugged and re-drilled.

Punching of holes in rails is not allowable.

4.4. Sawing and machining of rails

Rails shall only be cold sawn. Out-of-square cut of rail ends over the maximum width and/or height of the rail shall not exceed 0.50mm.

Flame cutting of rails is prohibited.

All machining operations must be carried out by approved methods.

All machining shall conform to approved templates and gauges and shall be finished to a roughness standard shown on the manufacturing drawings.

4.5. Bending, curving and setting of rails

Rails shall be pressed straight and true before commencing fabrication.

When curved rails are specified, they shall conform to the uniform arcs of circles and be bent cold without injury to the material.

Rails shall only be curved, bent or set in an approved rail bender or rail press. Curved or set rails shall have no twist when sitting free on a level surface.

Under no circumstances shall rails be heated above 175°C.

4.6. Riveting

All rivets shall be hydraulically or pneumatically riveted and shall be heated uniformly from head to point before riveting.

No rivets shall be over heated. All loose rivets and rivets with misshaped heads shall be cut out and replaced by sound rivets.

4.7. Fitting

All parts of the items shall be to the correct form, dimensions and angles. They shall be fitted with accuracy to the dimensions and within the tolerances shown on the drawings and in this Specification.

Cast iron chocks shall be finished to fit rail profile over 80% of their fitting faces, and machined to fit 90% where nominated on the drawings.

All chocks except those nominated above shall be set in epoxy.

4.8. Forgings

All forgings shall conform to the drawings and shall be free from distortion, rags, pins, excessive scale and other imperfections.

Allowance must be made in the dies to prevent excessive drawing of the metal or distortion of the holes and rail slide surfaces.

Chair type baseplates, where required, shall be flat on the base and shall accurately fit the rails as required.

5. Assembly

5.1. Assembly platform

Crossings shall be fitted together on a strong level platform or other surface and shall be measured for compliance to the drawings and this specification

5.2. Assembly of fabricated crossings

Initial assembly shall be carried out with assembly bolts. When proven correct, the required chocks (i.e. those chocks that do not have a 90% fit to the rail profile) shall be set in approved epoxy and the bolts replaced by high tensile bolts tightened as indicated on the drawings with all nuts being set with 'Locktite' or an approved equivalent nut/bolt adhesive.

Bolts shall be inserted with all the heads on one side of the crossing. Tapered washers shall be fitted left or right hand as required with the indicating arrow marked on the flat face pointing towards the head of the rail.

Bolts shall not protrude out of the nuts more than 12mm.

The use of alternate high tensile fastening systems such as swage fasteners may be approved as part of the design. Where approved, the fastening manufacturer's specification and recommendations for assembly shall be followed.

5.3. Requirements for all crossings

The rates of crossing, catalogue number and manufacturers identification shall be clearly stamped on the head at the end of both wing rails with figures 12.5mm high in accordance with the requirements of CRN CS 250.

For K crossings with adjustable wings, this information shall be stamped on the housed rail of the V assembly as well as on the replacement wing.

A Crossing Identification tag shall be permanently attached to the web of the wing rail of the crossing. It shall contain the information specified in CRN CS 250.

The theoretical point mark shall be transferred square to the gauge faces and indicated by double 'centrepop' marks on the outside of each wing rail head.

In diamond crossings the theoretical point shall be marked on all "V" and "K" crossings.

When a crossing is to be supplied as an individual item, a vertical blue line shall be painted on both sides of the crossing (25mm to 50mm wide) to identify the position of the centre of balance.

5.4. Baseplates for crossings

Baseplates to fasten the crossing to the bearers shall be 200mm x 20mm thick and shall be manufactured to utilise Pandrol shoulders welded to the baseplate and Pandrol E2003 clips.

The position of the bearers shall be in accordance with relevant drawings and it shall be the manufacturer's responsibility to ensure that the crossing assembly with plating is interchangeable on the bearer hole positions.

5.5. Assembly of switches

Switches and stockrails must be machined accurately to the dimensions and sections shown on the Manufacturing Drawings.

Distortion of parts caused by machining or other operations shall be corrected before the switch and stockrail is assembled.

All arrises and sharp edges on switches created by the machining process shall be ground off.

Switch/Stockrail assemblies for the turnout shall have the appropriate set in the stockrails for that turnout. The assembly shall have all switch stops and plates attached to the stockrail, the heel block or anti-creep device fitted and the switch attached.

Each switch and stockrail assembly shall be fitted together as a complete set on a strong level platform, or other surface, and measured for compliance to the relevant drawings and this specification.

The position of each switch tip shall be marked (pop marked) on the outside head of the respective stockrails in accordance with the position documented on the Manufacturing Drawings.

Anti creep devices shall be centralised at assembly. The tongue unit should be centred in the restraining unit at Rail Neutral Temperature (35°C, ± 5°C)

5.6. Baseplates for switch sets (tangential turnouts ONLY)

In the switch rail area an elastic rail fastening system shall be used inside the stockrail. The plating system shall match to hole positions and geometry as shown on the nominated drawings and it shall be the manufacturer's responsibility to ensure that the half switch assembly with plating is interchangeable on the bearer hole positions.

5.7. Closure rails

Closure rails shall be curved uniformly for their entire length.

The middle ordinate, measured at gauge level below the head of the rail, shall not vary by more than 10% from the correct value when using a 3m chord at any location along the length of a curved closure rail. Where curved crossings are used, the checkrails shall be curved to the radius of the check rail carrier before assembling the checkrail unit.

The closure rails shall be drilled at each end with two holes (2 back holes) to allow temporary attachment of fishplates.

5.8. Checkrails

5.8.1. Raised checkrails

Shims shall be supplied as part of the guard rail (checkrail) assembly.

5.8.2. Baseplates for checkrails

Plating to fasten the checkrail (guard rail) assembly to the bearers shall be 200mm x 20mm thick and shall have Pandrol shoulders welded to the base plate and utilise Pandrol E2003 clips.

The position of the bearers shall be in accordance with relevant drawings and it shall be the manufacturer's responsibility to ensure that the checkrail assembly with plating is interchangeable on the bearer hole positions.

5.9. Consumable items

The following consumable items shall be manufactured in sufficient quantities for supply as replacement components:

- Checkrail (guard rail) shims
- Special switch fastenings (eg VAE chucking wedges, laminated springs, Schwihag stockrail-bracing clips
- Special removal or installation tools (eg VAE extractor tool)

5.10. Fastening plates and fastening material

5.10.1. For timber bearers

The plates with Pandrol fastening are 200mm wide x 20mm thick.

The Pandrol shoulder is welded on to the base plate and the fastening of the rails is carried out with Pandrol clips.

5.10.2. For concrete bearers

In the switch and crossing area concrete bearers are provided with cast-in ferrules according to the list of coordinates specified in the drawings.

The plates are laid upon pads and fastened by means of screw spikes and double helical washers to the bearers.

In the area of the closure rails the concrete bearers are provided with Pandrol shoulders. The rails are laid upon pads and are fastened by means of Pandrol clips.

6. Tolerances and finishes

Tolerances occur in the rolling of rails and due allowances shall be made by turnout manufacturers for variations in rail size.

Except where otherwise shown on the drawings and in this Specification, the following tolerances shall be permitted.

6.1. Switches, stockrails and closures

The switches shall give the required amount of throw.

Rails shall be straight where required without pressure being applied to the parts.

Dimensions shall comply with the drawings and the tolerances specified in Table 1.

Table 1 – Switch and stockrail tolerances

Measurement	Tolerances	Tolerances
Heel spread	+2mm	- 0mm.
Toe thickness	+1mm	- 0mm.
Blade length	+ 2mm	- 2mm.
Stockrail and closure rail lengths	+2mm	- 2mm.
Set stockrail heel end offset	+2mm	- 2mm.
	+ 0.5mm maximum clearance Shall touch the web of the switch rail over 80% of the face of the stop when the switches are closed	+ 0.5mm maximum clearance Shall touch the web of the switch rail over 80% of the face of the stop when the switches are closed
Position of drilled holes (longitudinal)	+1mm	-1mm.
Position of all holes (vertical)	+1mm	- 1mm.
Sizes of all rail holes	+1mm	- 1mm.
Switch head mating surface fit with stockrail	0.5mm maximum clearance.	0.5mm maximum clearance.

6.2. Crossings

Crossings shall be manufactured from rail sections that are consistent in height, twist etc.

The top surfaces of the rail parts shall be to true surface. The running edges shall be to true alignment at gauge level below the top surface of the rails.

The base of the crossing shall be flat across the baseplates to a tolerance of 0.5mm.

Chocks shall be finished as specified in Section 4.7 and any work that permits the insertion of a 0.5mm feeler gauge between rails and fitting faces of the cast iron chocks is not acceptable.

All surface finishes of components are to be in accordance with the roughness value specified on the manufacturing drawings.

Dimensions shall comply with the drawings and the tolerances specified in Table 2.

Table 2 – Crossing tolerances

Measurement	Tolerances	Tolerances
Flangeway widths	+1mm	- 1mm.
Rail flange clearances	+1mm	- 0mm.
Positions of fishbolt holes	+1mm	- 1mm.
Size of fishbolt holes	+1mm	- 1mm.
Alignment of running edges and surfaces measured from a fine taut line	1mm maximum deviation.	1mm maximum deviation.
Leg opening	+1mm	- 1mm.
Relative Leg lengths from nose to adjacent 'V' ends of 'V' crossings	2mm maximum variation.	2mm maximum variation.
Overall lengths	+4mm	- 4mm

7. Final assembly and inspection

Where required by the contract a whole item, or any portion thereof, shall be completely assembled and measured prior to delivery. The assembly shall comply with all specified dimensions of the assembly drawings.

The manufacturer shall undertake and document a full inspection meeting the requirements of its Quality Assurance system.

7.1. Protective coating

Turnout components shall be coated in a protective coating suitable for storage in an open environment for 12 months.

Markings used in the manufacturing process shall be removed or hidden from view by the protective coating.

7.2. Marking

The centre line location of all bearers shall be marked with a 5mm white paint pen. Each bearer location shall be labelled with:

- For concrete bearers – bearer number and plate number
- For timber bearers – plate number

The pop mark on the outside head of each respective stockrail identifying the position of each switch tip shall be highlighted with 10mm diameter circle surrounding the mark and a line on the head of the stockrail marked with a white paint pen.

All other items shall be labelled in accordance with the design drawings for correct assembly and to distinguish them from similar components. A Contract/order identifier shall also be marked on each component.

7.3. Match marking

All rail ends shall to be appropriately marked in oil paint to ensure ease of assembly at the site.

8. Preparation for dispatch

The items shall to be prepared for dispatch in the following sub-units.

- Individual closures.
- Crossing assembly.
- Checkrail unit (conventional turnouts only).
- Each switch and stockrail assembly, consisting of switch, stockrail, switch stops, baseplates and heel units. The switch shall be securely fastened to the stockrail to prevent damage.
- Baseplates for crossing and heel area, bolts and other items shall be packaged into bags or boxes. Each bag (or box) shall also be labelled with a contract/order identifier

Special care shall be taken in the packing and methods of support and lifting during transport and handling of all steel work to prevent distortion and damage to the steel work, its protective coating or finishes.

The crossing assembly shall be appropriately protected against movement (distortion during transport and movement to installation site).

Where Lifting points have been established by the manufacturer during assembly, they shall be marked on the assemblies to aid lifting at the installation site. This requirement also applies to larger components (switches, crossing units etc) to prevent damage to components during assembly.