



Government of South Australia

Department of Planning,
Transport and Infrastructure

PUBLIC TRANSPORT SERVICES

TECHNICAL SPECIFICATION

FOR

BW-TYPE TRAM POINTS AND CROSSINGS

PTS-AR-10-TK-SPE-00000093



and THINK

Zero Harm



Document Control

DOCUMENT STATUS

Document Owner: Director, Asset Management			
Action	Name and Position	Signature	Date
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Risk Category: Low			
Document Review Schedule: As required			

DOCUMENT AMENDMENT RECORD

Rev	Change Description	Date	Prepared	Reviewed	Authorised
0	Initial Issue	July 2012	Craig Evans	Keith Charlton	Rob Taverner



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1.0 INTRODUCTION AND CONTEXT

1.1 INTRODUCTION

The Department of Planning, Transport and Infrastructure (DPTI) Public Transport Services Division (PTS) owns and operates the Adelaide Metropolitan Passenger Rail Network (AMPRN). This specification forms part of the engineering management system used to ensure safety and customer service levels are efficiently and effectively supported.

The BW (Burton-Wyatt) switch is a unique type of tram switch and crossing which is checked throughout and, in combination with conventional style rail v-crossings (i.e. not flange running), allows trams to operate at line speed through the straight section of the turnout. There are 3 types of BW switches (BW1, BW2, BW3), with BW2 switches being the most commonly used.

1.2 PURPOSE

The purpose of this specification is to describe the requirements for BW points and crossings for use on the AMPRN tram system.

1.3 SCOPE

This specification applies to all PTS projects and contractor organisations supplying BW points and crossings for the AMPRN tram system.

1.4 ACRONYMS, DEFINITIONS AND REFERENCED DOCUMENTS

1.4.1 Acronyms

Acronym	Full Name
AMPRN	Adelaide Metropolitan Passenger Rail Network
DPTI	Department of Planning, Transport and Infrastructure
O&M	PTS Operations and Maintenance
PTS	Public Transport Services and Strategic Projects Division
TA	The former Trans Adelaide
ALRP	Adelaide Light Rail Project
RISSB	RISSB Glossary of Railway Terminology - Guideline

1.4.2 Related Documents

Document Number or Abbreviation	Title
AS-1085 Series	Australian Standard-Railway track material



AS 1110	Australian Standard-ISO metric hexagon bolts and screws Product grade A and B
AS 1111	Australian Standard-ISO metric hexagon bolts and screws Product grade C
AS 1204	Australian Standard-Structural Steel; Superseded by AS-3678 and AS-3679
AS 1252	Australian Standard- High strength steel bolts with associated nuts and washers for structural engineering
AS 1830	Australian Standard-Grey cast iron
AS 2074	Australian Standard-Cast steels
AS 1448	Australian Standard- Carbon steel and carbon-manganese steels-Forgings
AS 1554	Australian Standard-Structural steel welding
AS 1831	Australian Standard-Ductile cast iron
AS 3818	Australian Standard- Timber, Heavy structural products
RSA 2007	Rail Safety Act 2007
CP-TS-983	Code of practice –Points and Crossings-volume 3-tram system
PTS-MS-10-EG-PRC- 0000032	Approval of Technical Standards and Waivers Procedure
PTS Manual	PTS Tram Wheel Inspection & Defects Standard.
301-A2-81-118	Diagram – Minimum Structures Tramline
310-A0-2005-119A	ALRP 1 in 5 crossover 4000 track centres type BW switches 1435 gauge 41kg rail
310-A0-2005-120A	ALRP 1 in 6 crossover 4000 track centres type BW switches 1435 gauge 41kg rail
310-A0-2005-121A	ALRP 1 in 8 crossover 4000 track centres type BW switches 1435 gauge 41kg rail
310-A0-2006-014B	ALRP 1 in 5 turnout type BW switches 1435 gauge 41kg rail
310-A0-2006-535	ALRP 1 in 5 crossover 4000 track C/C type BW switches, 1435 gauge 41kg rail (switches 7 & 7A)
310-A3-2009-132	ALRP Manual operating equipment for crossovers - General Arrangement
310-A3-2009-133	ALRP Manual operating equipment for crossovers – Sections 1
310-A3-2009-134	ALRP Manual operating equipment for crossovers – Sections 2
310-A3-2009-135	ALRP Manual operating equipment for crossovers – Rodding Elevations
310-A3-2009-136	ALRP Manual operating equipment for crossovers – Details (1)
310-A3-2009-137	ALRP Manual operating equipment for crossovers – Details (2)



310-A3-2009-138	ALRP Manual operating equipment for crossovers – Details (3)
310-A3-2009-139	ALRP Manual operating equipment for crossovers – Details (4)
314-A3-2007-109A	ALRP Type BW switch assemblies switch M/C and rodding layout & schedule
314-A0-2005-113L	ALRP Type BW-1 41kg 4571 Bevel undercut straight switch assembly & details
314-A0-2005-114L	ALRP Type BW-2 41kg 4571 Bevel undercut straight switch assembly & details
314-A0-2006-005E	ALRP Type BW-3 41kg 4571 Bevel undercut straight switch assembly & details
314-A0-2006-027D	ALRP Type BW 41kg 4571 Switches details of extended checkrails & stockrails
314-A3-2006-013	ALRP Switches types BW1, BW2, BW3 – Alternative special switch bar bracket
314-A3-2007-110	ALRP Type BW switch assemblies details of front switch bar components
314-A3-2007-111	ALRP Type BW switch assemblies details of lock bar connecting rod
314-A3-2007-112	ALRP Type BW switch assemblies details of actuating rod and modified socket
314-A3-2007-114	ALRP Type BW switch assemblies details of modified detector rods
314-A0-2005-115M	ALRP BW1, BW2, BW3 41kg 4571 Bevel undercut switch assemblies miscellaneous details
314-A0-2006-536C	ALRP Type BW 41kg 4571 switches – special details for switches 9 & 7A
314-A3-2007-097B	ALRP Type BW switch assemblies details of switch clamp
315-A3-2004-132	Modified 1 in 5 'V' crossing to suit tram operation 41kg AS rail Sheet 1 of 2
315-A3-2004-133	Modified 1 in 5 'V' crossing to suit tram operation 41kg AS rail Sheet 2 of 2
315-A3-2007-066A	Modified 1 in 6 'V' crossing to suit tram operation 41kg AS rail – Sheet 1 of 2
315-A3-2007-067A	Modified 1 in 6 'V' crossing to suit tram operation 41kg AS rail – Sheet 2 of 2
315-A3-2007-068	Modified 1 in 8 'V' crossing to suit tram operation 41kg AS rail Sheet 1 of 2
315-A3-2007-069	Modified 1 in 8 'V' crossing to suit tram operation 41kg AS rail Sheet 2 of 2
318-A0-2009-198E	ALRP Scope of Switches Upgrade
318-A3-2006-037A	ALRP Fixing of bar-type checkrails at insulated joints



318-A3-2006-038A	ALRP Termination of single bar-type checkrail at 1 in 5 crossing
318-A3-2005-117B	ALRP Checkrails – Clamped bar type 41kg AS rail – 26mm flangeway
681-A3-2006-046A	ALRP Detection bars for W'house M70 Mk3 switch M/C and type BW switches
681-A3-2006-028A	ALRP Locking bars for W'house M70 Mk3 switch M/C and type BW switches
318-A0-2006-020B	ALRP Rerailers for uncanted 41kgAS on timber sleepers
318-A0-2006-021B	ALRP Rerailers for canted 41kgAS on timber sleepers
318-A1-2008-xxx	ALRP Re-railer guiderails special for switch #10
318-A1-2008-012	ALRP Re-railer guiderails installation details
318-A1-2008-013	ALRP Re-railer guiderails fabrication details



2.0 REQUIREMENTS

The requirements of this specification are:

2.1 GENERAL

BW-type tram points and crossings shall comply with the following specifications:

2.1.1 Gauge

- i) The standard gauge of AMPRN's rail tracks shall be 1435 mm.
- ii) The profile of rolling stock wheels shall comply with PTS Tram Wheel Inspection & Defects Standard.
- iii) BW points and crossings shall be designed for the back to back dimension of wheel sets to be 1389 ± 1 mm and shall allow for a maximum wheel flange height of 30 mm.
- iv) The dimension from the running rail gauge face of the 'V' crossing to the working face of the check rail shall be 1390 ± 1 mm.
- v) BW points and crossings shall be designed for a flangeway gap of 26mm.
- vi) Check rails shall be flared in accordance with ALRP – BW drawings found in related documents.

2.1.2 Speed

- a) The speed through running line BW points and crossings shall be in accordance with the approach signalling aspects, the trackside speed boards or published speed indications. However, permissible speeds must never exceed the theoretical speed.
- b) On main line straight track the design of BW points and crossings shall be suitable for a speed of 60 km/h on the straight road of the turnout.
- c) On sidings or in stabling yards the design of points and crossings shall be suitable for a speed of 15 km/h.
- d) On the turnout road of BW points and crossings the design shall be suitable for a speed of 15km/h.

2.2 TYPICAL STANDARD TURNOUT GEOMETRIC LAYOUT

Refer to ALRP - BW drawings found in related documents.

2.3 MATERIAL AND MANUFACTURING SPECIFICATIONS

Refer to ALRP - BW drawings found in related documents.

2.3.1 Material specifications

All the components for BW points and crossings manufactured from rail shall use standard carbon steel.

All the material used in the BW points and crossings shall comply with the following specification:



- a) Rail
 - i) Steel Rails shall comply with AS 1085 Part 1: Steel rails.
 - ii) In addition to AS1085 Part 1, the straightness when measured with a two-metre straightedge at any point shall not vary by more than 1 mm.
 - iii) Rails to be curved shall conform to the straightness requirements before bending. Curved or set rails must be free of twist when sitting free on a plane.
 - iv) Structural steels shall comply with AS 1204: Structural Steels.
 - i) Timber bearers shall comply with AS 3818.1, Timber- Heavy structural products – visually graded – general requirements and AS 3818.2, Timber - Heavy structural products - visually graded, Part 2: Railway track-timbers.

b) Fastenings

Type of fastenings shall be in accordance with ALRP - BW drawings found in related documents.

- i) Fish Plates shall comply with AS 1085 Part 2: Fishplates.
- ii) All fishbolts and nuts shall conform to the relevant drawings and shall comply with AS 1085, Part 4: Fishbolts and nuts.
- iii) All components of swage fasteners shall be of high strength steel. They shall have the same shank diameter as specified for bolts, and the collar shall be flanged or supplied with a washer or washer plate as specified by the manufacturer.

For factory-assembled bonded insulated joints, unless specified otherwise, bolts and swage fasteners shall be installed so that adjacent fasteners face opposite directions and shall be properly tightened to make a friction joint.
- iv) All spring washers shall comply with AS 1085 Part 7: Spring washers.
- v) Switch plates, crossing plates and check rail plates shall comply with AS 1085, Part 3: Sleeper Plates.
- vi) ISO metric hexagon precision bolts and screws shall comply with AS 1110.
- vii) ISO metric hexagon commercial bolts and screws shall comply with AS 1111.
- viii) General Grade high strength steel bolts with associated nuts and washers shall comply with AS 1252 High strength steel bolts with associated nuts and washers for structural engineering.
- ix) For insulated and non insulated applications, resilient fastening assemblies shall comply with AS 1085 Part 19: Resilient fastening assemblies.

For timber bearer

- i) Sleeper plates shall comply with AS 1085 Part 3: Sleeper plates.
- ii) Screw spikes and threaded inserts shall comply with AS 1085 Part 18: Screw spikes and threaded inserts.
- iii) Rail anchors with non-resilient fastenings shall comply with AS 1085 Part 10: Rail anchors. (Essential)



- iv) Resilient fastening assemblies shall comply with AS1085, Part 19: Resilient Fastening Assemblies.

- b) Checkrail (Billet Bar)

BW points and crossings shall be designed for billet bar checkrails 50 x 50mm (nominal) steel billet Grade AS 1442/1045. M/c 6 x 6mm chamfers on rear corners.

2.3.2 Castings

Refer to ALRP - BW drawings found in related documents

- i) Grey Iron Castings

All grey iron castings shall comply with AS 1830: Grey cast iron Grade H241. The castings shall be embossed to indicate the crossing and rail section for which they are intended and any other feature if applicable.

- ii) Carbon Steel Castings

All steel castings shall comply with AS 2074: Cast steels Grade C3. The castings shall be embossed to indicate the crossing and rail section for which they are intended and any other feature if applicable.

- iii) Ductile Iron Castings

All ductile iron castings shall comply with AS 1831: Ductile Cast Iron.

2.3.3 Forgings

- i) All steel forgings shall comply with AS 1448: Forgings.
- ii) Forgings shall be free from distortion, scale and other imperfections.

2.3.4 Welding and Cutting

- i) All the welding of structural components, excluding rail, shall be in strict accordance with the requirements of AS 1554 part 1: Structural steel welding - Welding of steel structure.
- ii) The welding of rail shall be in strict accordance with AS 1085 Part 20: Railway track material - Welding of steel rail.
- iii) Cutting shall be done in an approved manner. All materials other than rails and fishplates, which are cut using an oxy-acetylene or oxy propane flame, shall be ground smooth and all burnt metal shall be removed.
- iv) Rails and fishplates shall not to be flame cut.

2.3.5 Drilling and Machining

- i) All holes for drilling and machining shall be accurately set out using templates or gauges, which conform to the centres and dimensions shown on the drawings and to the tolerances, set out in this specification.



- ii) Incorrectly drilled holes in rail components shall not be plugged and re-drilled. Other components shall not be plugged and redrilled without approval.
- iii) The running surfaces of all cast inserts shall be machine finished.
- iv) All machined components shall be machined accurately to the dimensions and sections shown on the relevant drawings.
- v) Any sharp edges and burrs shall be removed.

2.3.6 Fitting

- i) All parts required for the works shall be to the correct forms, dimensions and angles, and shall be fitted with accuracy to the dimensions and within the tolerances shown on the relevant drawings and this specification.
- ii) Unless otherwise specified, cast blocks shall be finished to fit accurately over 90 per cent of their fitting faces. Any block which permits the insertion of a 0.5 mm feeler gauge between the rails and fitting faces of the cast blocks shall not be used in the final assembly.
- iii) The design of rail parts and blocks shall allow for variations in rail size tolerances.

2.3.7 Bending, Curving, Setting and Twisting of Rails

- i) Rails shall only be curved, bent or twisted in machines approved by PTSOM. Curved or set rails must have no twist when sitting free on a level surface.
- ii) Rails shall not be heated above 175°C when bending.

2.3.8 Assembly of 'V' Crossings

- i) 'V' crossings' components shall be fitted together on the platform and shall be shown to be correct to the satisfaction of the PTSOM. The running edges shall be to true alignment at a depth 11 mm below the top surface of the rails and as specified on the relevant drawings.
- ii) Fastenings shall be inserted with all heads on the one side of crossings wherever practical.
- iii) All crossings shall be assembled utilising 25.4 mm high tensile swage lock fastenings, unless otherwise specified. Swage lock fastenings shall be tightened commencing from the nose of the crossing, alternating in each direction towards the openings.
- iv) Tensioning of swage lock fastenings shall be carried out in two stages. First stage is nip up the assembly so all matching components are in contact with each other. Final tensioning shall only be performed after epoxy filler is cured.
- v) All sharp edges shall be ground off the ends of swage lock fastenings after installation.

2.3.9 Rail Insulated Joints

- i) Rail insulated joints shall be in accordance with AS 1085 Part 12: Railway track material - Insulated joint assemblies
- ii) Factory-made epoxy bonded insulated joints are to be incorporated into the final assembly of BW points and crossings. Insulated Joints are to form part of the closure rails. Insulated Joints are to be manufactured using a 15 degree angled joint and swage lock fastenings.



2.4 TOLERANCES

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

2.4.1 Manufactured Rails

- i) Where rails are to be cut to length the maximum out of square tolerance for the ends is 1 mm.
- ii) Rails required to be curved to a specified radius shall be formed to an even radius. The maximum deviation from the specified radii is - 10% of the correct versine for that radius, measured over a 3-metre cord length at any point. Where offset dimensions are given, the rail position shall be within +2,-0 mm of that position in addition to meeting the above radius specification.
- iii) The position of holes in rails shall not vary more than 1 mm horizontally or vertically from that specified on the drawings. The size of drilled holes shall be +0.5,-0 mm of that specified.
- iv) The surface roughness value of machined or planed surfaces shall be better than 12.5 μm (N10).

2.4.2 Crossings

Following are the tolerances that shall be permitted.

- i) Flange way widths and depths, ± 1 mm.
- ii) Nose width, ± 1 mm.
- iii) Positions of fishbolt holes, ± 1 mm.
- iv) Size of fishbolt holes, ± 1 mm.
- v) Relative lengths from nose to adjacent 'V' ends of 'V' crossings, +2,-0 mm variation..
- vi) Alignment of running edges and surfaces, measured from a fine taut line, +1,-0 mm deviation.
- vii) Overall lengths, ± 2 mm.

2.5 FINISHES AND IDENTIFICATION

2.5.1 Stamping

- i) All crossing, fixed gauge components shall be clearly and legibly stamped for identification with minimum 15 mm letters and numerals.
- ii) Crossings shall be stamped on the head and within 300 mm of the end of the wing rail with the weight of rail and angle of crossing i.e. "41 kg", "1 in 5", also the initials of the manufacturer shall be stamped in this same location. Switch assemblies shall be stamped on the heel block with the initial of the manufacturer.

2.5.2 Corrosion Protection

- i) The surfaces of all materials coated shall be brushed clean and shall be dry before corrosion protection is applied.



- ii) All components shall be coated with one coat of relevant “environmentally friendly” protective coating. Coating shall be done after final inspection.

2.5.3 Lubrication or Oiling

After inspection, the sliding surfaces of the points and crossings shall be lubricated with one application of dry film lubricant available for points and crossings (DPTI lubricant is ROCOL switch plate spray or similar).

2.6 QUALITY ASSURANCE AND RE-WORKING

- i) There shall be a QA system that complies with relevant ISO 9000 standards (ISO 9001-Quality systems-Model for quality assurance in design, development, production, installation and servicing).
- ii) There shall be staff or group suitably qualified in quality assurance to ensure QA during all processes.
- iii) Quality plan shall be developed to ensure compliance with the specification and related drawings and the quality of material used.
- iv) Quality plan shall detail the key elements in the provision of the services, the type and frequency of inspection, checks and audits to be carried out and delegated authority.
- v) There shall be effective and continuous monitoring of quality of all manufacturing processes which affect the quality and acceptability of the final product.
- vi) All the tests required by this specification and/or the Australian Standard specifications or other approved specifications shall be carried out in compliance with standards.
- vii) All re-work shall be done with consultation and approval of authorised or nominated personnel.

2.7 WARRANTY AND TECHNICAL DATA

2.7.1 Warranty period

The warranty period shall be 2 years.

2.7.2 Technical data supplied

- i) Technical data shall be supplied in hard copy and electronic copy.
- ii) Technical data shall consist of test certificates, material safety data sheets and any other relevant technical data.



APPENDIX A- DEFINITIONS

Defined Term	Definition
Points and Crossings	Track structures which provide for one track to join or cross another. (RISSB Guideline)
Crossing	<p>A track component that enables a wheel travelling along one rail to pass through the tail of a track which crosses its path. The most common types are "V" and "K". Sometimes called the 'Frog'.</p> <p>Crossing angle: The angle of approach between the two roads of a turnout or diamond crossing.</p> <p>Welded crossing: A crossing utilizing a hardened, machined block in the wheel transfer area. Extension wing and running rails are welded to the machined block utilizing specialized techniques.</p> <p>Fabricated crossing: A crossing manufactured from machined and set rails separated by blocks and suitably fastened as a unit.</p> <p>V crossing: A crossing comprising a nose and two wings. Typical V crossing is shown in figure A1.</p> <p>K crossing: A crossingwork comprising two opposite noses, a running wing rail and a guard wing rail. K crossings are used in diamond crossingwork assemblies. Typical K crossing is shown in figure A2.</p> <p>Crossing number: Crossings may be designated by a number which refers to the the half-sine measure methodused for crossings on the AMPRN.</p>
Check rail	Rails placed in track inside the running rail at particular locations which comes into contact with the back of the wheel flange to guide wheels through points and crossings, on curves and through flangeway gaps in streets. (RISSB Guideline)
Type Approval	A formal statement given by PTS that declares the suitability of an item to be used within the AMPRN system
Specification	Means this document