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1	15/05/2024	Initial version generated from the most recently published version
2	4/06/2024	Minor changes to align with styles and voice

Preface

This standard was prepared by the Railway Track Material – Part 2: Fishplates Development Group, overseen by the RISSB Infrastructure Standing Committee.

Objective

The objective of this Standard is to provide purchasers and suppliers, including owners, operators, designers and manufacturers of railway rail with requirements for fishplates for use with rails in accordance with AS 1085.1 in railway track.

Changes to the previous edition are as follows:

- (a) Change of title of the AS 1085 series (previously *Railway permanent way material*).
- (b) The referenced documents list has been revised.
- (c) Reference to the withdrawn Standards AS 1213 and K1 have been removed.
- (d) The most recent version of the informative Appendix 'Means of demonstrating compliance with this Standard' has been included.

Compliance

There are four types of provisions contained within Australian Standards developed by RISSB:

- (a) Requirements.
- (b) Recommendations.
- (c) Permissions.
- (d) Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term 'shall'.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term 'should'.

Recommendations recognize that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term 'may'.

Constraints – provided by an external source such as legislation. Constraints are identified within the text by the term 'must'.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities or interfacing organisations where the risk may be shared.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix A.

Appendices in RISSB Standards may be designated either "normative" or "informative". A "normative" appendix is an integral part of a Standard and compliance with it is a requirement, whereas an "informative" appendix is only for information and guidance.

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Section 1 Scope and general

1.1 Scope

This Standard specifies requirements for bar-type steel fishplates for use in conjunction with steel rails rolled in accordance with AS 1085.1.

1.2 Normative references

The following documents are referred to in the text in such a way that *some* or all of their content constitutes requirements of this document:

- AS 1085, *Railway Track Material*
- AS 1085.1, *Railway Track Material – Part 1: Steel Rails*
- AS 1199, *Sampling procedures and tables for inspection by attributes*
- AS 1391, *Methods for tensile testing of metals*
- AS 1399, *Guide to AS 1199 – Sampling procedures and tables for inspection by attributes*
- AS 1442, *Carbon steels and carbon-manganese steels – Hot-rolled bars and semifinished products*
- AS 1448, *Carbon steels and carbon-manganese steels – Forgings (ruling section 300 mm maximum)*
- AS 2706, *Numerical values – Rounding and interpretation of limiting values*
- AS 4291, *Mechanical properties of fasteners made of carbon steel and alloy steel*
- AS 4291.1 *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1 Bolts, screws and studs*
- AS/NZS 1050, *Methods for the analysis of iron and steel (all methods)*
- ISO 9001, *Quality management systems – Requirements*
- ISO 9004, *Quality management systems – Guidelines for performance improvements*
- HB 18, *Guidelines for third-party certification and accreditation*
- HB18.28, *Guidelines for third-party certification and accreditation – Guide 28 – General rules for a model third-party certification scheme for products*

NOTE:

Documents for informative purposes are listed in a Bibliography at the back of the Standard.

1.3 Defined terms and abbreviations

For the purposes of this document, the following terms and definitions apply:

1.3.1

acceptable quality levels (AQLs)

defined quality thresholds used in quality assurance

1.3.2

anchor

device used to secure the rail to the sleeper, preventing movement

1.3.3**audit**

systematic examination of a quality management system

1.3.4**bearing area**

the area of the anchor that bears uniformly on the side of the sleeper

1.3.5**branding**

distinct marking on each spike or fishplate indicating type and manufacturer

1.3.6**coating**

lead-free and chromate-free paint applied to spikes

1.3.7**compliance**

adherence to the requirements specified in the standard

1.3.8**crack detection test**

test to ensure spikes are free of cracks

1.3.9**decarburization**

reduction of carbon content on the spike surface

1.3.10**designation**

classification of spikes and fishplates according to type and standard number

1.3.11**dimensional tolerance**

allowable deviation from specified dimensions of spikes or fishplates

1.3.12**elongation**

measure of ductility, represented as the percentage increase in length before breaking

1.3.13**fatigue**

weakening of material due to repeated stress

1.3.14**finish**

surface condition of spikes and fishplates free from defects

1.3.15**fishbolt**

bolt used to fasten fishplates to rails

1.3.16**fishplate**

metal bar bolted to the ends of two rails to join them together in a track

1.3.17**function**

purpose of spring fastening spikes in securing sleeper plates

1.3.18**gauge length**

length of the test specimen used in tensile testing

1.3.19**hardness test**

test to measure the hardness of spikes

1.3.20**hazard register**

list of potential hazards related to the product

1.3.21**heat treatment**

process of quenching and tempering to strengthen spikes or fishplates

1.3.22**inspection**

examination of spikes or fishplates to ensure they meet specified requirements

1.3.23**marking**

labelling of each spike or fishplate with type and manufacturer information

1.3.24**material**

steel composition used for manufacturing spikes or fishplates

1.3.25**mechanical properties**

characteristics of the material, including tensile strength and elongation

1.3.26**microstructure**

internal structure of the spike, with at least 75% tempered martensite

1.3.27**nominal rail size**

designated size of the rail for which the spike or fishplate is intended

1.3.28**packing requirements**

specifications for packaging spikes or fishplates

1.3.29**preload**

initial force applied to allow the anchor to take its initial set

1.3.30**production certification**

independent assurance that products comply with the standard

1.3.31**purchaser**

entity buying the spring fastening spikes or fishplates

1.3.32**quality assurance system**

system ensuring products meet quality standards

1.3.33**quenching**

rapid cooling process used during heat treatment

1.3.34**rail anchor**

device used to secure rails to sleepers

1.3.35**roughness, burrs, notches, seams**

surface defects to be avoided on spikes or fishplates

1.3.36**rounding method**

procedure for assessing compliance by rounding numbers as specified

1.3.37**sampling plan**

strategy for selecting samples for testing

1.3.38**shear forces**

forces causing layers to slide against each other

1.3.39**skewed sleepers**

sleepers that are not perpendicular to the rails, causing torsional force

1.3.40**sleeper**

support for the rails in railway tracks, typically made of wood or concrete

1.3.41**spring fastening spikes**

spikes used to secure sleeper plates to timber sleepers

1.3.42**statistical sampling**

procedure for quality assessment based on sample testing

1.3.43**surface defects**

imperfections on the surface of spikes or fishplates

1.3.44**tempered martensite**

strengthened structure of the spike after heat treatment

1.3.45**tensile strength**

maximum stress a material can withstand while being stretched or pulled

1.3.46**tensile test**

test to determine the tensile strength and ductility of a material

1.3.47**tolerances**

permissible limits of variation in dimensions

1.3.48

torsional force

twisting force exerted by skewed sleepers

1.3.49

withdrawal forces

forces attempting to pull the spike out from the sleeper

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Section 2 Designation

Fishplates shall be designated by the number of this Australian Standard and the nominal rail size.

Example: Fishplate in accordance with AS 1085.2 for 50 kg rail.

Section 3 Steel-making process

The steel used for the manufacture of the fishplates shall comply with AS 1442 or AS 1448 and shall meet all the requirements of this Standard.

Section 4 Brands

Each fishplate shall be branded with figures denoting the mass per metre of rails for which it is intended, and a mark to identify the manufacturer and the year in which it was rolled or forged, e.g., 50XXX03.

The letters and figures shall be rolled or forged on the outside surface of the fishplate and shall be raised a minimum of 0.5 mm from the plane surface of the fishplate.

The year of manufacture shall be used for the purpose of identification only and should not be used as a basis for rejection of the fishplates.

Manufacturers making a statement of compliance with this Australian Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

Section 5 Chemical composition

5.1 General

The chemical composition shall be determined by cast analysis.

Sampling, preparation and testing shall be by any procedures that are not less accurate than those in AS/NZS 1050.

5.2 Cast analysis

Separate analyses shall be made from samples representing ingots from the first one-third of the heat and ingots from the last one-third of the heat, or one sample from each ladle of the heat if the heat is continuously cast.

5.3 Composition

The cast analysis of the steel as per Clause 5.2 shall conform to the limits of chemical composition given in Table 5-1.

Table 5-1 Chemical Composition (Cast Analysis) – Fishplates

Analysis, %									
Carbon		Silicon		Manganese		Phosphorus		Sulfur	
Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
0.35	0.55	-	0.35	0.55	1.00	-	0.05	-	0.05

Section 6 Holes for fishbolts

The holes for fishbolts shall be drilled or punched and shall be to the centres and dimensions shown in the appropriate drawing in Appendix B, subject to the tolerances given in Table 11-1.

NOTE: This requirement does not preclude the negotiation between the manufacturer and purchaser of dimensions and tolerances of holes and hole centres other than those specified in this Standard.

Section 7 Finish

Fishplates shall be free from defects that are detrimental to their end use. Localized areas of deformation caused by shearing or punching and conforming to the tolerance limits given in Table 11-1 shall be permitted.

Section 8 Tolerances on section and dimensions

8.1 Section

The section shall conform to the appropriate profile given in Appendix B.

A variation of 2.0 mm horizontally outwards shall be permitted if a fishplate template is placed on the rolled bar or forging.

The section shall not vary horizontally outwards by more than 2.0 mm from the nominal position.

8.2 Dimensions

Fishplates shall conform to the dimensions indicated for the appropriate profile given in Appendix B, subject to the tolerances given in Table 11-1.

Section 9 Calculated mass per pair of fishplates

Calculated mass values per pair of fishplates (unpunched) are set out in Table 11-2.

NOTE: These are theoretical values based on nominal dimensions.

Section 10 Mechanical properties

The mechanical properties of test pieces sampled and tested in accordance with Clause 11 shall comply with the limits given in Table 4.

Section 11 Tensile strength

11.1 General

Samples for tensile testing shall be selected from any two fishplates or fishplate bars representative of each heat of steel.

It shall be permissible to discard a test piece that shows defective rolling, forging or develops flaws, and to submit another test piece.

Table 11-1 Dimensional Tolerances

Characteristics	Tolerances mm	
Length	±3.0	
Thickness	±3.0, -0.5	
Size of hole	±1.0	
Position of holes	±1.0	
Localized areas of deformation on the fishing surfaces	±0.5, -1.0	
All other dimensions	±1.0	
Camber	Fishplates ≤650 long	Fishplates >650 long
Centre upwards	1.0	2.0
Centre downwards	1.0	2.0
Centre outwards from rail	1.0	2.0
Centre inwards from rail	1.0	2.0

Table 11-2 Calculated Mass Per Pair of Fishplates (Unpunched)

Nominal rail size	Mass, kg	
	4-hole	6-hole
Kg/m		
31	14.5	21.8
41, 47	22.6	33.8
50	-	34.4
53	23.7	35.5
60	-	39.7

Table 11-3 Mechanical Properties

Property	Value
Tensile strength, MPa	550 to 740
Elongation on $5.65\sqrt{S_0}$ *, % <i>min</i>	13

*Gauge length as defined in AS/NZS 4291.1

11.2 Tensile test pieces

Test pieces shall be circular-section proportional test pieces of 150 mm² cross-sectional area, prepared and tested in accordance with AS 1391.

If a test piece breaks outside the middle third of its gauge length, resulting in an elongation below the specified value, the test may, at the manufacturer's option, be discarded and another test piece made from the same test sample.

Section 12 Retests

If either of the test pieces fail to comply with the specified requirements, two further samples shall be taken and tested in accordance with this Standard.

If the test pieces from both of these further samples pass, the parcel shall be deemed to comply with this Standard.

If either of the additional test pieces fails, the parcel shall be deemed not to comply with this Standard.

Section 13 Rounding of numbers

For the purpose of assessing compliance with this Standard, the specified limiting values herein shall be interpreted in accordance with the 'rounding method' described in AS 2706. The observed or calculated value shall be rounded to the same number of figures as in the specified or calculated value and then compared with the specified limiting values. For example, for specified limiting values of 2.5, 2.50 and 2.500, the observed or calculated value would be rounded respectively to the nearest 0.1, 0.01 and 0.001.

Appendix A Information to be supplied the by purchaser (Informative)

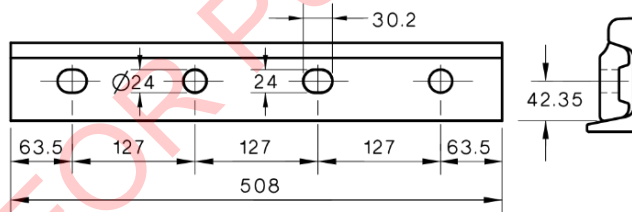
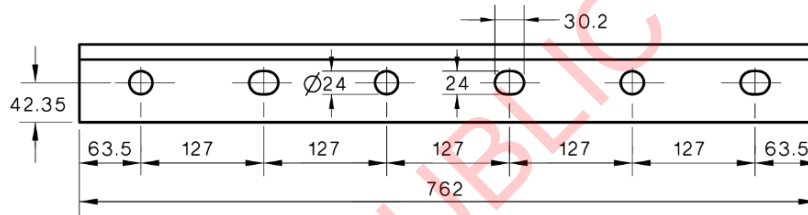
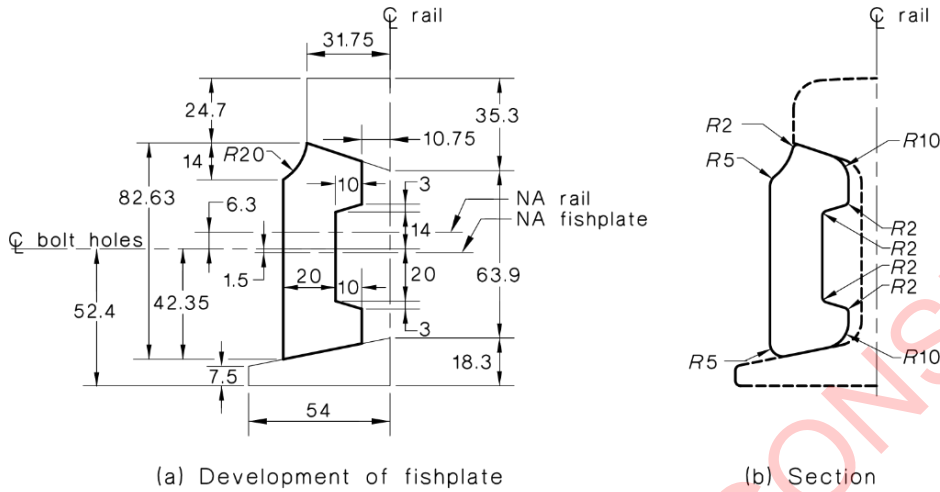
The following information should be supplied by the purchaser:

- (a) Designation of the fishplate as per Clause 2 including the number of this Australian Standard, i.e. AS 1085.2
- (b) The nominal rail size (e.g., 50 kg) with which the fishplates are intended to be used or the number of the appropriate drawing, or both
- (c) Quantity measured as either mass or number of pairs
- (d) The number and diameter of holes
- (e) Whether a test certificate is required
- (f) Whether it is the intention of the purchaser to inspect the material at the manufacturer's works
- (g) Any exceptions to the requirements specified, and any special or supplementary requirements

Appendix B Fishplate profiles, section properties and punching details (Normative)

B.1 Scope

This Appendix provides profile details, section properties and punching details for rolled and forged bar-type fishplates.

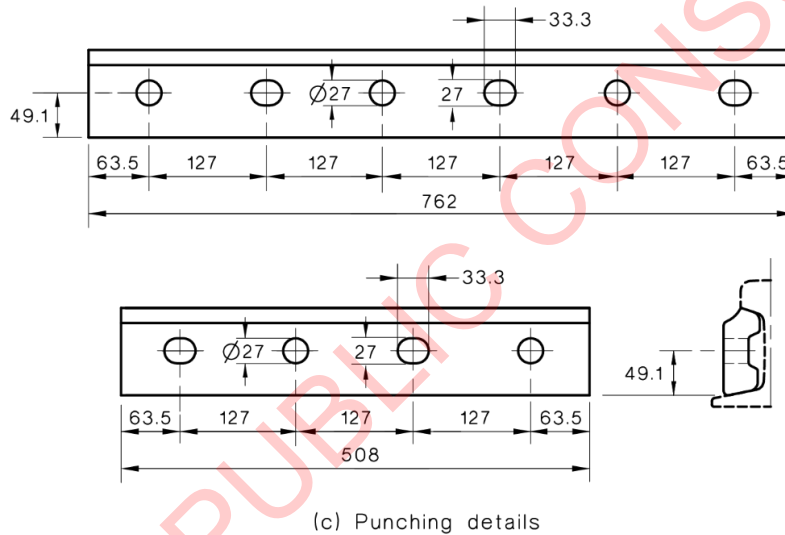
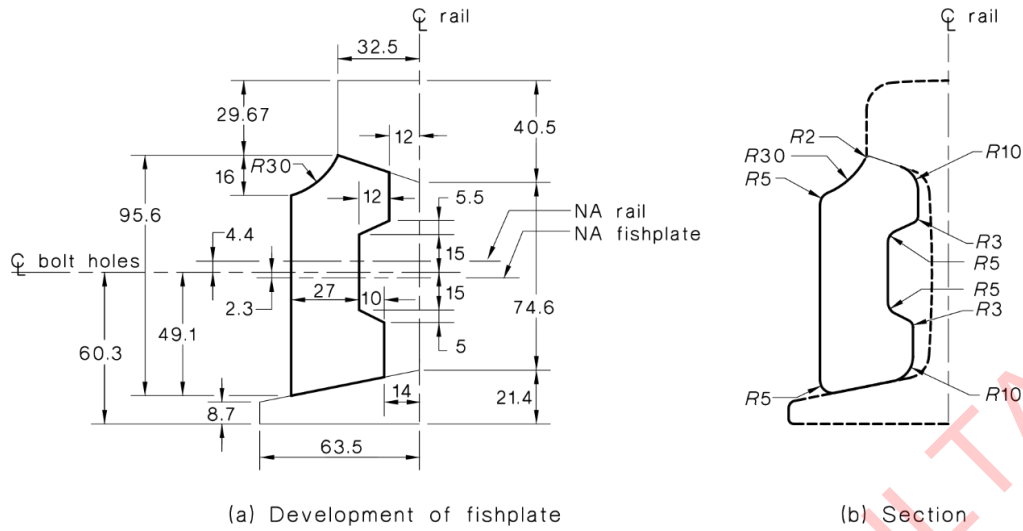


(c) Punching details

Area	1823 mm ²
Unit mass	14.3 kg/m
Second moment of area	$0.97 \times 10^6 \text{ mm}^4$
Section modulus head	$23.5 \times 10^3 \text{ mm}^3$
Section modulus base	$24.6 \times 10^3 \text{ mm}^3$

Appendix Figure B.1-1 Section and punching details of bar-type (rolled) fishplate for 31 kg/m rail.

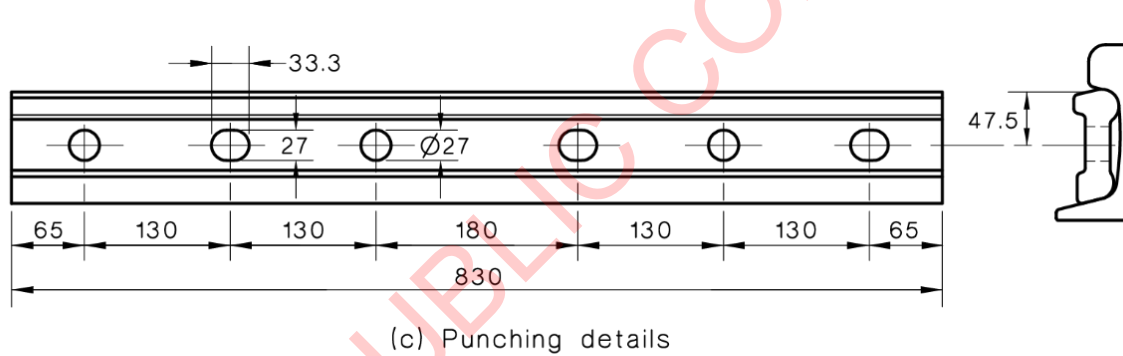
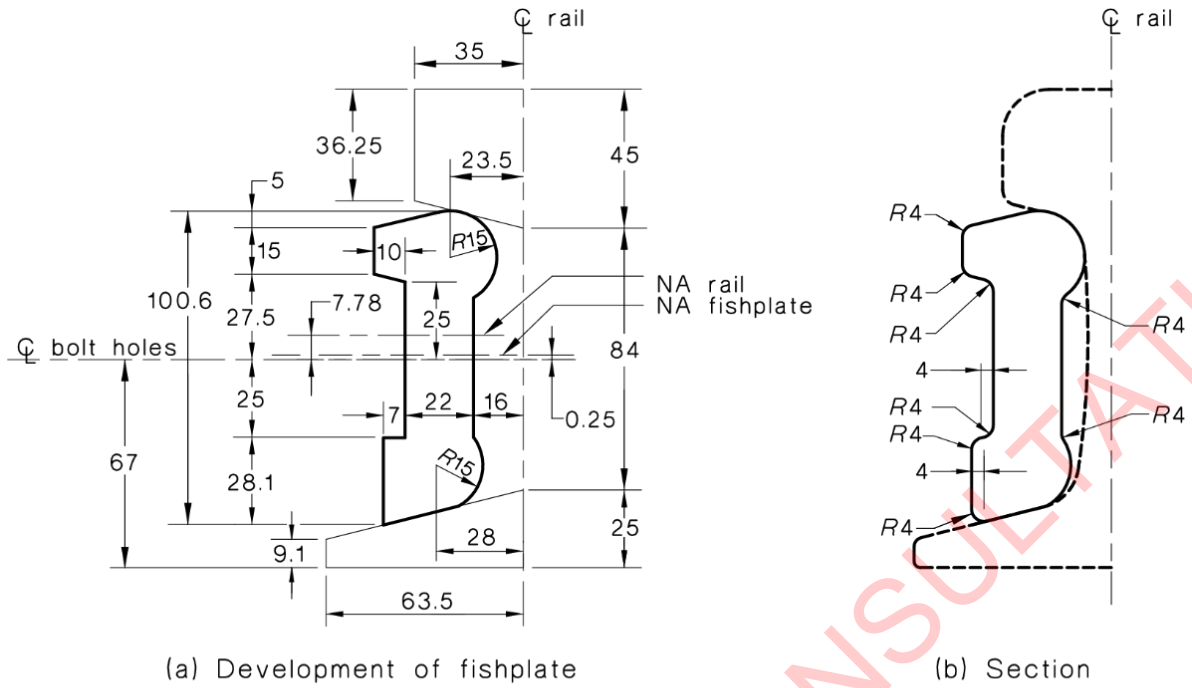
Dimension in millimetres.



Area	2823 mm ²
Unit mass	22.2 kg/m
Second moment of area	$2.03 \times 10^6 \text{ mm}^4$
Section modulus head	$41.9 \times 10^3 \text{ mm}^3$
Section modulus base	$44.4 \times 10^3 \text{ mm}^3$

Appendix Figure B.1-2 Section and punching details of bar-type (rolled) fishplate for 41 kg/m and 47 kg/m rail

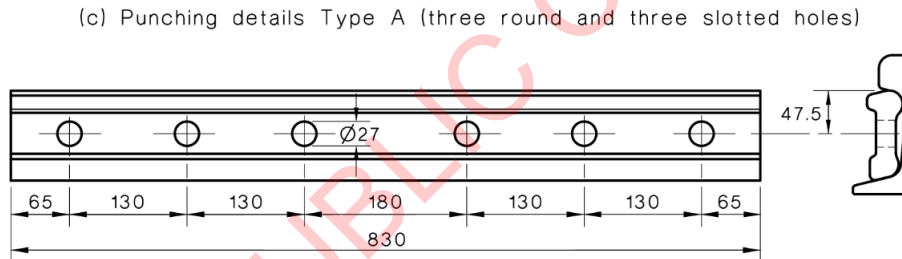
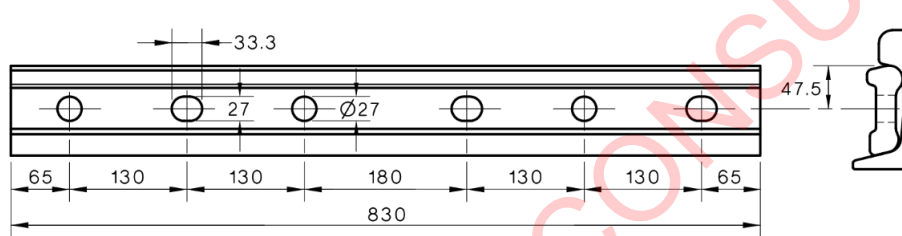
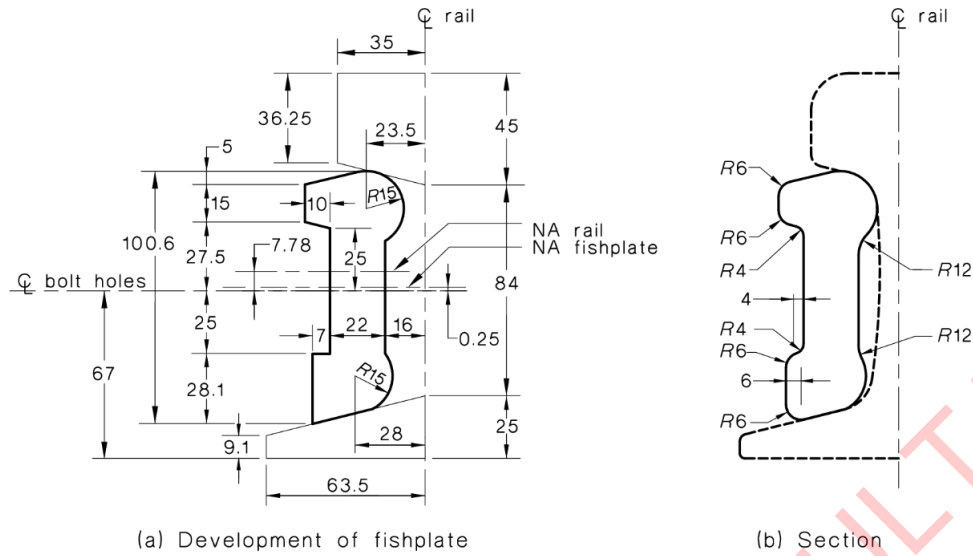
Dimension in millimetres.



Area	2639 mm ²
Unit mass	20.7 kg/m
Second moment of area	2.29×10^6 mm ⁴
Section modulus head	48.14×10^3 mm ³
Section modulus base	43.77×10^3 mm ³

Appendix Figure B.1-3 Section and punching details of bar-type (rolled) fishplate for 50 kg/m rail

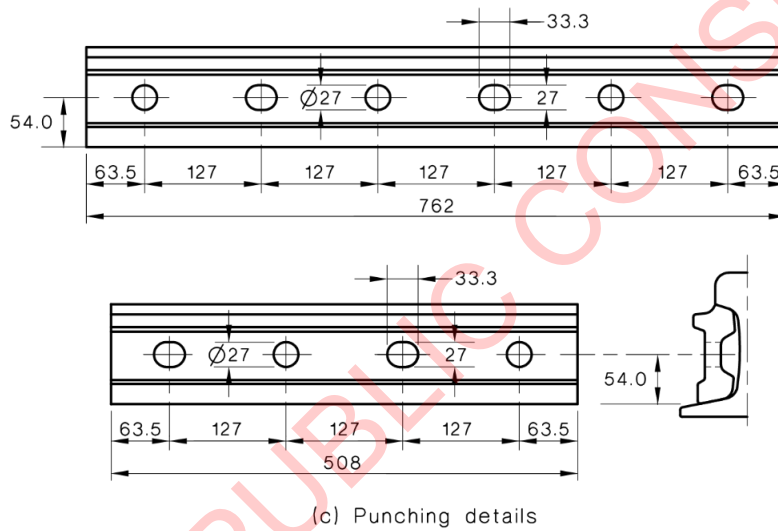
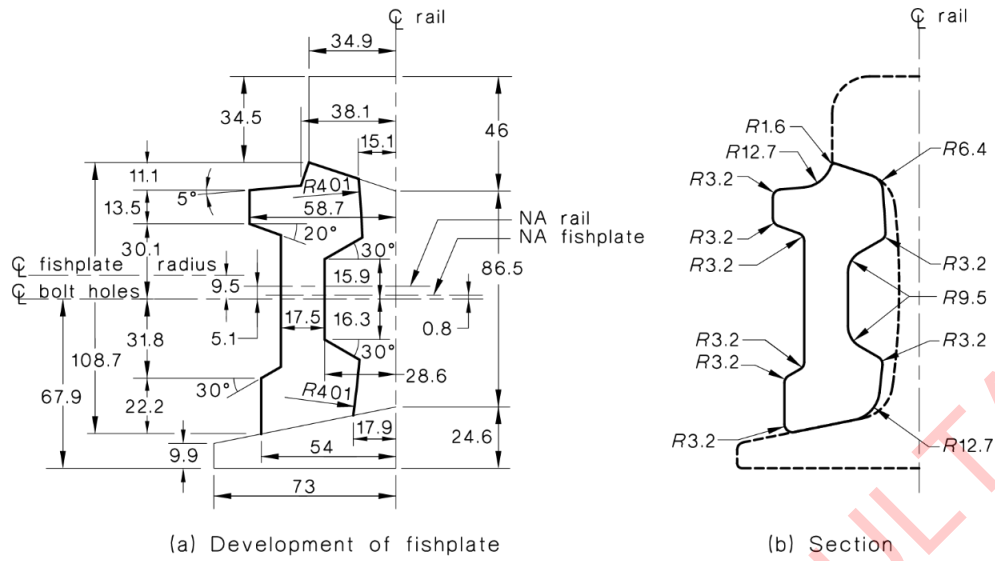
Dimension in millimetres.



Area	2639 mm ²
Unit mass	20.7 kg/m
Second moment of area	$2.29 \times 10^6 \text{ mm}^4$
Section modulus head	$48.14 \times 10^3 \text{ mm}^3$
Section modulus base	$43.77 \times 10^3 \text{ mm}^3$

Appendix Figure B.1-4 Section and punching details of bar-type (forged) fishplate for 50 kg/m rail

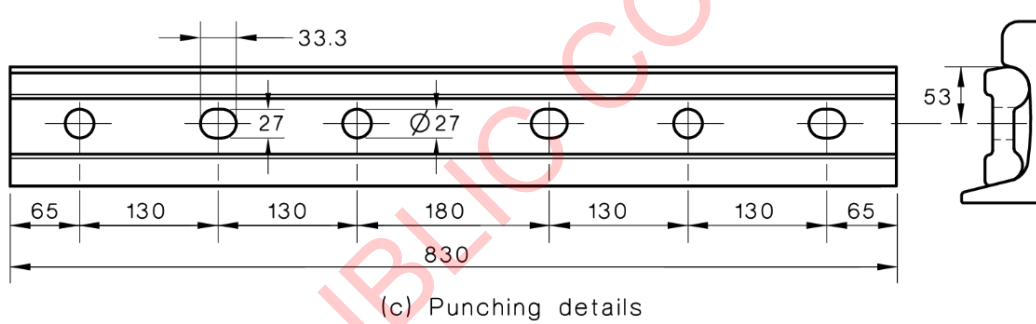
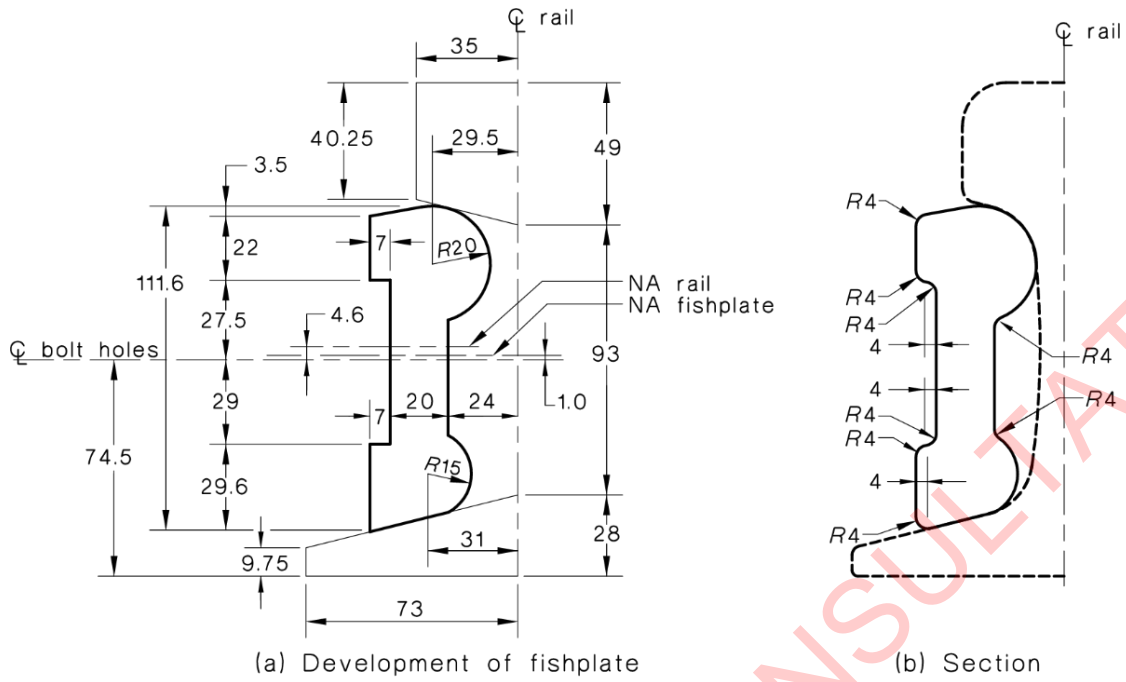
Dimension in millimetres.



Area	2968 mm ²
Unit mass	23.30 kg/m
Second moment of area	$3.14 \times 10^6 \text{ mm}^4$
Section modulus head	$59.00 \times 10^3 \text{ mm}^3$
Section modulus base	$57.20 \times 10^3 \text{ mm}^3$

Appendix Figure B.1-5 Section and punching details of bar-type (rolled) fishplate for 53 kg/m rail

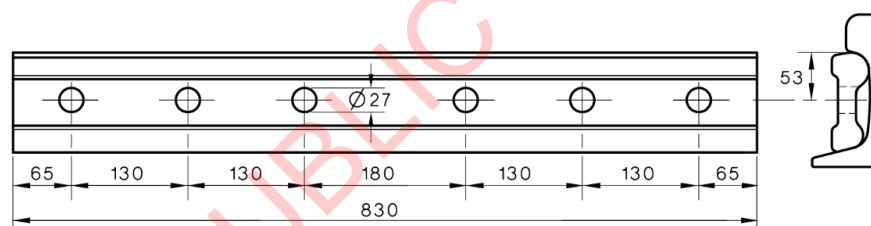
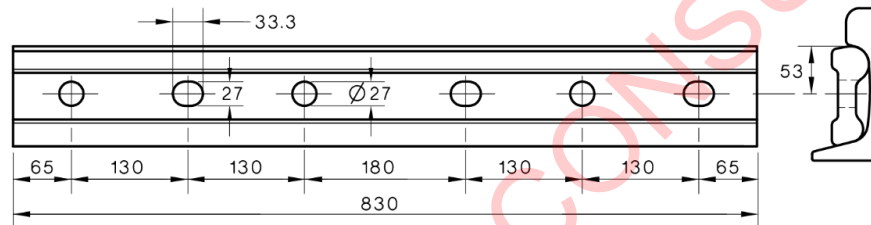
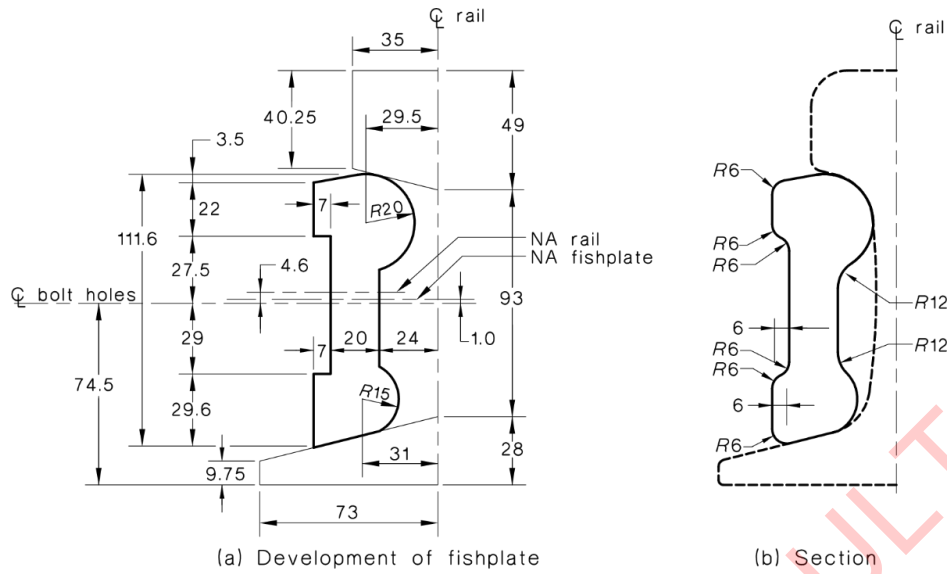
Dimension in millimetres.



Area	3046 mm ²
Unit mass	23.90 kg/m
Second moment of area	3.37 × 10 ⁶ mm ⁴
Section modulus head	64.72 × 10 ³ mm ³
Section modulus base	57.33 × 10 ³ mm ³

Appendix Figure B.1-6 Section and punching details of bar-type (rolled) fishplate for 60 kg/m rail

Dimension in millimetres.



Area	3046 mm ²
Unit mass	23.90 kg/m
Second moment of area	$3.37 \times 10^6 \text{ mm}^4$
Section modulus head	$64.72 \times 10^3 \text{ mm}^3$
Section modulus base	$57.33 \times 10^3 \text{ mm}^3$

Appendix Figure B.1-7 Section and punching details of bar-type (forged) fishplate for 60 kg/m rail

Dimension in millimetres.

Appendix C Demonstrating compliance with this standard (Informative)

C.1 Scope

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

- (a) Evaluation by means of statistical sampling.
- (b) The use of a product certification scheme.
- (c) Assurance using the acceptability of the supplier's quality system.
- (d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

C.2 Statistical sampling

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

- (a) The sample needs to be drawn randomly from a population of product of known history. The history needs to enable verification that the product was made from known materials at essentially the same time, by essentially the same processes and under essentially the same system of control.
- (b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199, guidance to which is given in AS 1399.

C.3 Product certification

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Standard.

The certification scheme should meet the criteria described in HB 18.28 in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective quality planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

C.4 Supplier's quality management system

Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or international Standard for a supplier's quality management system or systems, this may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Information on establishing a quality management system is set out in AS/NZS ISO 9001 and AS/NZS ISO 9004.

C.5 Other means of assessment

If the above methods are considered inappropriate, compliance with the requirements of this Standard may be assessed from the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform to the full requirements of the Standard.

Bibliography (Informative)

- PLACEHOLDER

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