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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 4 Fishbolts and Nuts Development Group, overseen by the RISSB Infrastructure Standing Committee.

Objective

The objective of this Standard is to provide manufacturers and purchasers with manufacturing and performance requirements for oval-necked fishbolts and nuts for use with fishplates and spring washers in railway track in accordance with the AS 1085 series of Standards.

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.

Commentary

Commentary *C Preface*

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

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Section 1 Scope and general

1.1 Scope

The scope is required for all standards and defines unambiguously the subject of the document and the extent and limitations of the matter covered by the standard or parts of it. Requirements and recommendations shall not be included. Background material relating to the topic shall not be included either. The scope should be clear, succinct, and unambiguous.

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 1085.1, *Railway Track Material – Part 1: Steel Rails*
- AS 1085.2, *Railway Track Material – Part 2: Fishplates*
- AS 1085.7, *Railway Track Material – Part 7: Spring Washers*
- AS 1199, *Sampling procedures and tables for inspection by attributes*
- AS 1275, *Metric screw for fasteners*
- 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 semi-finished products*
- 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, *Part 1: Bolts, screws and studs*
- AS/NZS 1252, *High-strength steel bolts with associated nuts and washers for structural engine*
- ISO 9001, *Quality management systems – Requirements*
- ISO 9004, *Quality management systems Guidelines for performance improvements*
- HB18, *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

chamfer
a bevelled edge connecting two surfaces

1.3.2
elongation
the degree to which a material can be stretched before breaking

1.3.3
fishbolts and nuts
components used with fishplates to connect lengths of rail in railway tracks

1.3.4
fishplates
metal bars that are bolted to the ends of two rails to join them together in a track

1.3.5
grip length
the distance from the bearing face of the bolt to the first full thread

1.3.6
hardened and tempered
heat treatment processes to increase the hardness and strength of the fishbolts

1.3.7
head radius
the radius of the curved part of the bolt head

1.3.8
head thickness
the distance from the top to the bottom of the bolt head

1.3.9
hot or cold forging
manufacturing processes involving shaping metal using heat (hot forging) or at room temperature (cold forging)

1.3.10
ISO coarse series 6 g
an international standard for screw thread dimensions and tolerances

1.3.11
laps
small overlaps of material on the crest of the thread formed during the rolling process

1.3.12
length of unthreaded shank
the portion of the shank that does not have threads

1.3.13
nominal length
the specified length of a bolt from the underside of the head to the end of the shank

1.3.14
oval section
the cross-sectional shape of the shank of a fishbolt

1.3.15
radius under head
the curved transition between the head and the shank

1.3.16
secondary machining
additional machining processes after initial shaping to achieve the final dimensions and finish

1.3.17
screw threads
the helical structure used on the bolts to enable fastening

1.3.18
shank
the part of the bolt between the head and the thread

1.3.19
stress at permanent set limit
the stress level at which a material undergoes a defined permanent deformation

1.3.20
tensile strength
the maximum stress that a material can withstand while being stretched or pulled

1.3.21
thermal expansion and contraction
the increase and decrease in size of the rails due to temperature changes

1.3.22
thread cutting
a process of forming screw threads by cutting into the bolt blank

1.3.23
thread rolling
a process of forming screw threads by rolling the bolt blank between dies

1.3.24
tensile strength
the maximum stress that a material can withstand while being stretched or pulled

General rail industry terms and definitions are maintained in the RISSB Glossary. Refer to:
https://www.rissb.com.au/products/glossary/

Section 2 Purpose and context of use

2.1 Function

Fishbolts and nuts are intended for use with fishplates to connect lengths of rail that are laid in railway tracks.

The effectiveness of the connection relies on the bolts remaining tight and holding the fishplates firmly against the rails. The assembly ensures that the running surfaces of the rails remain properly aligned with an allowance for a small gap between the rail ends. Fishplated joints are designed to allow a degree of longitudinal expansion and contraction of the rail.

2.2 Action

Fishbolts and nuts are tightened so that the fishplates are held firmly against the rails. The assembly is subjected to forces due to thermal expansion and contraction of the rail, passage of rolling stock at speed (including vibration effects) and maintenance operations.

Section 3 Fishbolts

3.1 Manufacture

Fishbolts may be produced by hot or cold forging and with or without secondary machining.

The fishbolts shall be hardened and then tempered by being uniformly reheated to a minimum temperature of 450°C.

Screw threads shall be formed by thread rolling or thread cutting.

NOTE: When the threads are produced by rolling, small laps are commonly present at the crests and are generally of a magnitude that is not detrimental to the performance of the bolt. A lap formed at the crest of the thread, perpendicular to the axis of the thread of the fishbolt, is not considered cause for rejection if the lap does not exceed 33 percent of the depth of thread.

3.2 Chemical composition

The steel used for the manufacture of fishbolts shall comply with AS 1442 and the grades used shall be selected from appropriate grades listed in the tables of AS 1442 and shall comply with the chemical composition limits (cast analysis) as set out in Table 3-1.

Table 3-1 Chemical Composition (Cast Analysis) – Fishbolts

Analysis, %			
Carbon	Manganese	Phosphorus	Sulfur
0.55 max	0.25 min	0.04 max	0.04 max

3.3 Mechanical properties

When tested for mechanical properties in accordance with AS 1391, using a test piece prepared in accordance with AS/NZS 4291.1, the finished fishbolts shall conform to the values in Table 3-2.

Table 3-2 Mechanical Properties of Fishbolts

Property	Requirement
Minimum tensile strength	800 MPa
Stress at permanent set limit, R_r 0.2	640 MPa
Minimum elongation $6.65\sqrt{s_0^*}$	12%
*Gauge length as defined by AS/NZS 4291.1	

3.4 Screw threads

Profile and basic dimensions of the fishbolt screw threads shall be in accordance with the ISO coarse series 6 g for external screw threads as given in AS 1275.

3.5 Shape, dimensions and finish

The shape and dimensions of fishbolts shall be in accordance with Figure 3-1 and Table 3-3. The finish shall be in accordance with the following requirements:

(a) Bolts shall be cleanly finished, sound and free from defects detrimental to their end use.

(b) Ends of fishbolts shall be either reasonably square with the centreline of the shank or rounded (see Figure 3-1). Where the ends of the fishbolts are finished square, a nominal 45° chamfer is to be provided to a depth slightly exceeding the depth of the thread.

NOTE: Fishplates not in accordance with AS 1085.2 may require the shank of the bolt to have a different shape than the oval one given in this Standard.

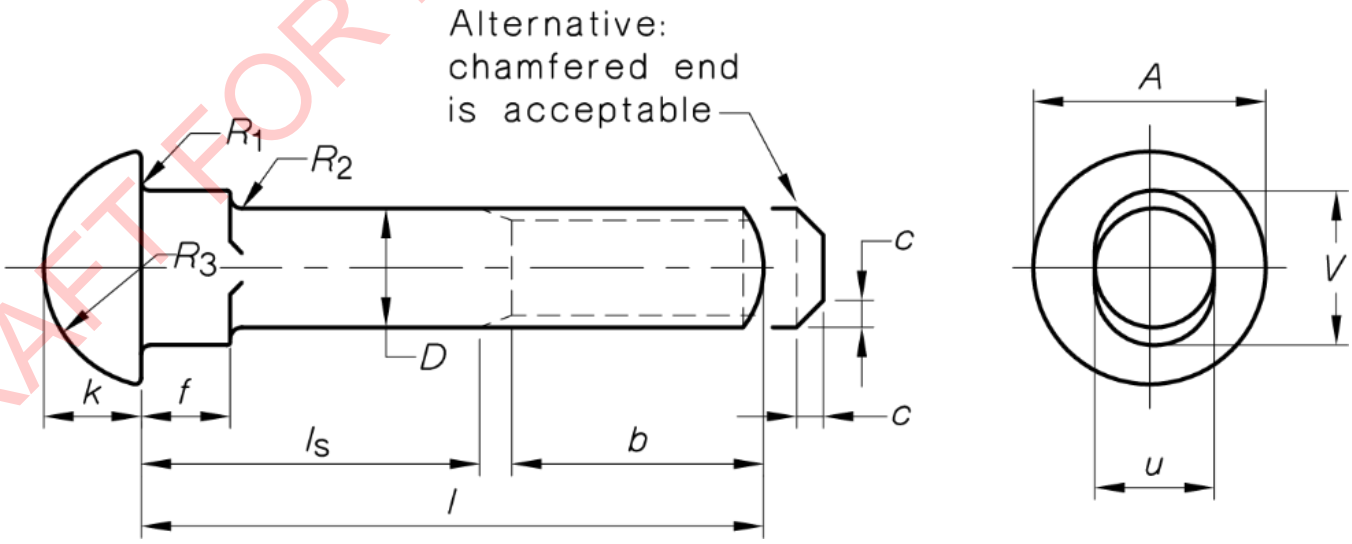

Figure 3-1 Fishbolt profile

Table 3-3 Fishbolts Profile

Fishbolts profile						
Dimensions (see Note 1)				Nominal thread dia. (see NOTE b)		
				M24	(M22)	M20
Pitch of thread				3.0	2.5	2.5
Shank diameter		D	min	23.6	21.6	19.7
			max	24.8	22.8	20.8
Oval section of shank	Major axis	V	min	30.5	28.0	24.4
			max	32.5	30.5	26.4
	Minor axis	u	min	25.0	23.0	21.0
			max	25.7	23.7	22.0
Head dia. to view		A	min	43.0	40.0	36.5
			max	46.0	43.0	39.0
Head radius front view		$R3$	min	18	18	18
			max	20	20	20
Min. radius under head		$R1$		1	1	1
Radius under oval shank		$R2$		3	3	2.5
Head thickness		k	min	18	18	15
			max	20	20	17
Length of oval shank		f	min	18	18	15
			max	20	20	17
Length of unthreaded shank (see Notes 3 and 4)		ls	min	as ordered	as ordered	as ordered
			max	as ordered +4	as ordered +4	as ordered +4
Length (see Note 5)		l	min	as ordered	as ordered	as ordered
Length of thread shank (See Note 6)		b	max	as ordered +4	as ordered +4	as ordered +3
Chamfer depth		c		3	2.5	2.5

NOTES:

All dimensions are in millimetres.

M22 is a non-preferred thread size but is listed in this Standard due to the need to replace bolts in existing installations.

Length of unthreaded shank (ls) is the distance from the last witness of thread on the shank to the bearing face of the bolt. For bolts with rolled threads, ls is the distance from the top of the extrusion cone to the bearing face of the bolt.

Length of grip (lg) is the distance from the bearing face of the bolt to the first full thread (which equals the length as ordered (l) minus the thread length (b)).

The nominal length of a fishbolt is the distance from the underside of the head to the extreme end of the shank including the chamfer. The nominal length is the length as ordered.

The purchaser and supplier may agree on different length of thread. It is recommended that the thread should not extend past the inside face of the fishplate

Section 4 Nuts

Nuts shall be in accordance with AS/NZS 1252.

Appendix A Hazard register (Informative)

Hazard number	Hazard	Heading number(s)

Appendix B Means of demonstrating compliance with this Standard (Informative)

B.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.

B.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.

B.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.

B.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.

B.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.

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

The following information should be supplied by the purchaser:

(a) The number of this Australian Standard, i.e. AS 1085.4.

(b) The nominal size of the bolt thread.

(c) The length of the bolt (l) and the unthreaded shank length (ls).

(d) The nominal size of the nut or the size across flats (e.g., 41/40 across flats).

(e) Quantity (mass or number of pieces).

(f) Exceptions to the requirements specified, and any special or supplementary requirements (e.g., locking clips).

(g) Packaging requirements including any assembly or treatment.

(h) Whether washers are to be packed together with the bolts and nuts.

NOTE:

Spring washers for use with fishbolts and nuts are described in AS 1085.7.