
SECTION SP39 FASTENERS FOR STRUCTURAL PURPOSES

1 GENERAL

1.1 CONTENTS

OUTLINE: This Section sets out the technical requirements for the manufacture and supply of steel and stainless steel (SS), bolts, studs, screws, nuts, pins, washers, blind rivets, and other related fasteners, not intended for high volume machine assembly, for application in buildings, civil works, rail and similar public infrastructure, either loose or incorporated in fabrications or other finished products.

[Note: The inclusion of all common fasteners in this Section is impractical, however omitted items can be addressed by inserting the required Standards information of Tables 1 and 2 in the Project Specifics.]

1.2 STANDARDS

MANUFACTURE: The fastener types and their Standards included herein are:

- [F1] Structural assemblies (high tensile) steel fastener: AS/NZS 1252 (1996 issue preferred)
- [F2] Direct tension indicators: ASTM F 959M & ASTM A 565/A 565M
- [F3] Stud bolts: ASTM A 193/A 194M & ASTM A 194/A 194M
- [F4] Hex and cup head bolts, nuts & washers: AS 1110, AS 1111, AS 1112 & AS 1390
- [F5] SS: hex & cup head bolts DIN 931, nuts DIN 934, washers DIN 125A, and set screws DIN 933
- [F6] Threaded steel rod: DIN 975
- [F7] Self drilling screws: AS 3566
- [F8] Rail track, screw spikes and threaded inserts: AS 1085, Part 18.

1.3 PACKAGING, STORAGE AND TRANSPORT

REQUIREMENT: At all times, all fasteners to be protected from contact with water, free from contamination and be accessible for inspection, sampling and identification purposes.

1.4 TERMS & DEFINITIONS

FASTENER: The term fastener covers all types of products designed to mechanically connect two or more structural parts to form a solid or movable joint or to contribute essentially to establish this function, such as screws, nuts, washers, pins, rivets and hose clamps. [Ref: Scope of ISO/TC2 Fasteners]

ACCEPTANCE INSPECTION: Adopt all terms and definitions of Clause 3, ISO 3269.

AUSTRALIAN DISTRIBUTOR: An entity (corporation or otherwise) based in Australia, including but not limited to an Australian manufacturer, overseas manufacturers local representative, wholesaler, importer, primary distributor (stockist) or contractor, which has the responsibility for verifying that the fastener properties comply with Section SP39.

ASSEMBLY TESTING: A test assembly consists of a bolt, nut and washer [including tapered washers and direct tension indicators], complying with the relevant requirements of AS/NZS 1252, supplied with corrosion-preventive coating. [Ref: AS/NZS 1252, Appendix C].

MANUFACTURING LOT NUMBER: Unique number assigned by the manufacturer and which allows full traceability from the finished product back through all previous manufacturing operations to a given heat number or cast number of the raw material of manufacture. [Ref: ISO 16426, Clause 3.14]

PRE NUMBER: An indication of pitting and crevice corrosion resistance is given by the 'Pitting Resistance Equivalent' (PRE) number: PRE = %Cr 3.3%Mo 16%N [Ref: www.nickelinstitute.org]

TRACE NUMBER: Alphanumeric code assigned by a distributor, which identifies the original manufacturer and manufacturing lot number. [Ref: ISO 16426, Clause 3.21]

CONFORMITY: General headings adopted from ISO/IEC Directives Part 2.

2 CONFORMITY

2.1 QUALITY MANAGEMENT SYSTEM

STANDARD: To ISO 9001, or ISO 16426, and the following with the certifier accredited or accepted by JAS-ANZ:

- Customer verification required (Clause 7.4.3).
- Service provision to include delivery (Clause 7.5.1f).
- Identification and traceability required (Clause 7.5.3).
- Scope of supply included in scope of certification.

2.2 PRODUCT CONFORMITY

MANUFACTURER: To provide one of the following, all written in the English language.

Option (A): Product certification.

- Details of the 3rd party certification scheme, including contacts and latest audit report.
- Type test results for Table 1, plus identification of manufacturing lot trace numbers.

Option (B): Sampling and testing plan.

- Test certificates of fastener attributes (ie: mechanical, chemical, etc.), as listed in Table 1 & 2.
- Identification of manufacturing lot trace numbers.

AUSTRALIAN DISTRIBUTOR: To provide the following:

- Verification of attribute by test certificate and/or letter of compliance [see Table A3].
- Identification of distributor trace numbers.
- Signed and dated approval by a verifying officer, including position, company and contact details.

ADDITIONAL SAMPLING & TESTING: Customer may specify in the Project Specifics [see Clause 5.3].

TESTING OF STRUCTURAL ASSEMBLIES: Test structural assemblies (high tensile) to AS/NZS 1252, Appendix C.

2.3 CONFORMITY ASSESSMENT

REQUIREMENT: The following ‘means of demonstrating compliance’ options are accepted:

- (A) Product certification, to Section SP39, Clause A2, with certifier accredited or accepted by JAS-ANZ.
OR
(B) Sampling and testing plan, to Section SP39, Clause A3, using a competent laboratory and auditor.

LABORATORY COMPETENCE: Accredited by NATA, or other internationally recognised accreditation body (ie: signatory to ILAC or APLAC), to AS ISO/IEC 17025 for the relevant sampling and testing. (ILAC & APLAC: International & Asia Pacific Laboratory Accreditation Cooperation)

AUDITOR COMPETENCE: Further to HB 18.65 (AS ISO/IEC Guide 65), the minimum criteria for competence of personnel to include all the following:

- Qualified auditor with tertiary qualifications in a relevant field.
- At least ten years in the manufacturing environment, with demonstrated competence in this particular product area, or particular product Standard/referenced standard.
- Demonstrated experience in auditing quality management systems, or quality plans, for these products.
- At least one year actively involved in product assessment of this or similar product, either in a laboratory or in production inspection.

3 MATERIALS

3.1 FASTENERS

REQUIREMENT: To the Standards listed in Tables 1 and 2 for each fastener type.

4 MANUFACTURE

4.1 GENERAL

REQUIREMENTS: To the Standards listed in Tables 1 and 2 for each fastener type.

4.2 HEAD MARKINGS

REQUIREMENTS: To be traceable back to the Australian Distributor.

4.3 CYCLONIC WASHERS

REQUIREMENT: To BCA, Volume 1 and 2, Part B, Structural Provisions, Clause 1.2.

TABLE 1: FASTENERS, REQUIREMENTS & TYPICAL OPTIONS

COMMON NAME	Structural Assemblies (High Strength) [F1]		Direct Tension Indicators [F2]		Stud Bolts [F3]		Hex & Cup Head Fasteners [F4]	
<i>Applications</i>	<i>Buildings & other structures</i>		<i>Torque control on struct assemblies</i>		<i>High pressure pipeline flanges</i>		<i>General construction</i>	
Standards	Aust Stds	Int Stds	Aust Stds	Int Stds	Aust Stds	Int Stds	Aust Stds	Int Stds
Components, Main Manufacturing Standards & Marking	Bolts, nuts & washers: to AS/NZS 1252:1996 (ISO equivalent)	Bolts, nuts & washers: to ISO 7411, 4775 & 7415 respectively	Not available	ASTM F 959M	AS 2528 not used	Stud ASTM A 193/A 194M & Nut ASTM A 194/A 194M	Bolts, nuts & washers: AS 1110 AS 1111 AS 1112 AS 1390	Bolts, nuts & washers: ISO 4014 ISO 4016 ISO 4032 --
Heads	Hex		--	--	--	#	Hex & cup	
Thread	ISO metric coarse		--	--	--	#	ISO metric coarse	
Size & Dimensional Characteristics	# except M20 size to AS 1252:1983	#	--	#	--	#	#	#
Property Class, & Mechanical Characteristics	Bolts & nuts Class 8.8, to AS/NZS 4291 (ISO 898 clone), & if required, assembly testing	ISO 898 Parts 1 & 2 [Duplicates EN 14399-1]	--	# ASTM A 565/A 565M	--	#	# Bolts , Class 4.6, 8.8 & 10.9 for use with nuts Class 5, 8 & 10 respectively, all to AS/NZS 4291	ISO 898 Parts 1 & 2
Chemical Composition	#	#	--	#	--	#	#	#
Finish & Coatings	# Hot-dip gal to AS 1214 or black		--	--	--	#	# Hot-dip gal to AS 1214, black or zinc plating	
Traceability	To ISO 16426, Clause 5.2, with details of assigned 'Manufacturing Lot Number' & 'Trace Number'							

Requirements to the main manufacturing standard(s), unless otherwise indicated.

TABLE 2: FASTENERS, REQUIREMENTS & TYPICAL OPTIONS

COMMON NAME	Threaded Steel Rods [F5]		SS Fasteners [F6]		Self-drilling Screws [F7]		Railway Track Screw Spikes & Threaded Inserts [F8]	
	<i>General construction</i>		<i>For use in corrosive environments</i>		<i>Buildings & general construction</i>		<i>Railways</i>	
Standards	Aust Stds	Int Stds	Aust Stds	Int Stds	Aust Stds	Int Stds	Aust Stds	Int Stds
Components, Main Manufacturing Standards & Marking	Not available	DIN 975	Not available	Bolts, nuts, washers & set screws: to DIN 931, 934, 125A & 933 resp'tvly	Screws to AS 3566, Parts 1 & 2	Not available	Screw spikes & threaded inserts generally to AS 1085.18	Not known
Heads	--	-	--	Hex & cup	Various, see AS/NZS 3566.1	--	To AS 1085.18	--
Thread	--	ISO metric coarse	--	ISO metric coarse	Various, see AS/NZS 3566.1	--	To AS 1085.18	--
Size & Dimensional Characteristics	--	#	--	#	To AS 3566.1 & AS/NZS 4411	--	To AS 1085.18, Fig 1 & 2	--
Property Class & Mechanical Characteristics	--	Class 4.6 & 8.8, plus SS 304 & 316	--	ISO 3506, SS 304 & 316	To AS 3566.1	--	To AS 1085.18	--
Chemical Composition	--	Class 4.6 & 8.8, plus SS 304 & 316	--	SS 304 & 316	To AS 3566.1	--	To AS 1085.18	--
Finish & Coatings	--	# Hot-dip gal to AS 1214, black, or zinc plating	--	-	To AS 3566.2	--	Nil	--
Traceability	To ISO 16426, Clause 5.2, with details of assigned 'Manufacturing Lot Number' & 'Trace Number'							

Requirements to the main manufacturing standard(s), unless otherwise indicated.

5 SCHEDULES

5.1 REFERENCED DOCUMENTS

STANDARDS:

- AS 1085 - Railway track material
 - .18 - Screw spikes and threaded inserts
- AS 1110 - ISO metric hexagon bolts and screws – Product grades A and B
 - .1 - Bolts (ISO 4014:1999)
 - .2 - Screws (ISO 4017:1999)
- AS 1111 - ISO metric hexagon bolts and screws – Product grade C
 - .1 - Bolts (ISO 4016:1999)
 - .2 - Screws (ISO 4018:1999)
- AS 1112 - ISO metric hexagon nuts
 - .1 - Style 1 – Product grades A and B (ISO 4032:1999)
 - .2 - Style 2 – Product grades A and B (ISO 4033:1999)
 - .3 - Product grade C (ISO 4034:1999)
 - .4 - Chamfered thin nuts – Product grades A and B (ISO 4035:1999)
- AS 1214 - Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 1459, ISO 1460, ISO 1461)
- AS 1237 - Plain washers for metric bolts, screws and nuts for general purposes
 - .1 - General plan (ISO 887:2000)
 - .2 - Tolerances (ISO 4759-3:2000)
- AS/NZS 1252 - High strength steel bolts with associated nuts and washers for structural engineering (ISO 7411:1984, ISO 7415:1984, ISO 4775:1984)
- AS 1390 - Cup head bolts with ISO metric coarse pitch threads
- AS 2528 - Bolts, studbolts & nuts for flanges & other high & low temperature applications (ISO 225, ISO 898-1, ISO 885:1976, ISO 4759-1:1978, ISO 272:1982, ISO 888:1976)
- AS 3566 - Self-drilling screws for the building and construction industries
 - .1 - General requirements and mechanical properties
 - .2 - Corrosion resistance requirements
- AS 4291 - Mechanical properties of fasteners made of carbon steel and alloy steel
 - .1 - Bolts, screws and studs (ISO 898-1:1999)
 - .2 - Nuts with specified proof load values – Course thread (ISO 898-2:1992)
 - .3 - Set screws & similar threaded fasteners not under tensile stresses (ISO 898-5:1998)
 - .7 - Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm (ISO 898-7:1992)
- AS/NZS 4411 - Tapping screws thread (ISO 1478:1983)
- AS/NZS ISO 9001 - Quality management systems - Requirements
- AS ISO/IEC 17025 - General requirements for the competence of testing and calibration laboratories
- ASTM A 193/A 193M - Standard Specification for Alloy-Steel & Stainless Steel Bolting Materials for High Temperature or High Pressure Service & Other Special Purpose Applications.
- ASTM A 194/A 194M - Standard Specification for Carbon & Alloy-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

ATIC-SPEC

ASTM A 565/A 565M	- Standard Specification for Martensitic Stainless Steel Bars for High Temperature Service
ASTM F 959M	- Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use With Structural Fasteners [Metric]
DIN 125A	- Product grade A washers
DIN 931	- Hexagon head bolts with shank
DIN 933	- M1.6 to M52 hexagon head screws threaded up to the head
DIN 934	- Hexagon nuts with metric course and fine pitch threads
DIN 975	- Stud bolt threads
EN 14399	- High-strength structural bolting assemblies for preloading -
.1	- General requirements
ISO 898	- Mechanical properties of fasteners made of carbon steel and alloy steel
.1	- Bolts, screws and studs
.2	- Nuts with specified proof load values --Coarse thread
ISO 3269	- Fasteners – Acceptance inspection
ISO 4014	- Hexagon head bolts – Product grades A and B
ISO 4016	- Hexagon head bolts – Product grade C
ISO 4032	- Hexagon head nuts, style 1 - Product grades A and B
ISO 4775	- Hexagon nuts for high-strength structural bolting with large width across flats -- Product grade B -- Property classes 8 and 10
ISO 7411	- Hexagon nuts for high-strength structural bolting with large width across flats (thread lengths according to ISO 888) -- Product grade C -- Property classes 8.8 and 10.9
ISO 7415	- Plain washers for high-strength structural bolting, hardened and tempered
ISO 16426	- Fasteners – Quality assurance system
ISO/TC2	- International Organisation for Standardization, ISO/TC 2, Fasteners.
ISO/IEC Directives	- Part 2, Rules for the structure and drafting of International Standards (5 th ed), 2004

OTHER DOCUMENTS:

BCA	- Building Code of Australia, Volumes 1 and 2.
HB 18.28	- AS ISO/IEC GUIDE 28 – General rules for a model third-party certification system for products (ISO/IEC GUIDE 28)
HB 18.65	- AS ISO/IEC GUIDE 65 – General requirements for bodies operating product certification systems (ISO/IEC GUIDE 65)
HB 162	- Rules for the structure and drafting of Australian Standards

5.2 COMPONENT SUPPLY

GENERAL: All assembly components to be sourced from the same Australian Distributor.

STRUCTURAL ASSEMBLIES (HIGH STRENGTH): Bolts, nut and washers having the same trace number to be supplied in the same box. Tapered washers and direct tension indicators to be in separate boxes, but each box to have only product of the same trace number.

SEALS: Provide one seal for each self tapping screws.

5.3 PROJECT SPECIFICS

[Note: For each fastener type required, select from, add to, or modify the following, and insert in project specs and/or purchase orders. If the fastener required is not listed, use Tables 1 and 2 as a guide to create an equivalent listing and insert in the Project Specifics.]

FASTENERS: Supply the nominated fasteners to the following and in compliance with Section SP39:

ITEM	PROJECT REQUIREMENTS
Common name of fastener type	
Standards [eg: as per Tables 1 & 2]	
Material class	
Sizes and dimensions [eg: bolt dia & length]	
Corrosion protection: [eg: electroplated zinc galv, hot dipped galv, SS grades: PRE number]	
Structural assemblies testing [see Clause 2.5]	
Any additional sampling & testing	
Description of any fabrications or finished products incorporating the fasteners	
Manufacturer's compliance certificates	Australian Distributor to supply [see Clause 2.3]
Australian Distributor's verification	Australian Distributor to supply [see Clause 2.3]

5.4 AGENCY PRACTICES

Agency	Item	Requirement
RTA		
Qld DTMR	Structural Assemblies (High Strength) [F1]	Assembly testing required
VicRoads		
Landcom		
HWC		
NSW Public Works		
NSW RailCorp		
Qld RailCorp		

APPENDIX A

PRODUCT CONFORMITY AND CONFORMITY ASSESSMENT

A1 SCOPE

This Appendix sets out two means by which conformity assessment can be demonstrated by the manufacturer or supplier (see HB 162, Annex F, with ‘Normative’ replacing ‘Informative’):

- The use of a third party product certification scheme [see Clause A2] OR
- Other means of assessment, involving the use of a minimum sampling and testing frequency plan [see Clause A3].

A2 CONFORMITY ASSESSMENT, THIRD PARTY

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

The certification scheme shall meet the criteria described in HB18.28 (AS ISO/IEC GUIDE 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 planning to control production.

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

Product certification shall be conducted by a certification body accredited by the Joint Accreditation System for Australia and New Zealand (JAS-ANZ) or by another certification body that is acceptable to JAS-ANZ.

The frequency of the sampling and testing plan, as detailed in Tables A1 & A2, shall be used by the certifying body for conformity assessment auditing. However, where the manufacturer can demonstrate adequate process control to the certifying body, the frequency of sampling and testing nominated in the manufacturer’s quality plan and/or documented procedures shall take precedence for the purpose of product certification.

A3 OTHER MEANS OF ASSESSMENT

A3.1 GENERAL Tables A1 and A2 set out the minimum sampling and testing frequency plan for a manufacturer to demonstrate product conformity to the nominated standards. All tests conducted to these requirements shall be NATA certified.

A3.2 TERMS & DEFINITIONS Adopt those used in Clause 3, ISO 3269.

**TABLE A1
ACCEPTANCE INSPECTION PROCEDURES FOR FASTENER CHARACTERISTICS**

Characteristic to be Tested	ISO 3269
Dimensional characteristics of threaded fasteners	Table 1
Dimensional characteristics of plain washers	Table 2
Dimensional characteristics of pins	Table 3
Dimensional characteristics of blind rivets	Table 4
Characteristics of threaded fasteners, excepting dimensional characteristics	Table 6
Mechanical characteristics of plain washers	Table 7
Mechanical characteristics of pins	Table 8
Mechanical characteristics of blind rivets	Table 9

**TABLE A2
SELECTED FASTENERS: CHARACTERISTICS TO BE TESTED**

FASTENER TYPES COMMON NAMES	Required Assessment to ISO 3269 (See Table A1 above) (#)			
	Table 1	Table 2	Table 6	Table 7
[F1] Structural assemblies (High Strength)	PG 1	A ^a	√	√
[F2] Direct Tension Indicators	--	A ^a	--	√
[F3] Studbolts & Nuts	PG 1	A ^a	√	--
[F4] Hex & Cup Head Fasteners - Bolts - Nuts	PG 1 or 2 PG 3 or 4	-- --	√ √	-- --
[F5] Threaded Steel Rods	PG 2	--	√	--
[F6] SS Fasteners & Set Screws - Bolts & Set Screws - Nuts	PG 2 PG 4	C ^a C ^a	√ √	√ √
[F7] Self-drilling Screws	PG 6	--	√	--
[F8] Railway Track Materials: - Fishbolts - Nuts	PG 2 ?	C ^a ?	√ ?	√ ?

PG = Product Group and Product Grade √ = Required A^a (typical) = product grade

A3 VERIFICATION TESTING

A3.1 GENERAL The default requirements of Table A3, are provided to suit the risk categories of each fastener type. Where inappropriate, these can be over-written by Project Specific requirements.

A3.2 TEST CERTIFICATES Verifies that the fasteners have been tested, yielding the results recorded therein, for each attribute listed in Tables 1 and 2, and complies with each of the Standards.

A3.3 LETTERS OF CONFORMANCE Confirms that the fasteners comply with each attribute listed in Tables 1 and 2, and with each of the Standards.

**TABLE A3
VERIFICATION REQUIREMENTS FOR FASTENERS**

PRODUCT RISK CATEGORY	FASTENER TYPE	REQUIREMENTS #
Critical [ie: heat treated]	[F1], [F2], [F3], [F4] Grade 8.8 & 8.9 & [F5] Grade 8.8	Test certificate
Non-critical [ie: un-heat treated]	[F4] Grade 4.6 & [F8]	Letter of conformance
Corrosion Resistant	[F5] SS & [F6]	Test certificate for chemical properties & a letter of conformance for the remaining attributes
Type Specific	[F7]	Test certificate

Certificate or letter, as nominated for each fastener type, covering all attributes listed in Tables 1 and 2.

A4 NON-COMPLIANCE

A4.1 GENERAL Document and refer all alleged non-complying product to the Australian Distributor for further investigation and any necessary corrective action.