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| AUSTROADS TECHNICAL SPECIFICATION ATS 5420Supply of Bolts, Nuts and Washers | A close up of a flag  Description automatically generated |

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# Scope

This Austroads Technical Specification ATS 5420 sets out the requirements for the supply of bolts, nuts, screws, washers, studbolts and threaded rods for steelwork. It also includes requirements for the supply of stainless steel Fasteners.

This Specification details the default properties of the Fasteners. Additional requirements may be specified elsewhere on the drawings or other contract documents.

# Definitions

The following definitions apply to this Specification:

Fasteners: Steel items used to secure or join together individual items of steelwork, e.g. bolts, studbolts, threaded rods, holding down bolts, screws, nuts and washers.

High strength Bolts, studbolts, threaded rods, and screws of property class 8.8 or higher, and nuts

Fasteners: of property class 8 or higher, made from heat treated carbon steel.

Manufacturing Fasteners of the same designation, including product grade, property class and size

Lot: (one thread diameter and one length), manufactured from wire, rod or flat product from the same heat, processed through the same or similar steps at the same time or over a continuous time period from a process with factory production control, including the same heat treatment and/or coating process, if any.

Purchase The number of Fastener items to be purchased from a single Manufacturing Lot. This

lot size: size is used to determine the frequency of testing in Annexure B.

Lot Unique number assigned by the manufacturer to a Manufacturing Lot, allowing full

identification traceability from the finished product item back through all previous manufacturing

number: operations to a given heat number or cast number of the raw material of manufacture.

Low strength Bolts, studbolts, threaded rods and screws of property class 4.6 or 4.8, and nuts with

Fasteners: property class 5, made from carbon steel not subjected to heat treatment during manufacturing.

Manufacturer: Entity providing the total, substantive or final production/assembly process of Fasteners.

Mild steel Washers not subjected to heat treatment during manufacturing.

washers:

Product grade: The precision of manufacture of the Fastener, based on the applicable dimensional tolerances. Grade A is the most precise and grade C is the least precise.

Property class: Numeric code, stamped on the Fastener to indicate its mechanical properties.

 Bolts, screws and studbolts have a two-digit number with a decimal point in between, the first digit being 0.01 times the nominal tensile strength in MPa and the second digit being 10 times the ratio of the lower yield strength (or stress at 0.2% permanent set) to the nominal tensile strength in MPa.

 Nuts have a single digit number representing 0.01 times the proof load stress in MPa, except for thin nuts which have a zero in front of the single digit.

Threaded rods: Rods that are threaded along their entire length, and used in conjunction with nuts.

High strength Assembly of bolts, nuts and washers conforming to AS/NZS 1252, commonly used in

structural bolt structural engineering applications.

assembly:

Studbolts: Short rods which are either threaded at both ends or along their entire length, and used in conjunction with nuts.

Supplier: Australian business entity, which can be a local representative of an overseas manufacturer, wholesaler, importer or contractor, and is responsible for ensuring conformity of the supplied Fasteners to this Specification.

Trace lot Unique alphanumeric code assigned by a Fastener manufacturer or distributor, to a

number: consignment of Fasteners which identifies the original Manufacturing Lot number in an unequivocal manner.

The following abbreviations apply to this Specification:

AISI American Iron and Steel Institute

HDG Hot-dip galvanizing

HRC Rockwell Hardness measured on the C scale

HV Vickers Hardness

JAS-ANZ Joint Accreditation System for Australia and New Zealand

NATA National Association of Testing Authorities, Australia

PC Property class

TB Bearing-type tensioned bolt conforming to AS 5100.6

TF Friction-type tensioned bolt conforming to AS 5100.6

# Referenced Documents

The following documents are referenced in this Specification:

**Austroads**

ATS 5310 Steel Fabrication

**Australian Standards**

AS 1110 ISO metric hexagon bolts and screws - Product grades A and B

AS 1110.1 Bolts

AS 1110.2 Screws

AS 1111 ISO metric hexagon bolts and screws - Product grade C

AS 1111.1 Bolts

AS 1111.2 Screws

AS 1112 ISO metric hexagon nuts

AS 1112.1 Style 1 - Product grades A and B

AS 1112.2 Style 2 - Product grades A and B

AS 1112.3 Product grade C

AS 1112.4 Chamfered thin nuts - Product grades A and B

AS 1214 Hot-dip galvanized coatings on threaded Fasteners (ISO metric coarse thread series)

AS 1237 Plain washers for metric bolts, screws and nuts for general purposes

 AS 1237.1 General plan

AS 1237.2 Tolerances

AS/NZS 1252.1 High-strength steel fastener assemblies for structural engineering - Bolts, nuts and washers - Technical requirements

AS 1275 Metric screw threads for Fasteners

AS/NZS 1390 Cup head bolts with ISO metric coarse threads

AS 1420 ISO metric hexagon socket head cap screws

AS 1443 Carbon and carbon-manganese steel - Cold finished bars

AS 1789 Electroplated zinc (electro-galvanized) coatings on ferrous articles (batch process)

AS 1815 Metallic materials - Rockwell hardness test

AS 1817 Metallic materials - Vickers hardness test

AS/NZS 2465 Unified hexagon bolts, screws and nuts (UNC and UNF threads)

AS 2528 Bolts, studbolts and nuts for flanges and other high and low temperature
applications

 AS 3566 Self-drilling screws for building and construction industry

AS 3566.1 General requirements and mechanical properties

AS 3566.2 Corrosion resistance requirements

AS 4291 Mechanical properties of Fasteners made of carbon steel and alloy steel

AS 4291.1 Bolts, screws and studs

AS/NZS 4291.2 Nuts with specified proof load - Coarse thread

AS/NZS 5100.6 Bridge design - Steel and composite construction

AS/NZS ISO 9001Quality management systems – Requirements

**ISO Standards**

ISO 898 Mechanical properties of Fasteners made of carbon steel and alloy steel

ISO 898-1 Bolts, screws and studs with specified property classes - Coarse thread and fine pitch thread

ISO 898-2 Nuts with specified proof load values - Coarse thread

ISO 965 ISO general-purpose metric screw threads

ISO 3506 Mechanical properties of corrosion-resistant stainless steel Fasteners

ISO 3506-1 Bolts, screws and studs

ISO 3506-2 Nuts

ISO 4014 Hexagon head bolts - Product grades A and B

ISO 4017 Hexagon head screws - Product grades A and B

ISO 4032 Hexagon nuts, Style 1 - Product grades A and B

ISO 4762 Hexagon socket head cap screws

ISO 7089 Plain washers - Normal series - Product grade A

ISO 7090 Plain washers, chamfered - Normal series - Product grade A

ISO 10642 Hexagon socket countersunk head screws

**ASTM International**

ASTM A193M Standard Specification for alloy-steel and stainless steel bolting for high temperature or high pressure service and other special purpose applications

ASTM A194M Standard specification for carbon steel, alloy steel, and stainless steel nuts for bolts for high pressure or high temperature service, or both

ASTM A240M Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications

ASTM A666 Standard specification for annealed or cold-worked austenitic stainless steel sheet, strip, and flat bar

ASTM B695-04 Standard specification for coatings of zinc mechanically deposited on iron and steel

**European Standards**

BS 4168 Hexagon socket screws and wrench keys

DIN 125A Product grade A washers

DIN 912 Socket head cap screws

DIN 931 Hexagon head bolts with shank

EN 14399 High strength Structural Bolting Assemblies for Preloading

EN 14399-2 Suitability Test for Preloading

EN 14399-3 System HR - Hexagon Bolt and Nut Assemblies

EN 14399-6 Plain Chamfered Washers

# Quality System Requirements

Fasteners must be manufactured and supplied by organisations that have quality management systems which are certified to AS/NZS ISO 9001 by an organisation which is accredited by JAS-ANZ or an International Accreditation Association member.

At least 6 weeks prior to the commencement of supply of Fasteners, the following information for each type of Fastener which is proposed to be used in the Works must be submitted to the Principal:

1. name and address of proposed supplier(s);
2. evidence of conformity to the requirements of Clause 4.1;
3. product designation, description and proposed Purchase Lot size;
4. list of required tests in accordance with Clause 9;
5. number of specimens to be tested in accordance with Annexure B;
6. initial evidence of conformity to the traceability requirements in Clause 10; and
7. sample test certificates of similar type(s) of Fasteners, showing conformity with this Specification.

Documents submitted on previous projects may be accepted as evidence for Items (f) and (g). The documents must clearly show the lot identification number of the Fastener on the test certificates.

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| **HOLD POINT 1** |
| Process Held | Commencement of supply of Fasteners. |
| Submission Details | The Required Information must be provided at least 6 weeks prior to the delivery of the Fasteners to the Site. |

# High Strength Structural Bolt Assemblies

## Assemblies Conforming to AS/NZS 1252

Assemblies comprising bolts PC 8.8 (sizes M12 to M36), nuts PC 8 (sizes M12 to M36) and hardened washers conforming to AS/NZS 1252 are acceptable as high strength Fastener assembly types under this Specification.

## Alternative Assembly Type (to EN 14399-3)

In accordance with AS/NZS 1252.1 Clause 1.5 “Alternative Assembly Type”, only assemblies comprising bolts PC 8.8, nuts PC 8 and hardened washers manufactured in accordance with EN14399-3, System HR, are acceptable under this Specification.

## Additional Assembly Type (to EN 14399-3)

In accordance with AS/NZS 1252.1 Clause 1.6 “Additional Assembly Type”, only assemblies comprising high strength bolts PC 10.9, high strength nuts PC 10 and associated hardened washers manufactured in accordance with EN14399-3, System HR, are acceptable under this Specification where shown on the drawings.

# Other Fasteners

This Clause sets out the requirements for carbon steel Fasteners, other than high strength structural Fasteners specified in Clause 5.

Unless stated otherwise, all references to Fasteners are to ISO metric Fasteners.

## Bolts and Nuts

The dimensions and associated tolerances (“product grade”), and material properties (“property class”), of bolts and nuts must conform to the standards stated in Table 6.3.

Table 6.3: Manufacturing and material standards for ISO metric bolts and nuts

|  |  |  |  |
| --- | --- | --- | --- |
| **Strength** | **Common name** | **Product grade/ manufacturing standard** | **Property class/material standard** |
| High  | ISO metric hexagon head bolts PC 8.8 | A or B | AS 1110.1 | 8.8 | AS 4291.1 |
| ISO metric hexagon head bolts PC 10.9 | A or B | AS 1110.1 | 10.9 | AS 4291.1 |
| ISO metric hexagon nuts PC 8 | A or B | AS 1112.1 | 8 | AS/NZS 4291.2 |
| ISO metric hexagon nuts PC 10 | A or B | AS 1112.1 | 10 | AS/NZS 4291.2 |
| ISO metric cup head bolts PC 8.8 (1) | – | AS/NZS 1390 (for dimensions only) | 8.8 | AS/NZS 4291.1 |
| Low  | ISO metric hexagon head bolts PC 4.6 | C | AS 1111.1 | 4.6 | AS 4291.1 |
| ISO metric hexagon nuts PC 5 | C | AS 1112.3 | 5 | AS/NZS 4291.2 |
| ISO metric cup head bolts PC 4.6 | – | AS/NZS 1390 | 4.6 | AS/NZS 4291.1 |
| ISO metric thin hexagon nuts PC 04 or PC 05 (2) | A or B | AS 1112.4 | 05 | AS/NZS 4291.2 |

1. AS/NZS 1390 covers cup head bolts to PC 4.6 only; however, the bolts can be manufactured to a higher property class (i.e. PC 8.8) as specified on the drawings for some applications.
2. Low strength thin nuts PC 04 or PC 05 are typically used as lock nuts with high or low tensile Fasteners.

For ISO metric bolts or other threaded components of a particular property class, use only steel nuts of the corresponding property class shown in Table 6.4.

Table 6.4: Corresponding property class of ISO metric nuts to bolts

|  |  |
| --- | --- |
| **Component** | **Property class** |
| Bolts, U-bolts, threaded rods, etc | 4.6 | 4.8 | 5.6 | 8.8 | 10.9 |
| Nuts | 5 | 5 | 5 | 8 | 10 |

## Screws

The dimensions and associated tolerances, and material properties, of steel screws must conform to the standards stated in Table 6.5.

Table 6.5: Manufacturing and material standards for ISO metric screws

|  |  |  |  |
| --- | --- | --- | --- |
| **Strength** | **Common name** | **Product grade/ manufacturing standard** | **Property class/ material standard** |
| High | ISO metric hexagon head screws PC 8.8 | A or B | AS 1110.2 | 8.8 | AS 4291.1 |
| ISO metric hexagon head screws PC 10.9 (1) | A or B | AS 1110.2 | 10.9 | AS 4291.1 |
| ISO metric hexagon socket head cap screws PC 10.9 | A | AS 1420 or DIN 912 | 10.9 | AS 4291.1 |
| ISO metric countersunk socket head screws PC 10.9 | – | ISO 10642 orBS 4168 | 10.9 | AS 4291.1or ISO 898-1 |
| ISO metric hexagon socket head cap screws PC 12.9 | A | AS 1420 or DIN 912 | 12.9 | AS 4291.1 |
| ISO metric countersunk socket head screws PC 12.9 (1) | – | ISO 10642 orBS 4168 | 12.9 | AS 4291.1or ISO 898-1 |
| Low | ISO metric hexagon head screws PC 4.6 | C | AS 1111.2 | 4.6 | AS 4291.1 |

1. Item may not be readily available in the Australian market

Self-drilling steel screws for fixing to steel must conform to AS 3566, with Class 4 protective coating.

## Fasteners in Imperial Units

Fasteners in imperial units comprising hexagon bolts, screws and nuts must conform to relevant standards, e.g. AS/NZS 2465.

## Washers

Unless shown otherwise on the drawings, all washers must be flat, round and normal size.

Hardened steel washers for use with Fasteners PC 8.8 or higher must conform to AS/NZS 1252.1. Washers conforming to EN 14399-6 are acceptable.

Steel washers for use with bolts PC 4.6, PC 4.8 or PC 5.6 must conform to AS 1237.1 and AS 1237.2.

Oversize and square washers must be manufactured to the dimensions and material properties specified on the drawings.

## Studbolts

ISO metric high strength steel studbolts must be PC 8.8 to AS 2528 or ASTM A193M. Associated nuts must be PC 8 to AS 2528 or ASTM A194M.

ISO metric low strength steel studbolts must be PC 4.6 to AS 2528. Associated nuts must be PC 5 to AS 2528.

High strength steel studbolts in Imperial units must be Grade B7 to AS 2528 or ASTM A193M. Associated nuts must be Grade 2H to AS 2528 or ASTM A194M.

Low strength steel studbolts in Imperial units must be Grade B8 to AS 2528. Associated nuts must be Grade 8 to AS 2528.

## Threaded Rods, Holding Down Bolts and Other Non-standard Fasteners

The pitch and dimensional tolerances of threaded rods and associated nuts must conform to AS 1275 or ISO 965. Their material property class must conform to AS 4291.1 and AS/NZS 4291.2, or ISO 898-1 and ISO 898-2, as specified on the drawings.

U-bolts, L-bolts and other non-standard Fasteners must conform to the dimensions, material properties and protective treatment shown on the drawings.

Low strength Fasteners (e.g. bolts and rods PC 4.6 and nuts PC 4) may be welded. Welding must conform to ATS 5310. Such Fasteners must not be manufactured from free-cutting steel as specified in AS 1443.

## Locking Devices

Locking devices must be a type approved by the Principal.

# Stainless Steel Fasteners

## Composition

Stainless steel Fasteners must be of austenitic AISI 316L to ASTM A240M or ASTM A666 (or equivalent) steel, with maximum carbon content of 0.03 % and minimum molybdenum content of 2%.

High strength stainless steel Fasteners must have a minimum ultimate tensile strength of 800 MPa.

The dimensions and associated tolerances of stainless steel Fasteners must conform to the standards stated in Table 7.3.

Table 7.3: Manufacturing requirements for stainless steel fasteners

|  |  |
| --- | --- |
| **Fastener** | **Manufacturing standard** |
| ISO metric hexagon head bolts | ISO 4014 or AS 1110.1 or DIN 931 |
| ISO metric hexagon head screws | ISO 4017 or AS 1110.2 |
| ISO metric hexagon socket head cap screws | ISO 4762 or AS 1420 |
| ISO metric hexagon nuts | ISO 4032 or AS 1112.1 |
| Washers | ISO 7089 or ISO 7090 for chamfered washers or DIN 125A (withdrawn) |
| ISO metric threaded rods | ISO 965 or AS 1275 |

# Protective Treatment for Fasteners

The protective treatment of Fasteners must conform to Table 8.1.

Table 8.1: Protective treatment of Fasteners

|  |  |  |
| --- | --- | --- |
| **Fastener type** | **Clause reference** | **Protective treatment** |
| High strength structural bolts PC 8.8, and associated nuts and washers | 5.1,5.2 | Hot-dip galvanizing (HDG) (1) |
| Low strength hexagon head bolts and screws PC 4.6, and associated nuts and washers | 6.3 |
| Threaded rods PC 4.6 or PC 8.8, and associated nuts and washers | 6.3, 6.16 |
| Holding down bolts and associated nuts and washers | 6.16,6.3 |
| Cup head bolts | 6.3 |
| High strength structural bolts PC 10.9, and associated nuts and washers | 5.3 | Mechanical plating with zinc (2), or HDG (1, 4) |
| High strength hexagon head bolts and screws PC 8.8 or PC 10.9 product grade A or B, and associated nuts and washers | 6.3 | PC 8.8: Mechanical plating with zinc (2), or electroplating with zinc (3),PC 10.9: Mechanical plating with zinc (2) |
| High strength hexagon socket head cap screws PC 10.9 or PC 12.9 | 6.5 | Residual coating of light oil |
| High strength countersunk socket head screws PC 10.9 or PC 12.9 | 6.5 |
| Self-drilling screws | 6.5 | Class 4 to AS 3566.2 (withdrawn) |
| Stainless steel Fasteners | 7 | No additional protective treatment |
| Locking devices | 6.19 | As approved by the Principal |

1. HDG must be in accordance with AS/NZS 1214 or equivalent.
2. Mechanical plating with zinc must be in accordance with ASTM B695-04 or equivalent.
3. Electroplating with zinc must be in accordance with AS 1897 or equivalent.
4. Hot-dip galvanised high strength structural bolts PC 10.9 may be used only if the assembly test to AS/NZS 1252 or the preloading suitability test to EN 14399-2 has been carried out and found to be conforming to the relevant standard, to avoid the risk of hydrogen embrittlement associated with the galvanising process.

## Thermal Diffusion Galvanising

If specified in the Contract documents, thermal diffusion galvanising (TDG) instead of HDG or zinc plating must be used. The specified TDG layer thickness must be achieved for the bolt assembly product grades and the thread dimension tolerances.

A trial assembly of Fastener components with the specified coatings, to verify that the components will fit properly, must be carried out.

During the trial assembly, the nuts must be able to run up and down the threaded length of the bolt using only force applied by fingers.

# Testing

## General

The Contractor must ensure that the Fasteners are tested in accordance with this Clause and provide evidence of that testing.

Testing of Fasteners in Imperial units must conform to the relevant material and manufacturing standard(s), e.g. AS/NZS 2465.

Where less than 50 Fasteners of one type are required in the Works and those Fasteners are used in a low risk environment, the Contractor may request the Principal to approve a waiver of the specified testing requirements for those Fasteners.

Tests must be carried out in laboratories accredited by NATA for the test, or in laboratories accredited for that test by an organisation with a Mutual Recognition Agreement with NATA.

The frequency of testing of Fasteners in Imperial units must conform to Annexure B for the equivalent ISO metric Fastener grade.

Testing must be carried out on finished Fasteners which are representative of those supplied.

## Mechanical Properties

Testing for mechanical properties must be carried out in accordance with Annexure B, which overrides the requirements of the manufacturing standards, including AS/NZS 1252.

Tensile tests instead of wedge tensile test must be carried out on bolts with nominal diameters larger than 39 mm.

The hardness tests may be carried out using either the Vickers or Rockwell scale. Test results that have been converted from one scale to the other must not be provided

The proof load test (refer Clause 4.4) is a destructive test. Discard all proof load tested specimens.

The minimum number of specimens to be tested from each Purchase Lot for each of the specified tests must be in accordance with Annexure B.

## Chemical Composition

Chemical composition testing must be carried out in accordance with the applicable standard.

One chemical composition test must be carried out for each Purchase Lot.

## Test Certificates

The Contractor must provide test certificates showing that Fasteners tested conform to the requirements of this Specification.

The test certificate for each Purchase Lot must include the following:

1. test certificate number and test date;
2. test description and applicable standard;
3. identification of test specimen and Purchase Lot;
4. description of test specimen and stage of manufacture at the time of testing;
5. protective treatment (if applicable) and lubrication condition
6. test result and acceptance criteria;
7. description of type and location of failure and the fracture surfaces, where applicable;
8. chemical composition of Purchase Lot;
9. name of and position of the person authorised the test report and dated signature; and
10. laboratory accreditation details.

## Testing by Principal

If requested by the Principal, the Contractor must supply additional Fasteners from each Purchase Lot to enable the Principal to undertake testing of those Fasteners.

## Nonconforming Purchase Lots

Where any test fails to meet the acceptance criteria, the Purchase Lot from which the sample specimen was taken must be discarded and replaced with a new Purchase Lot.

The replacement Purchase Lot must not be replaced from the same Manufacturing Lot as the rejected Lot.

# Traceability

Each supplied Fastener item must be traceable. Documentation and identification of Fastener items and their packaging must enable traceability of each item.

The lot identification number (and trace lot number, if any) must be recorded for each item within each Purchase Lot to enable identification of the source of each item and each production process used for its manufacture.

# Delivery and Storage

The following documentation must be provided prior to delivery:

1. Documents specified in Clause 4.
2. Details of supplier(s), the relevant lot identification number and trace lot number if any, and the Fastener description/designation.
3. Test certificates for the Purchase Lot(s) in accordance with Clause 9.14.
4. Supplier declaration of conformity (“SDoC”) of the Purchase Lot(s) to the standards specified in this Specification.

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| **HOLD POINT 2** |
| Process Held | Delivery of each consignment of Fasteners to Site |
| Submission Details | The documentation in Clause 11.1 must be provided at least 14 days prior to the delivery of the Fasteners to the Site  |

Fasteners must be delivered as assemblies and components of assemblies must not be interchanged.

Fasteners of the same Purchase Lot must be delivered in the same container or in containers with identical labels for large quantities.

Fasteners must be stored in a waterproof container clear of the ground and protected from damage.

Annexure A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points/Hold Points that apply to this Specification and the Records that the Contractor must submit to the Principal to demonstrate compliance with this Specification.

|  |  |  |  |
| --- | --- | --- | --- |
| **Clause** | **Hold point** | **Witness point** | **Record** |
| 4.3 | Commencement of supply of Fasteners |  | The documentation listed in Clause 4 |
| 11.1 | Delivery of each consignment of Fasteners to Site |  | Fastener delivery documentation listed in Clause 11.1 |

Annexure B: Testing of Mechanical Properties

## Required Tests

Table B.1: Mechanical testing requirements

| **Fastener type** | **Clause reference**  | **Tensile strength (1)** | **Proof load (1)** | **Other tests (1)** |
| --- | --- | --- | --- | --- |
| **Test method** | **Test plan** | **Test method** | **Test plan** | **Test method** | **Test plan** |
| High strength structural bolts | 5 | Wedge test to AS/NZS 1252.1, Clause 6.6 | B | AS/NZS 1252.1, Clause 6.6 | B | Assembly test to AS/NZS 1252.1 | B |
| Hardness test to AS/NZS 1252.1, Clause 2.4 |
| High strength structural nuts | 5 | NA |  | AS/NZS 1252.1, Clause 6.6 | B | Hardness test to AS/NZS 1252.1, Clause 3.4 | B |
| Structural washers (hardened) | 5 | NA |  | NA |  | Hardness test to AS/NZS 1252.1, Clause 6.6 | C |
| High strength bolts | 6 | Wedge test to AS 4291.1, Clause 9.1 | A | AS 4291.1, Clause 9.6 | A | Hardness test to AS 4291.1, Clause 9.9 | C |
| High strength nuts | 6 | NA |  | AS/NZS 4291.2, Clause 9.1 | A | Hardness test to AS/NZS 4291.2, Clause 9.2 | C |
| High strength screws other than socket head cap screws | 6 | Wedge test to AS 4291.1, Clause 9.1 | A | AS 4291.1, Clause 9.6 | A | Hardness test to AS 4291.1, Clause 9.9 | C |
| High strength socket head cap screws | 6 | AS 4291.1, Clause 9.4 | A | AS 4291.1, Clause 9.6 | A | Hardness test to AS 4291.1, Clause 9.9 | C |
| High strength studbolts or threaded rods | 6 | Wedge test to AS 2528, Clause 2.3.6.3 | A | AS 2528, Clause 2.3.6.2 | A | Hardness test to AS 2528, Clause 2.3.6.6 | C |
| Hardened washers | 6 | NA |  | NA |  | Vickers hardness test to AS 1817 or Rockwell hardness test to AS 1815 | B |
| Low strength bolts | 6 | AS 4291.1, Clause 9.2 (or wedge test to Clause 9.1) | B | AS 4291.1, Clause 9.6 | B | NA |  |
| Low strength screws | 6 | AS 4291.1, Clause 9.2 (or wedge test to Clause 9.1) | B | AS 4291.1, Clause 9.6 | B | NA |  |
| Low strength nuts | 6 | NA |  | AS/NZS 4291.2, Clause 9.1 | B | NA |  |
| Low strength studbolts or threaded rods | 6 | AS 4291.1, Clause 9.2 | B | AS 2528, Clause 2.3.6.2 | B | NA |  |
| Mild steel washers | 6 | NA |  | NA |  | Hardness test to AS 1237.1 | B |
| Stainless steel bolts | 7 | ISO 3506-1, Clause 7 | B | ISO 3506-1, Clause 7 | B | NA |  |
| Stainless steel screws | 7 | ISO 3506-1, Clause 7 | B | ISO 3506-1, Clause 7 | B | NA |  |
| Stainless steel nuts | 7 | NA |  | ISO 3506-2, Clause 7 | B | NA |  |
| Stainless steel studbolts or threaded rods | 7 | ISO 3506-1, Clause 7 | B | ISO 3506-1, Clause 7 | B | NA |  |
| Stainless steel washers | 7 | NA |  | NA |  | Vickers hardness test to AS 1817 or Rockwell hardness test to AS 1815 | B |
| Self-drilling screws | 6 | AS 3566.1, Clause 1.11 |  | NA |  | NA |  |

NA = Not applicable

1 Refer to Table B2 for details of minimum testing frequency for the respective Test Plans.

## Test Frequency

The test frequency must be determined as follows:

1. Identify the type of tests required and the associated Test Plan from Table B1.
2. Determine minimum number of specimens for each test from Table B2 for the Purchase Lot size according to the specified Test Plan.

Table B2: Testing frequency for test plans

|  |  |
| --- | --- |
| **Purchase lot size (1)** | **Minimum number of specimens** |
| **Test Plan A** | **Test Plan B** | **Test Plan C** |
|  50 | 2 | 1 | 1 |
| > 50 and  200 | 3 | 1 | 1 |
| > 200 and  1,000 | 5 | 2 | 1 |
| > 1,000 and  5,000 | 8 | 3 | 2 |
| > 5,000 and  10,000 | 12 | 3 | 2 |
| > 10,000 | 16 | 4 | 2 |

1. Refer to Clause 2 for “Purchase Lot size” definition.

Amendment Record

|  |  |  |  |
| --- | --- | --- | --- |
| Amendment no. | Clauses amended | Action | Date |
| - | New specification | New | June 2020 |
|  |  |  |  |

|  |  |
| --- | --- |
| **Key** |  |
| Format | Change in format |
| Substitution | Old clause removed and replaced with new clause |
| New | Insertion of new clause |
| Removed | Old clauses removed |