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**Mechanical properties of
non-ferrous metal fasteners**

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Descriptors : threaded components, fasteners, copper alloys, aluminium alloys, copper, strength of materials, mechanical behaviour of materials

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS B 1057 : 1994** is replaced with **JIS B 1057 : 2001**.

In this revision, this Standard has been subjected to the formal revision that the new specification is added to **JIS B 1181 : 1993** as Annex 2, following the revision of **JIS B 1052** on January 20, 1998 and the withdrawal of Annex 3 to **JIS B 1052** dated on December 31, 2000.

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Mechanical properties of non-ferrous metal fasteners

Introduction This Japanese Industrial Standard has been made based on **ISO 8839** *Mechanical properties of fasteners—Bolts, screws, studs and nuts made of non-ferrous metals* published in 1986 as the first edition, without changing the technical contents and adding some items not specified in the corresponding International Standard. The revision at this time has been made for the sake of formality as a result of the revision of **JIS B 1052** on January 20, 1998 and the withdrawal of Annex 3 (Nuts for property classes 4T to 12T) to **JIS B 1052** on December 31, 2000 followed by the development of a new standard as Annex 2 to **JIS B 1181**.

The parts covered by half tone dot mesh (■) in this Standard are the matters not specified in the corresponding International Standard.

1 Scope This Japanese Industrial Standard specifies the mechanical properties of bolts (including studs), machine screws and nuts made of non-ferrous metals such as copper, copper alloys and aluminium alloys and conforming to the requirements for application given in Table 1⁽¹⁾ and the test and inspection methods and the marking of them.

Note (1) The bolts, machine screws and nuts made of non-ferrous metals which apply in this Standard are referred to hereafter as “bolts, machine screws and nuts” and a generic term of them as “non-ferrous metal fasteners”.

Table 1 Requirements for application of non-ferrous metal fasteners

Items (to be) applied	Requirements for application
Type of threads	In accordance with JIS B 0205 .
Range of nominal thread diameter	M1.6 to M39.
Material	Copper, copper alloys and aluminium alloys

Remarks 1 The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 8839 : 1986 *Mechanical properties of fasteners—Bolts, screws, studs and nuts made of non-ferrous metals* (MOD)

2 This Standard which specifies the mechanical properties at ordinary temperature of the non-ferrous metal fasteners for general use does not apply to those with special property requirements such as corrosion resistance and electrical conductivity.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0101 *Screw threads and fasteners—Vocabulary*

JIS B 0205 *Metric coarse screw threads*

JIS B 1051 *Mechanical properties of fasteners made of carbon steel and alloy steel—Part 1 : Bolts, screws and studs*

Remarks : **ISO 898-1 : 1999** *Mechanical properties of fasteners made of carbon steel and alloy steel—Part 1 : Bolts, screws and studs* is identical with the said standard.

JIS B 1052 *Mechanical properties of steel nuts*

JIS B 1058 *Mechanical properties of fasteners—Part 7 : Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm*

Remarks : **ISO 898-7 : 1992** *Mechanical properties of fasteners—Part 7 : Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm* is identical with the said standard.

JIS Z 2201 *Test pieces for tensile test for metallic materials*

3 Definitions For the purposes of this Standard, the definitions given in **JIS B 0101** apply.

4 Expression of mechanical properties The mechanical properties of non-ferrous metal fasteners are expressed by the symbols for materials given in Table 2.

Table 2 Symbols for materials

Division of non-ferrous metals	Symbols for materials ⁽²⁾
Copper	CU1
Copper alloy	CU2
	CU3
	CU4
	CU5
	CU6
	CU7
Aluminium alloy	AL1
	AL2
	AL3
	AL4
	AL5
	AL6

Note ⁽²⁾ The symbols for materials indicate the division of non-ferrous metals and the level of mechanical properties of non-ferrous metal fasteners (see 5.1 and 5.2).

5 Mechanical properties

5.1 Mechanical properties of bolts and machine screws

5.1.1 Tensile strength, proof stress and elongation of bolts and machine screws The tensile strength, proof stress at permanent elongation 0.2 % and elongation after rupture of bolts and machine screws are set out in Table 3.

Table 3 Tensile strength, proof stress and elongation of bolts and machine screws

Symbols for materials	Nominal designation of threads	Mechanical properties		
		Tensile strength ⁽³⁾ N/mm ²	Proof stress ⁽⁴⁾ N/mm ²	Elongation ⁽⁵⁾ %
		Minimum	Minimum	Minimum
CU1	M1.6 or over up to and incl. M39	240	160	14
CU2	M1.6 or over up to and incl. M6	440	340	11
	Over M6 up to and incl. M39	370	250	19
CU3	M1.6 or over up to and incl. M6	440	340	11
	Over M6 up to and incl. M39	370	250	19
CU4	M1.6 or over up to and incl. M12	470	340	22
	Over M12 up to and incl. M39	400	200	33
CU5	M1.6 or over up to and incl. M30	590	540	12
CU6	Over M6 up to and incl. M39	440	180	18
CU7	Over M12 up to and incl. M39	640	270	15
AL1	M1.6 or over up to and incl. M10	270	230	3
	Over M10 up to and incl. M20	250	180	4
AL2	M1.6 or over up to and incl. M14	310	205	6
	Over M14 up to and incl. M36	280	200	6
AL3	M1.6 or over up to and incl. M6	320	250	7
	Over M6 up to and incl. M39	310	260	10
AL4	M1.6 or over up to and incl. M10	420	290	6
	Over M10 up to and incl. M39	380	260	10
AL5	M1.6 or over up to and incl. M39	460	380	7
AL6	M1.6 or over up to and incl. M39	510	440	7

Notes (3) Tensile strength applies to the tensile strength of the product obtained in accordance with 7.2.1 a).

(4) Proof stress applies to the proof stress at permanent elongation 0.2 % obtained in accordance with 7.2.1 b).

- (5) Elongation applies to the elongation after rupture obtained in accordance with 7.2.1 b).

Remarks 1 The mechanical properties given in this Table apply to those included in the above categories of "nominal designation of threads" and in the case of those out of the nominal designations, the mechanical properties shall be agreed between the parties concerned, when required.

- 2 In the case of the metal fasteners of high plastic working to which this Table is difficult to apply, the mechanical properties shall be agreed between the parties concerned.

5.1.2 Torsional strength of bolts and machine screws Table 4 lists the minimum breaking torque in the torsional strength test of the bolts and machine screws of the nominal designations M1.6 to M5.

Table 4 Minimum breaking torque of bolts and machine screws

Nominal designation of threads	Symbols for materials										
	CU1	CU2	CU3	CU4	CU5	AL1	AL2	AL3	AL4	AL5	AL6
	Minimum breaking torque ⁽⁶⁾										
M1.6	0.06	0.10	0.10	0.11	0.14	0.06	0.07	0.08	0.10	0.11	0.12
M2	0.12	0.21	0.21	0.23	0.28	0.13	0.15	0.16	0.20	0.22	0.25
M2.5	0.24	0.45	0.46	0.5	0.6	0.27	0.3	0.3	0.43	0.47	0.5
M3	0.4	0.8	0.8	0.9	1.1	0.5	0.6	0.6	0.8	0.8	0.9
M3.5	0.7	1.3	1.3	1.4	1.7	0.8	0.9	0.9	1.2	1.3	1.5
M4	1.0	1.9	1.9	2.0	2.5	1.1	1.3	1.4	1.8	1.9	2.2
M5	2.1	3.8	3.8	4.1	5.1	2.4	2.7	2.8	3.7	4.0	4.5

Note (6) It applies to the torsional strength of the product obtained in accordance with 7.2.2.

The symbols of materials of CU6 and CU7 are applied to those for exceeding M5 and, therefore, their torsional strengths are not specified herein.

5.1.3 Other mechanical properties In the case of non-ferrous metal bolts and machine screws other than those specified in 5.1.1 and 5.1.2, the mechanical properties, if required, should be agreed between the parties concerned.

5.2 Mechanical properties of nuts

5.2.1 Proof load stress of nuts The proof load stress of nuts is in accordance with the values of the tensile strength (minimum) given in Table 3.

Besides, the nuts shall endure, when tested in accordance with 7.2.3, the proof load (see Attached Table 1) without rupture or shearing of thread ridge. After unloaded, the nuts shall be able to be taken away from the mandrel by hand.