

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 1054-4 : 2013

(ISO 3506-4 : 2009)

(JFRI/JSA)

**Mechanical properties of corrosion-resistant stainless steel fasteners—
Part 4: Tapping screws**

ICS 21.060.10

Reference number : **JIS B 1054-4 : 2013 (E)**

PROTECTED BY COPYRIGHT

Date of Establishment: 2006-03-25

Date of Revision: 2013-05-20

Date of Public Notice in Official Gazette: 2013-05-20

Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Machine Elements

JIS B 1054-4:2013, First English edition published in 2013-09

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

PROTECTED BY COPYRIGHT

Contents

	Page
Introduction.....	1
1 Scope.....	1
2 Normative references	2
3 Designation, marking and finish	2
3.1 Designation.....	2
3.2 Marking.....	3
3.3 Finish	4
4 Chemical composition	4
5 Mechanical properties.....	5
5.1 General.....	5
5.2 Surface hardness	5
5.3 Core hardness	6
5.4 Torsional strength	6
5.5 Thread forming capability.....	6
6 Test methods.....	6
6.1 Surface hardness test	6
6.2 Core hardness test	6
6.3 Torsional strength test	7
6.4 Drive test	8
Annex A (informative) Description of the groups and grades of stainless steels.....	10
Annex B (informative) Stainless steels for cold heading and extruding (Extract from ISO 4954:1993).....	13
Annex C (informative) Austenitic stainless steels with particular resistance to chloride induced stress corrosion (Extract from EN 10088-1:2005)	15
Annex D (informative) Time-temperature diagram of intergranular corrosion in austenitic stainless steels, grade A2 (18/8 steels)	16
Annex E (informative) Magnetic properties for austenitic stainless steels	17
Annex JA (informative) Stainless steel grades and chemical composition (comparison table between JIS and ISO Standards)	18

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 as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Research Institute for Screw Threads and Fasteners (JFRI)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently, **JIS B 1054-4:2006** is replaced with this Standard.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or a utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or the utility model rights.

JIS B 1054 series consists of the following 4 parts under the general title “*Mechanical properties of corrosion-resistant stainless steel fasteners*”:

Part 1: Bolts, screws and studs

Part 2: Nuts

Part 3: Set screws and similar fasteners not under tensile stress

Part 4: Tapping screws

Mechanical properties of corrosion-resistant stainless steel fasteners— Part 4: Tapping screws

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 3506-4** published in 2009 without any modifications of the technical contents.

Annex JA in this Standard is not contained in the corresponding International Standard.

1 Scope

This Standard specifies the mechanical properties of tapping screws made of austenitic, martensitic and ferritic steel grades of corrosion-resistant stainless steels, when tested over an ambient temperature range of 10 °C to 35 °C. Properties vary at higher or lower temperatures.

It applies to tapping screws with threads from ST2.2 up to and including ST8, in accordance with **JIS B 1007**.

It does not apply to screws with special properties, such as weldability.

NOTE : The designation system of this Standard can be used for sizes outside the limits given in this clause (e.g. $d > \text{ST8}$), provided that all applicable mechanical and physical requirements of the hardness classes are met.

This Standard does not define corrosion or oxidation resistance in particular environments. However, some information on materials for particular environments is given in Annex C. Regarding definitions of corrosion and corrosion resistance, see **ISO 8044**.

The aim of this Standard is the classification of corrosion-resistant stainless steel tapping screws into hardness classes.

Corrosion and oxidation performances and mechanical properties for use at elevated or sub-zero temperatures can be agreed on between the user and the manufacturer in each particular case. Annex D shows how the risk of intergranular corrosion at elevated temperatures depends on the carbon content.

All austenitic stainless steel fasteners are normally non-magnetic in the annealed condition; after cold working, some magnetic properties can be evident (see Annex E).

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 3506-4:2009 *Mechanical properties of corrosion-resistant stainless steel fasteners—Part 4: Tapping screws* (IDT)

The 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 21-1**.

2 Normative references

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

JIS B 1007 *Tapping screws thread*

NOTE : Corresponding International Standard: ISO 1478:1999 *Tapping screws thread* (MOD)

JIS B 1047 *Passivation of corrosion-resistant stainless-steel fasteners*

NOTE : Corresponding International Standard: ISO 16048:2003 *Passivation of corrosion-resistant stainless-steel fasteners* (IDT)

JIS B 1092 *Fasteners—Quality assurance system*

NOTE : Corresponding International Standard: ISO 16426:2002 *Fasteners—Quality assurance system* (IDT)

JIS G 0573 *Method of 65 per cent nitric acid test for stainless steels*

NOTE : Corresponding International Standard: ISO 3651-1:1998 *Determination of resistance to intergranular corrosion of stainless steels—Part 1: Austenitic and ferritic-austenitic (duplex) stainless steels—Corrosion test in nitric acid medium by measurement of loss in mass (Huey test)* (MOD)

JIS G 0575 *Method of copper sulfate-sulfuric acid test for stainless steels*

NOTE : Corresponding International Standard: ISO 3651-2:1998 *Determination of resistance to intergranular corrosion of stainless steels—Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels—Corrosion test in media containing sulfuric acid* (MOD)

JIS Z 2244 *Vickers hardness test—Test method*

NOTE : Corresponding International Standard: ISO 6507-1:2005 *Metallic materials—Vickers hardness test—Part 1: Test method* (MOD)

3 Designation, marking and finish

3.1 Designation

The designation system for stainless steel grades and hardness classes for tapping screws is given in figure 1. The designation of the material consists of two blocks, which are separated by a hyphen. The first block designates the steel grade and the second block, the hardness class.

The designation of the steel grade (first block) consists of one of the letters

- A: austenitic stainless steel
- C: martensitic stainless steel
- F: ferritic stainless steel

which indicates the group of steel and a digit, which indicates a range of chemical compositions within this steel group (see table 2).

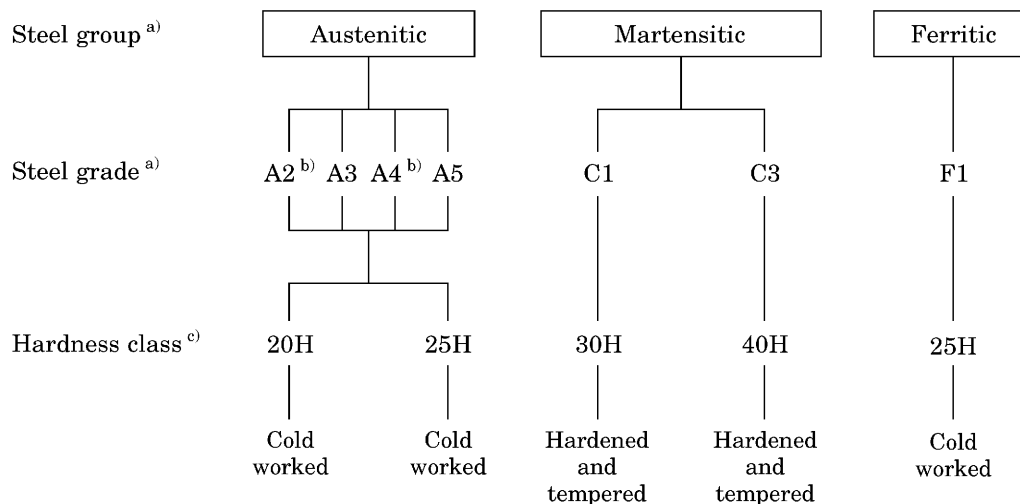
The designation of the hardness class (second block) consists of two digits representing 1/10 of the minimum Vickers hardness and the letter H, referring to hardness (see table 1).

Table 1 Designations of hardness classes in relation to Vickers hardness

Hardness class	20H	25H	30H	40H
Vickers hardness, HV min.	200	250	300	400

Example 1 A4-25H indicates: austenitic stainless steel of steel grade A4, cold worked, minimum hardness 250 HV.

Example 2 C3-40H indicates: martensitic stainless steel of steel grade C3, hardened and tempered, minimum hardness 400 HV.



Notes ^{a)} The steel groups and steel grades classified in figure 1 are described in Annex A and specified by the chemical composition given in table 2.

^{b)} Low-carbon austenitic stainless steels with carbon content not exceeding 0.03 % may additionally be marked with an "L".

Example: A4L-25H

^{c)} Tapping screws passivated in accordance with **JIS B 1047** may additionally be marked with a "P".

Example: A4-25HP

Figure 1 Designation system for stainless steel grades and hardness classes for tapping screws

3.2 Marking

3.2.1 General

Marking of tapping screws is not mandatory.

When tapping screws manufactured according to the requirements of this Standard are designated and marked, they shall be designated in accordance with the designation system described in 3.1 and marked in accordance with 3.2.2 and 3.2.3. However,

the designation system described in **3.1** and the provisions for marking according to **3.2.3** shall be used only if all relevant requirements of this Standard are met.

3.2.2 Manufacturer's identification mark

A manufacturer's identification mark shall be included during the manufacturing process on all tapping screws which are marked with a hardness class symbol, provided this is possible for technical reasons. Manufacturer's identification marking is also recommended on tapping screws which are not marked with a hardness class symbol.

3.2.3 Tapping screws

When tapping screws are marked, they shall be clearly marked in accordance with **3.1**. The marking should include the steel grade and hardness class.

3.2.4 Packages

All packages for all types of tapping screws of all sizes shall be marked (e.g. through labelling). The marking shall include the manufacturer's and/or distributor's identification and the marking symbol for the steel grade and hardness class according to figure 1 and the manufacturing lot number, as defined in **JIS B 1092**.

3.3 Finish

Unless otherwise specified, tapping screws in accordance with this Standard shall be supplied clean and bright. For maximum corrosion resistance, passivation is recommended. When passivation is required, it shall be performed in accordance with **JIS B 1047**. Tapping screws that are passivated may additionally be marked with the symbol "P" after the symbols for steel grade and hardness class [see Note ^{c)} of figure 1].

For tapping screws manufactured to a specific order, the additional marking should be applied to both the fastener and the label. For tapping screws delivered from stock, the additional marking should be applied to the label.

4 Chemical composition

The chemical compositions of stainless steels suitable for tapping screws in accordance with this Standard are given in table 2.

NOTE : The chemical compositions given in table 2 correspond with the chemical compositions given in **JIS B 1054-1**, table 1, for the relevant steel grades.

The final choice of the chemical composition within the specified steel grade is at the discretion of the manufacturer, otherwise by prior agreement between the purchaser and the manufacturer.

In applications where risk of intergranular corrosion is present, testing in accordance with **JIS G 0573** or **JIS B 0575** is recommended. In such cases, stabilized stainless steels of grades A3 and A5 or stainless steels of grades A2 and A4 with carbon content not exceeding 0.03 % are recommended.

Table 2 Stainless steel grades—Chemical composition

Steel group	Steel grade	Chemical composition ^{a)} mass fraction, %								
		C	Si	Mn	P	S	Cr	Mo	Ni	Cu
Austenitic	A2 ^{c) d)}	0.10	1	2	0.05	0.03	15 to 20	— ^{b)}	8 to 19	4
	A3 ^{e)}	0.08	1	2	0.045	0.03	17 to 19	— ^{b)}	9 to 12	1
	A4 ^{d) f)}	0.08	1	2	0.045	0.03	16 to 18.5	2 to 3	10 to 15	4
	A5 ^{e) f)}	0.08	1	2	0.045	0.03	16 to 18.5	2 to 3	10.5 to 14	1
Martensitic	C1 ^{f)}	0.09 to 0.15	1	1	0.05	0.03	11.5 to 14	—	1	—
	C3	0.17 to 0.25	1	1	0.04	0.03	16 to 18	—	1.5 to 2.5	—
Ferritic	F1 ^{h) i)}	0.12	1	1	0.04	0.03	15 to 18	— ^{g)}	1	—
NOTE 1 A description of the groups and grades of stainless steels also entering into their specific properties and applications is given in Annex A. NOTE 2 Examples of stainless steels standardized in accordance with ISO 4954 are given in Annex B. NOTE 3 Certain materials for specific application are given in Annex C. Notes ^{a)} Values are maximum, unless otherwise indicated. ^{b)} Molybdenum (Mo) may be present at the discretion of the manufacturer. However, if for some applications limiting of the molybdenum content is essential, this shall be stated at the time of ordering by the purchaser. ^{c)} If the chromium (Cr) content is below 17 %, the minimum nickel (Ni) content should be 12 %. ^{d)} For austenitic stainless steels having a maximum carbon (C) content of 0.03 %, nitrogen (N) may be present to a maximum of 0.22 %. ^{e)} This shall contain titanium (Ti) $\geq 5 \times C$ up to 0.8 % maximum for stabilization and be marked appropriately as specified in this table, or shall contain niobium (Nb) and/or tantalum (Ta) $\geq 10 \times C$ up to 1.0 % maximum for stabilization and be marked appropriately as specified in this table. ^{f)} At the discretion of the manufacturer, the carbon content may be higher where required in order to obtain the specified mechanical properties at larger diameters, but shall not exceed 0.12 % for austenitic steels. ^{g)} Molybdenum (Mo) may be present at the discretion of the manufacturer. ^{h)} This may contain titanium (Ti) $\geq 5 \times C$ up to 0.8 % maximum. ⁱ⁾ This may contain niobium (Nb) and/or tantalum (Ta) $\geq 10 \times C$ up to 1 % maximum.										

5 Mechanical properties

5.1 General

For acceptance purposes, the mechanical properties and performance characteristics specified in **5.2** to **5.5** apply and shall be tested in accordance with **6.1** to **6.4**.

5.2 Surface hardness

Screws of martensitic steel grades shall conform to the surface hardness requirements given in table 3 when tested in accordance with **6.1**.