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Fasteners—Electroplated coatings

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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, as the result of proposal for revision of Japanese Industrial Standard submitted by the Japan Research Institute for Screw Threads and Fasteners (JFRI)/the Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law. Consequently **JIS B 1044 : 1993** is replaced with this Standard.

This revision has been made based on **ISO 4042 : 1999 Fasteners—Electroplated coatings** for the purposes of making easy to compare this Standard with International Standards, to prepare Japanese Industrial Standard conforming with International Standard, and to propose a draft of International Standard which is based on Japanese Industrial Standard.

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

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Fasteners—Electroplated coatings

Introduction This Japanese Industrial Standard has been prepared based on the second edition of **ISO 4042 Fasteners—Electroplated coatings** published in 1999 without modifying the technical contents.

1 Scope This Standard specifies dimensional requirements for electroplated fasteners of steel or copper alloy. It specifies coating thicknesses and gives recommendations for hydrogen embrittlement relief for fasteners with high tensile strength or hardness and for surface-hardened fasteners.

This Standard primarily concerns the electroplating of threaded fasteners, but it may also be applied to other threaded parts. For the applicability to screws that cut or form their own mating threads, see clause 8.

The specifications given in this Standard may also be applied to non-threaded parts such as washers and pins.

Remarks : 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 4042 : 1999 *Fasteners—Electroplated coatings* (IDT)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of coming into effect is given to these referred standards, only the edition of indicated year constitutes the provisions of this Standard but the revision and amendment made thereafter are not applied. The normative references without the indication of the year of coming into effect apply limiting only to the most recent editions (including amendments).

JIS B 0209-1 *ISO general purpose metric screw threads—Tolerances—Part 1 : Principles and basic data*

Remarks : **ISO 965-1 : 1998** *ISO general-purpose metric screw threads—Tolerances—Part 1 : Principles and basic data* is identical with the said standard.

JIS B 0209-2 *ISO general purpose metric screw threads—Tolerances—Part 2 : Limits of sizes for general purpose external and internal screw threads—Medium quality*

Remarks : **ISO 965-2 : 1998** *ISO general purpose metric screw threads—Tolerances—Part 2 : Limits of sizes for general purpose external and internal screw threads—Medium quality* is identical with the said standard.

JIS B 0209-3 *ISO general purpose metric screw threads—Tolerances—Part 3 : Deviations for constructional screw threads*

Remarks : **ISO 965-3 : 1998** *ISO general purpose metric screw threads—Tolerances—Part 3 : Deviations for constructional screw threads* is identical with the said standard.

JIS B 0251 *Limit gauges for metric screw threads*

Remarks : Items cited from **ISO 1502 : 1996** *ISO general-purpose metric screw threads—Gauges and gauging* are equivalent to the corresponding matters of the said standard.

JIS B 1045 *Fasteners—Preloading test for the detection of hydrogen embrittlement—Parallel bearing surface method*

Remarks : **ISO 15330 : 1999** *Fasteners—Preloading test for the detection of hydrogen embrittlement—Parallel bearing surface method* is identical with the said standard.

JIS B 1091 *Fasteners—Acceptance inspection*

Remarks : **ISO 3269 : 1989** *Fasteners—Acceptance inspection* is identical with the said standard.

ISO 1456 : 1988 *Metallic coatings—Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium***ISO 1458 : 1988** *Metallic coatings—Electrodeposited coatings of nickel***ISO 2064 : 1996** *Metallic and other inorganic coatings—Definitions and conventions concerning the measurement of thickness***ISO 2081 : 1986** *Metallic coatings—Electroplated coatings of zinc on iron or steel***ISO 2082 : 1986** *Metallic coatings—Electroplated coatings of cadmium on iron or steel***ISO 4520 : 1981** *Chromate conversion coatings on electroplated zinc and cadmium coatings***ISO 9227 : 1990** *Corrosion tests in artificial atmospheres—Salt spray tests***ISO 9587 : 1999** *Metallic and other inorganic coatings—Pretreatments of iron or steel for reduce the risk of hydrogen embrittlement*

3 Terms and definitions For the purposes of this Standard, the definitions given in **ISO 2064** (in particular, the definitions of significant surface, measuring area, local thickness and minimum local thickness) and **JIS B 1091** together with the following, apply.

3.1 batch quantity of identical fasteners from the same manufacturing lot processed together at one time.

3.2 production run those batches of parts processed continuously without any changes in coating techniques or constituents.

3.3 batch average thickness calculated average thickness of a coating if it was uniformly distributed over the surface of the parts of the batch.

3.4 baking process of heating parts for a definite time at a given temperature in order to minimize the risk of hydrogen embrittlement.

3.5 baking duration time at which the parts are held at the specified temperature which they shall have completely reached.

4 Dimensional requirements and gauging

4.1 Dimensional requirements before electroplating Before coating, parts shall comply with the relevant standards if applicable or other standards as specified, except where threads or other features are specifically manufactured to allow, for functional reasons, the application of thicker coatings than are possible on normal threads.

Coating thicknesses which can be applied on **ISO** metric threads in accordance with **JIS B 0209-1**, **JIS B 0209-2** and **JIS B 0209-3** depend on the fundamental deviation available, which itself depends on the screw thread and the following tolerance positions:

- g, f, e for external threads;
- G for internal threads or H if required.

The tolerance positions apply prior to application of the electroplated coating.

4.2 Dimensional requirements after electroplating After coating, **ISO** metric screw threads shall be gauged in accordance with **JIS B 0251** with a GO gauge of tolerance position h for external threads and H for internal threads.

Other product dimensions apply only before coating.

Note: Care should be exercised where relatively thick coatings may affect dimensions with small tolerances as in the case of internal drives; in these cases an agreement should be made between the supplier and the purchaser.

The applicability of the recommended coatings to **ISO** metric threads is limited by the fundamental deviation of the threads concerned and hence, by the pitch and tolerance positions. The coating shall not cause the zero line (basic size) to be exceeded in the case of external threads, nor shall it fall below this line in the case of internal threads. This means that for an internal thread of tolerance position H, a measurable coating thickness can only be applied to the threads if the tolerance zero is not taken up to the zero line (basic size).

5 Other coating requirements The electroplated coating shall comply with the provisions of the relevant International Standards (**ISO 1456**, **ISO 1458**, **ISO 2081**, **ISO 2082**) for the coating concerned in respect of appearance, adhesion, ductility, corrosion resistance, etc.

6 Hydrogen embrittlement relief

In cases of parts

- with high tensile strength or hardness or which have been surface hardened,
- which have absorbed hydrogen and
- are under tensile stress

there is the risk of failure due to hydrogen embrittlement.

When the core or surface hardness is above 320 HV, process investigation shall be conducted using a test to detect hydrogen embrittlement, for example the "Parallel bearing surface method" in accordance with **JIS B 1045**, to be sure that the process with regard to embrittlement is under control. If embrittlement is discovered, modification of the manufacturing process will be necessary, such as the inclusion of a baking process (see informative annex A for more information).

For fasteners of hardness in excess of 365 HV, a written agreement should exist between the customer and manufacturer to define how to manage the risk. If written agreement does not exist, the manufacturer shall process the parts in accordance with his recommended practices to reduce the risk of hydrogen embrittlement.

Complete elimination of hydrogen embrittlement cannot be assured. If a reduced probability of encountering hydrogen embrittlement is desired, alternative procedures should be evaluated.

Note : Investigations are proceeding to develop methods for the reduction of hydrogen embrittlement.

7 Corrosion protection The corrosion protection of an electroplated coating depends to a considerable extent on its thickness. In addition to greater coating thickness, a chromate conversion treatment can be specified for increased corrosion protection on zinc and cadmium coatings.

Contact with other metals and materials, the frequency and duration of wetting and service temperatures may influence the protective performance of coatings and expert advice is essential when uncertainties of choice arise.

Coatings of Zn and Cd applied to ferrous substrates are less electropositive than the steel base metal and consequently provide cathodic protection. In contrast, Ni and Cr coatings are more electropositive than the steel base metal and may intensify part corrosion where the coating is damaged or pitted.

Cadmium coatings are dealt with in **ISO 2082**.

Zinc coatings are dealt with in **ISO 2081**.

Nickel coatings are dealt with in **ISO 1458**.

Nickel + chromium and copper + nickel + chromium coatings are dealt with in **ISO 1456**.

Chromate conversion treatments are dealt with in **ISO 4520**.

Note : Information on salt spray corrosion protection performance of metallic coatings is given in informative annex B.

8 Applicability to fasteners that cut or form their own mating threads All recommended coatings may be applied to screws that cut or form their own mating threads such as wood screws, self tapping screws, self drilling screws and thread forming screws. The maximum value for batch average thickness given in Table 1 may be ignored unless otherwise specified.

9 Specification of coating thickness The local and batch average thicknesses corresponding to the nominal coating thicknesses recommended in the relevant standards for electroplating are given in Table 1.

In order to reduce the risk of interference on assembly of threads with electroplated coatings, the coating thickness shall not exceed one-quarter of the fundamental deviation of the thread. These values are specified in Table 2.

Note : For accommodation of thick coatings guidance is given in informative annex C.

The effective coating thicknesses measured according to one of the methods specified in clause 10 shall comply with the values specified in Table 1.

Table 1 Coating thicknesses

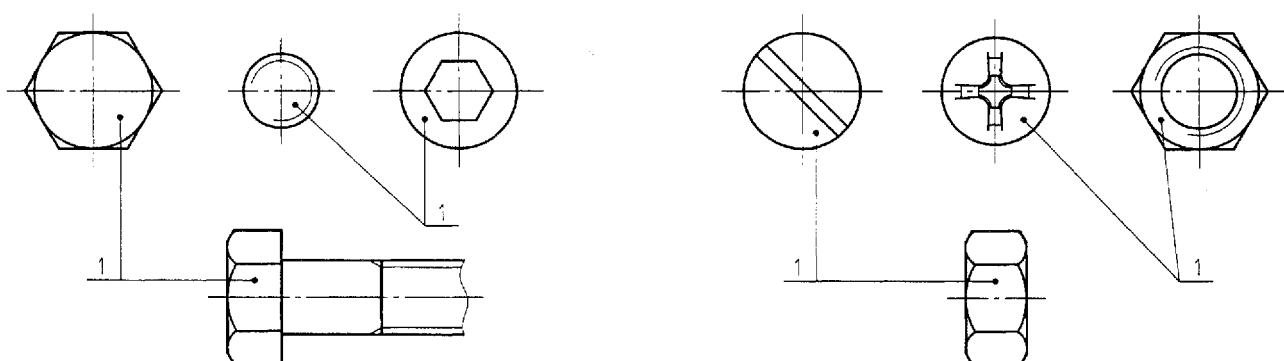
Thicknesses in micrometres

Nominal coating thickness	Effective coating thickness		
	Local ⁽¹⁾	Batch average ⁽²⁾	
	min.	min.	max.
3	3	3	5
5	5	4	6
8	8	7	10
10	10	9	12
12	12	11	15
15	15	14	18
20	20	18	23
25	25	23	28
30	30	27	35
(1) For measuring local thickness see 10.1.			
(2) For measuring batch average thickness see 10.2.			

In the case of batch average thickness measurement and if the threaded parts have nominal lengths $l > 5d$, smaller nominal thicknesses than those specified in Table 1 shall be applied, see Table 2.

10 Measurement of coating thickness

10.1 Local thickness The local thickness shall be not less than the minimum thickness specified in the order, and shall be measured using one of the methods specified in the standard for the coating being applied. Thicknesses on bolts, screws and nuts shall only be measured on the test surfaces shown in Figure 1.



Key

1 Measurement area

Figure 1 Measuring area for local coating thickness measurement on fasteners