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**Steel bolts and nuts for fish-plates
and fastenings**

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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 Japan Railway Civil Engineering Association (JRCEA)/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 E 1107**:1998 is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Steel bolts and nuts for fish-plates and fastenings

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 6305-4** published in 1985 with some modifications of the technical contents intended to adapt the requirements to the actual trading in Japan.

The portions with continuous sidelines and dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with explanations is given in Annex JC (informative).

1 Scope

This Standard specifies the fish-plate bolts and nuts used for **JIS E 1102** and fastening bolts and nuts used for **JIS E 1110** (hereafter referred to as “bolts and nuts”). In the case of using Whitworth screw threads, bolts and nuts shall be in accordance with Annex JA.

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

ISO 6305-4:1985 *Railway components—Technical delivery requirements—Part 4: Untreated steel nuts and bolts and high-strength nuts and bolts for fish-plates and fastenings* (MOD)

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

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For the standards with the indication of the year, only the edition of the indicated year shall be applied and not any revisions (including amendments) made thereafter. For those without, the most recent edition (including amendments) shall be applied.

- | | |
|-------------------|--|
| JIS B 0205-4 | <i>ISO general purpose metric screw threads—Part 4: Basic dimensions</i> |
| JIS B 0209-3:2001 | <i>ISO general purpose metric screw threads—Tolerances—Part 3: Deviations for constructional screw threads</i> |
| JIS B 0251 | <i>Limit gauges for metric screw threads</i> |
| JIS B 1041 | <i>Fasteners—Surface discontinuities—Part 1: Bolts, screws and studs for general requirements</i> |
| JIS B 1042 | <i>Fasteners—Surface discontinuities—Part 2: Nuts</i> |
| JIS B 1051:2000 | <i>Mechanical properties of fasteners made of carbon steel and alloy steel—Part 1: Bolts, screws and studs</i> |
| JIS B 1052:1998 | <i>Mechanical properties of steel nuts</i> |

JIS B 1180:2004	<i>Hexagon head bolts and hexagon head screws</i>
JIS B 1181:2004	<i>Hexagon nuts and hexagon thin nuts</i>
JIS B 7420	<i>Plain limit gauges</i>
JIS E 1102	<i>Fish plates for rails</i>
JIS E 1110	<i>Carbon steel tie-plates</i>
JIS G 0404:2005	<i>Steel and steel products—General technical delivery requirements</i>
JIS G 3101:2004	<i>Rolled steels for general structure</i>
JIS Z 2201	<i>Test pieces for tensile test for metallic materials</i>
JIS Z 2241	<i>Method of tensile test for metallic materials</i>
JIS Z 2244	<i>Vickers hardness test—Test method</i>
JIS Z 2245	<i>Rockwell hardness test—Test method</i>
JIS Z 8101-2:1999	<i>Statistics—Vocabulary and symbols Part 2: Statistical quality control terms</i>
JIS Z 9015-1	<i>Sampling procedures for inspection by attributes—Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection</i>

3 Terms and definitions

For the purpose of this Standard, the terms and definitions in **JIS Z 8101-2** and the following apply.

3.1 Whitworth screw threads

triangular thread with thread angle 55°, whose diameter is expressed in inch and pitch of thread in numbers of threads in 25.4 mm

4 Manufacturing methods and other matters

4.1 Steelmaking process of materials for bolts and nuts

Steelmaking process of materials for bolts and nuts shall be as follows:

- The steelmaking process is the prerogative of the manufacturer. However, at the request of the purchaser, the manufacturer shall indicate in his offer the nature and main characteristics of the steelmaking process; he may not amend these without the purchaser's consent.
- In addition to the blooms from ingots, those obtained from continuous casting may also be used.

4.2 Manufacture of bolts and nuts

Manufacture of bolts and nuts shall be as follows.

- The bolts shall be made from one single piece without welding.
- The heads of the bolts shall be produced by hot forging or cold heading. Among them, however, those of types A50, B40N, B50, B50N and B60 shall be subjected to hot forging.

- c) The nuts shall be hot forged or cold headed.
- d) The screw threads of the bolts and nuts shall be formed by rolling or machining.
- e) The bolts and nuts shall be classified as either Class A or Class B, depending on whether they have been heat treated or not.
 - 1) Class A Not heat treated.
 - 2) Class B Quenched and tempered.
- f) While the method of heat treatment of the bolts and nuts is left to the discretion of the manufacturer, if requested by the purchaser, the manufacturer shall indicate the heat treatment conditions; he may not amend them without informing the purchaser of this.
- g) Throughout the manufacturing process, the steel manufacturer and processor shall apply the best available practices so that the bolts comply with the requirements of this Standard.

4.3 Property class, classification and symbols, shape and dimensions, and thread form of bolts and nuts

4.3.1 Property class of bolts and nuts

The property class of bolts and nuts shall be as specified in **JIS B 1051** and **JIS B 1052**, respectively. The most typical combination of the bolts and nuts are shown in table 1.

Table 1 Combination of bolts and nuts according to property class

Classification	Property class			
Bolts	4.6	5.6	8.8	10.9
Nuts	4	5	5	10

4.3.2 Classification and symbols of bolts and nuts

The bolts and nuts are classified and symbolized according to the usage as given in table 2.

4.3.3 Shape and dimensions of bolts and nuts

The shape and dimensions of bolts and nuts shall be as given in table 2.

4.3.4 Thread form

The thread forms shall be those of metric screw threads with nominal diameter 18 and pitch 2.5, nominal diameter 20 and pitch 2.5, and nominal diameter 24 and pitch 3.0, all of which are specified in **JIS B 0205-4**.

Table 2 Classification, symbol, use, shape and dimensions and property class of bolts and nuts

Classification				Symbol	Use	Figures and tables of shape and dimensions	Property class
For fish-plates	Class A	Bolts	For 30 kg rails	A30	Untreated fish-plate	Figure 1 a), table 5	5.6
			For 37 kg rails	A37	Untreated fish-plate	Figure 1 a), table 5	
			For 50 kg rails	A50	Untreated fish-plate	Figure 1 b), table 5	
		Nuts	For 30 kg rails	A30–M18N	Untreated fish-plate	Figure 3, table 7	5
			For 37 kg rails	A37–M18N	Untreated fish-plate	Figure 3, table 7	
			For 50 kg rails	A50–M24N	Untreated fish-plate	Figure 3, table 7	
	Class B	Bolts	For 30 kg rails	B30	Heat-treated fish plate	Figure 1 a), table 5	8.8
			For 37 kg rails	B37	Heat-treated fish plate	Figure 1 a), table 5	
			For 40 kgN rails	B40N	Untreated fish plate and heat-treated fish plate	Figure 1 b), table 5	10.9
			For 50 kg rails	B50	Heat-treated fish plate	Figure 1 b), table 5	8.8
			For 50 kgN rails	B50N	Untreated fish plate and heat-treated fish plate	Figure 1 b), table 5	10.9
			For 60 kg rails	B60	Heat-treated fish plate	Figure 1 b), table 5	
		Nuts	For 30 kg rails	B30–M18N	Heat-treated fish plate	Figure 3, table 7	10
			For 37 kg rails	B37–M18N	Heat-treated fish plate	Figure 3, table 7	
			For 40 kgN rails	B40N–M20N	Untreated fish plate and heat-treated fish plate	Figure 3, table 7	
			For 50 kg rails	B50–M24N	Heat-treated fish plate	Figure 3, table 7	
			For 50 kgN rails	B50N–M20N	Untreated fish plate and heat-treated fish plate	Figure 3, table 7	
			For 60 kg rails	B60–M20N	Heat-treated fish plate	Figure 3, table 7	

Table 2 (concluded)

Classification				Symbol	Use	Figures and tables of shape and dimensions	Property class
For rail fastening	Class A	Bolts	Type F tie-plate for 50 kg and 50 kgN rails general	F50	Type F tie-plate	Figure 2, table 6	4.6
			Type F tie-plate for 50 kg rail joint	F50J	Type F tie-plate	Figure 2, table 6	
			Type F tie-plate for 50 kg rail joint N	F50NJ	Type F tie-plate	Figure 2, table 6	
		Nuts	Type F tie-plate for 50 kg and 50 kgN rails general	F50–M20N	Type F tie-plate	Figure 3, table 7	4
			Type F tie-plate for 50 kg rail joint	F50J–M20N	Type F tie-plate	Figure 3, table 7	
			Type F tie-plate for 50 kg rail joint N	F50NJ–M20N	Type F tie-plate	Figure 3, table 7	
NOTE: See 4.2 e) for Class A and Class B.							

4.4 Limit gauges

Measurement of dimensional tolerances using limit gauges shall be as follows.

4.4.1 Non screw thread limit gauges

The limit gauges, excluding screw thread limit gauges, such as plain gauges shall be as follows.

- If the order so requires, the manufacturer shall provide prior to production two sets of limit gauges on his own responsibility. For the tolerances, dimensional tolerance and permissible wear of these limit gauges, JIS B 7420 shall apply.
- One set of gauges shall be made available to the purchaser for inspection purposes.
- Only these gauges are valid for inspection in above b).

4.4.2 Screw thread limit gauges

The screw thread limit gauges shall comply with **JIS B 0251**.

4.5 Marking

4.5.1 Products marking

The bolt heads and nuts shall be marked with the following information by embossing or stamping on the top face.

- Manufacturer's name or its abbreviation
- A letter "M" (only for meter screw threads)
- Symbol "H" representing heat treatment (only for Class B bolts), and symbol of property class or material (only for Class B nuts).

Further, yellow paint shall be applied to the heads of B30, B37 and B50 bolts.

4.5.2 Package marking

The following information shall be marked on the package.

- a) Designation of products
Name of product or class symbol (thread form may be omitted) and nominal size of thread, and length of bolt (L) shall be indicated (see table 2).
- b) Number of contents
- c) Manufacturer's name or its abbreviation

4.6 Quality

The quality shall be as follows.

- a) The bolt and nut surfaces shall be free from cracks and other such faults detrimental to application as flaws, burrs, fins and warp.
For the criteria for permissible limit of surface faults, unless indicated by the purchaser, **JIS B 1041** and **JIS B 1042** apply.
- b) The degree of finish of bolts and nuts shall be the coarse finish of **JIS B 1180 : 2004** and **JIS B 1181 : 2004**.
- c) Dimensions of bolts and nuts shall be in accordance with figures 1, 2 and 3.
Inspection of dimensions of bolts and nuts shall be in accordance with **5.2**.
- d) The mechanical properties of fish-plate bolts shall satisfy the values for mechanical properties of products in table 3. However, when the purchaser requests, the values for mechanical properties of test pieces in table 3 may be applied.
The mechanical properties of fish-plate nuts shall satisfy the requirements in table 4.
The mechanical property test and inspection of fish-plate bolts and nuts shall be conducted in accordance with **5.1**.
- e) The mechanical properties of bolts and nuts for rail fastening shall be equal to or better than the requirements of SS400 given in **JIS G 3101 : 2004**.
The test for mechanical properties of bolts and nuts for fastening rails shall be carried out according to the procedure for steel bars in **8.2** of **JIS G 3101 : 2004**.
- f) In the case of Class B bolts and nuts, if the mechanical properties are not attained, subsequent heat treatment may be applied according to **9.9** of **JIS G 0404 : 2005** and the purchaser shall be informed of the conditions of this treatment.

Table 3 Mechanical properties of fish-plate bolts

Classification	Symbol	Property class	Nominal thread designation	Mechanical properties of products		Mechanical properties of test piece			
				Tensile load kN	Hardness	Yield point or 0.2 % proof stress N/mm ²	Tensile strength N/mm ²	Elongation %	Reduction of area %
Class A	A30 A37	5.6	M18	96 min.	79 to 95 HRB	—	—	—	—
	A50	5.6	M24	176 min.	79 to 95 HRB	—	—	—	—
Class B	B30 B37	8.8	M18	159 min.	23 to 34 HRC	660 min.	830 min.	12 min.	52 min.
	B50	8.8	M24	293 min.	23 to 34 HRC				
	B40N B50N	10.9	M20	255 min.	32 to 39 HRC	940 min.	1 040 min.	9 min.	48 min.
	B60	10.9	M20	255 min.	32 to 39 HRC				

Table 4 Mechanical properties of fish-plate nuts

Classification	Symbol	Property class	Hardness HV	Proof load stress N/mm ²
Class A	A30-M18N A37-M18N A50-M24N F50-M20N F50-M20N F50NJ-M20N	5	146 to 302	630
Class B	B30-M18N B37-M18N B40N-M20N B50-M24N B50N-M20N B60-M20N	10	272 to 353	1 060

4.7 Dimensional tolerances

4.7.1 Basic size and dimensional tolerances of bolts and nuts

The basic size and dimensional tolerances of the bolts and nuts shall be according to figures 1 to 3.

4.7.2 Thread tolerances

The tolerances on dimensions of metric coarse screw thread shall be in accordance with the tolerance class 8g for external thread and 7H for internal thread as specified in **JIS B 0209-3 : 2001**.

5 Tests and inspection of mechanical properties and dimensions

The tests and inspection of mechanical properties and dimensions shall be carried out on finished products.

5.1 Test and inspection of mechanical properties

The test and inspection of mechanical properties shall be in accordance with the following specifications. However, they may be subjected to a change as agreed between the purchaser and the manufacturer.

5.1.1 Test items

The following tests shall be performed.

- a) For bolts, the tensile load test and hardness test for products as specified in **JIS B 1051**. If requested by the purchaser to use a test piece, the yield point or 0.2 % proof stress, tensile strength, elongation and reduction of area (excluding Class A) shall be tested.
- b) For nuts, the proof load test and the hardness test as given in **JIS B 1052**.
- c) For bolts and nuts, the screwing test.

5.1.2 Size of batch

The following batching method shall be applied for the tests on the nuts and bolts.

- a) One series of tests per batch of 20 000 items in maximum for the fish-bolts and the fastening bolts.
- b) One series of tests per batch of 100 000 items in maximum for the coupling bolts.

5.1.3 Test procedure

5.1.3.1 Test procedure of bolts

For the bolts, the mechanical and hardness tests shall be carried out in accordance with the following and the specifications of clause 8 of **JIS B 1051 : 2000**.

- a) Tensile test of B40N, B50N and B60 bolts shall be the wedge load test, the wedge angle for which shall be 10°. For the bolts of other types, the product tensile test shall apply.
- b) Mechanical test for the test piece shall be carried out, using No. 14A test piece of **JIS Z 2201** cut out from a heat-treated bolt, in accordance with **JIS Z 2241**.
- c) The bolt hardness test shall be carried out on a polished flat of the bolt head or body in accordance with **JIS Z 2245**.

5.1.3.2 Test procedure of nuts

The nuts shall be tested as follows.

The hardness measured in Rockwell hardness values shall be converted to those in Vickers hardness.

- a) For the nuts, the proof load test and the hardness test shall be carried out in accordance with the provisions of **8.1** and **8.2** of **JIS B 1052**: 1998.
- b) The screwing test shall be carried out as described in **5.1.3.3**.
- c) Unless indicated by the purchaser, the nut hardness test shall be carried out on a polished flat of the nut bearing surface in accordance with **JIS Z 2244**.

5.1.3.3 Screwing test method

For the screwing test, the nut shall be screwed on by hand over two thirds of its height at least, and the rest be screwed down with a torque wrench.

The tightening torque shall not exceed 35 N · m for bolts of diameter less than or equal to 20 mm and 48 N · m for bolts of diameter greater than 20 mm.

At the request of the purchaser, the checking of thread tolerance may be replaced with this screwing test (see **4.7.2**).

5.1.3.4 Inspection

The mechanical properties, when tested in accordance with **5.1**, shall satisfy the requirements in **d)**, **e)**, and **f)** of **4.6**. The statistical sampling plan to be used shall be the subject of an agreement between the purchaser and the manufacturer. The agreement shall mention the risks, the accepted quality level and the batch and sample size. If there is no such agreement, the sampling shall be carried out in accordance with **JIS Z 9015-1** or the Wald sampling plan (see Annex A). This case shall also lead to the same risks to the purchaser (see **4.24** of **JIS Z 8101-2**: 1999) and the manufacturer (see **4.27** of **JIS Z 8101-2**: 1999).

The risks defining the scheme translated by the diagrams of Annexes A and B are as follows.

- a) for batches of 500 to 2 000 items:
 - 1) 10 % probability of rejecting a batch containing a 20 % proportion of defectives,
 - 2) 10 % probability of accepting a batch containing a 30 % proportion of defectives;
- b) for batches of 2 001 and to 100 000 items:
 - 1) 10 % probability of rejecting a batch containing a 10 % proportion of defectives,
 - 2) 10 % probability of accepting a batch containing a 20 % proportion of defectives.

The test is complete when the representative point of the test development has passed into the acceptance zone or the rejection zone in the diagram.

5.2 Test and inspection

The test and inspection of dimensions shall be as follows.

5.2.1 Types of tests and inspections

The systematic tests and inspections of dimensions shall be conducted on the items with tolerances shown in figures 1 to 3.

Checking of the tolerance class for thread may be substituted by the screwing test if requested by the purchaser (see **4.7.2**).

The other dimensions than those indicated in figures 1 to 3 may be the subject of inspection as agreed between the purchaser and the manufacturer, except that they are not to be judged according to the acceptance criteria given in **5.2.3**.

5.2.2 Batching method

The following batching method shall apply.

- a) The items selected shall be arranged in batches having the same characteristics.
The samples taken shall be such that they are representative of the batches submitted.
- b) The batch size shall be in accordance with **5.1.2**.
- c) The purchaser has the right to split up the lots or group them together for the checks.
- d) The symbols and signs marked by the inspector on the samples taken shall be kept intact until the acceptance tests have been completed.

5.2.3 General matters of tests and inspections

The dimensional checks shall be carried out on samples taken from batches of bolts and nuts by direct measurement, limit gauge and other means.

After the inspection, if at least one checked dimension of any bolt and nut is outside the tolerance limits or the finish of the bolt and nut does not satisfy the requirements of **4.7**, that bolt and nut is regarded as a “bad” sample.

The bolts and nuts satisfying the requirements of **4.7** shall be accepted.

While the statistical sampling plan may be applied on an agreement between the purchaser and the manufacturer, the agreement shall mention the batch and sample size, the accepted quality level and the risks. If there is no such agreement, the statistical sampling plan shall be in accordance with **JIS Z 9015-1** or with the Wald diagram.

The risks defining the scheme transmitted by the Wald diagram (Annexes C and D) are as follows:

- a) 5 % probability of rejecting a batch containing a 5 % proportion of defectives;
- b) 5 % probability of accepting a batch containing a 15 % proportion of defectives.

The inspection is complete when the representative point of the test development has passed into the acceptance zone or the rejection zone in the diagram.

In the case of rejection, the manufacturer has the right of picking out the items of the rejected batch and resubmitting the batch for the acceptance test.

During this second test, the check shall be carried out in accordance with the sequential sampling plan, (Annex D), providing the purchaser with a lower risk.

The purchaser may waive the dimensional check under the conditions specified in **5.2.4**.

5.2.4 Alternative to dimensional checks on samples taken from batches— Control chart

When the manufacturer applies a permanent control chart system approved by the purchaser, the latter may space out inspections on samples taken from the batches as he wishes.

The results recorded in the control charts are then regarded as constituting the inspection check.

The agreement of the purchaser on the system of control charts covers the following main points:

- the stages of manufacture at which the inspection is carried out;
- the sampling size and frequency;
- the inspection limits;
- the number of items outside the limits allowed during a given period.

The control charts shall be kept available for the purchaser who may check at any time that the system is being applied correctly by whatever method the purchaser chooses.

The control charts shall contain all the data permitting clear identification of the manufactured goods.

They shall be kept by the manufacturer until at least 31 December of the year following the one indicated on the items.

6 Data to be supplied by the purchaser

The attention of users of this Standard is drawn to the fact that the data normally contains a definition of the conditions for use, in addition to documents useful in drawing up the contract.

7 Packaging

The bolts and nuts shall be subjected to rust proof treatment after the inspection, and packed with the nuts coupled on the bolts.