

Prevailing Torque Type Hexagon Nuts

1. Scope

This standard specifies prevailing torque type hexagon nuts (hereinafter referred to as “nuts”) for use on automobiles.

Remarks:

1. This standard is not applicable to nuts for which weldability, heat resistance at 300 °C or over (at 80 °C or over for nuts with polyamide inserts), and cold resistance at -50 °C or below are required.
2. Applicable standards and related international standards of this standard are shown in **Attached table 1** and 2.
3. An international standard corresponding to this standard is shown below.

ISO/DIS 2320: 1995 Prevailing torque type steel hexagon nuts-Mechanical and performance requirements.

2. Definitions

Major terms used in this standard are defined as follows as well as in **JIS B 0101**.

(1) Prevailing torque type hexagon nut:

A nut which has a prevailing torque developing element as its self-locking element, the developing element which produces a frictional resistance and makes it difficult for the nut to rotate relatively to the mating male part.

(2) Prevailing torque developing element:

An element which provides the function to develop the torque of a screw thread as its self-locking element.

3. Type of nuts

Type of nuts shall be classified into 8 types in **Table 1** according to combinations of shape, prevailing torque developing element, and width across flat.

Table 1 Type of nut

Type		Prevailing torque developing element	Width across flat and shape divisions
Type1	Normal type	A polyamide resin insert is used.	Normal type
	Small type		Small type
Type2	Normal type	Part of the nut is deformed.	Normal type
	Small type		Small type
Type1 with flange	Normal type	A polyamide resin insert is used.	Normal type with flange
	Small type		Small type with flange
Type2 with flange	Normal type	Part of the nut is deformed.	Normal type with flange
	Small type		Small type with flange

4. Mechanical properties and performance

4.1 Property class

Property class of nuts shall be in accordance with **Table 2**.

4.2 Mechanical properties corresponding to property class

Mechanical properties corresponding to property class of nuts shall be in accordance with the following.

- (1) **Proof load:** When tested in accordance with **11.4.1**, the nut shall withstand the load producing the stress given in **Table 3** without rupture or thread stripping.

Further, after the proof load is relieved, the maximum removal torque necessary to remove the nut completely shall not exceed the maximum torque required to install the nut.

- (2) **Hardness:** When tested in accordance with **11.4.2**, the hardness of nuts shall conform to the requirements given in **Table 3**.

4.3 Prevailing torque

When tested in accordance with **11.4.3**, the prevailing torque of nuts shall satisfy the requirements given in **Table 4**.

Table 2 Property class

Type	Property class
Type 1 and Type 2	6 N and 8 N
Type 1 with flange and type 2 with flange	

Table 3 Mechanical properties

d (Nominal diameter of thread)

Property class		Proof load stress MPa	Hardness	
			HV	HRC
6N		600	Max. 302	Max. 30
8N	$d \leq 16$	800		
	$d > 16$	830	Max. 353	Max. 36

Table 4 Clamp load, installation torque, and removal torque

Thread size	Clamp load kN		Installation and removal torque N • m		
	Property class		First installation torque (max.)	First removal torque (min.)	Fifth removal torque (min.)
	6N	8N			
M4	2.89	3.82	0.9	0.18	0.12
M5	4.69	6.17	1.6	0.29	0.20
M6	6.63	8.70	3.0	0.45	0.30
M8	12.1	15.9	6.0	0.85	0.60
M10 × 1.25	20.2	26.6	10.5	1.5	1.0
M12 × 1.25	30.4	40.0	15.5	2.3	1.6
M14 × 1.5	41.2	54.4	24.0	3.3	2.3
M16 × 1.5	55.1	72.7	32.0	4.5	3.0
M18 × 1.5	71.2	97.5	42.0	6.0	4.2
M20 × 1.5	90.0	122	54.0	7.5	5.3
M22 × 1.5	109	150	68.0	9.5	6.5
M24 × 2	127	172	80.0	11.5	8.0

Reference: The clamp loads given in this table are determined in accordance with the property class of hexagon bolts specified in JASO F 101.

For property class 6N: 75% of the proof load of property class 6.8 bolts

For property class 8N: 75% of the proof load of property class 8.8 bolts

5. Shape, dimensions, and geometrical tolerance

Shape, dimensions, and geometrical tolerance of nuts shall be in accordance with **Attached tables 3 to 6**.

6. Screw thread

Screw threads of nuts shall be in accordance with **Table 5**.

7. Surface condition

Surface condition of nut shall be in accordance with the following (1) as well as **10**.

- (1) Permissible limit of surface discontinuities shall be in accordance with **Table 6**.

Table 5 Screw thread

Type of thread	Permissible limit of dimension
Metric coarse thread in JIS B 0205	6H of body of JIS B 0209 or Class 2 of Appendix 1 of JIS B 0209 (Limits of sizes and tolerances for classes 1, 2, and 3 of M1 to M68 screw threads).
Metric fine thread in JIS B 0207	6H of body of JIS B 0211 or Class 2 of Appendix of JIS B 0211 (Limits of sizes and tolerances for classes 1, 2, and 3 of M1 × 0.2 to M300 × 4 screw threads).

Remarks: 1. The permissible limit of dimension of the screw thread does not apply to the prevailing torque developing element.

2. Class 2 permissible limit of dimension will be abolished in the near future.

Table 6 Permissible limit of surface discontinuities

Surface discontinuities	Permissible limits
Quench crack	Impermissible in any case of depth, length, width, and location.
Forging crack and inclusion crack	Cracks in top face or bearing surface are permissible in the following cases. (a) Cracks crossing the entire width of bearing surface are 0.05d or below in depth and up to two in quantity. In the case of flanged nuts, however, cracks in the area between s and dw is not allowed. (b) Cracks are not extended beyond first crest of complete thread to threads. (c) Cracks at first crest of complete thread are 0.5 H or less in depth.
Crack in prevailing torque developing element of Type 2 and Type2 with flange	Cracks in the prevailing torque developing element, which develop during forging, are allowed in the case where all mechanical requirements and functional requirements are satisfied and in the following cases. However, cracks in the prevailing torque developing element, which develop during caulking, are not allowed. (a) Cracks extending across the entire width of cone frustum are 0.05 d or below in depth and up to two in quantity. (b) Cracks are not extended beyond first crest of complete thread to threads. (c) Cracks at first crest of complete thread does not exceed 0.5 H in depth.
Shear bursts	(a) Shear bursts caused in side face of hexagon nut are permissible if they do not reach the bearing surface of nut or the cone frustum of flanged nut. If width across corners is reduced smaller than the minimum value of the standard by shear bursts caused in intersection of two side planes, they are not permissible. (b) If shear bursts in intersection of side face and top face or bearing surface is (0.25+0.02s) mm or less in width, they are permissible. Shear bursts in the flange periphery of flanged nut are permissible if they are not larger in length than the minimum value of the diameter dw of the bearing surface and do not exceed 0.08 dc in width.
Bursts	If bursts are produced in conjunction with seams resulting from material, seams are allowed to extend to cone frustum, but bursts are not allowed to extend. (a) Bursts are not permissible if width across corners is reduced smaller than the minimum value of the standard by shear bursts caused in intersection of two side planes. (b) If bursts in intersection of side face and top face or bearing surface is (0.25+0.02s) mm or below in width, they are permissible. (c) Bursts in the flange periphery of flanged nut are permissible if they do not extend beyond the minimum value of the diameter dw of the bearing surface and do not exceed 0.08 dc in width.

Table 6 (continued)

Surface discontinuities	Permissible limits
Seams	For all normal threads, seams are permissible if their depth from surface is 0.05d or less.
Folds	Folds are permissible, but for flanged nut, folds in intersection of flange periphery and bearing surface are not allowed to extend to bearing surface.
Voids	(a) Voids are permissible if their depth is 0.02d (Max. 0.25 mm) or less. (b) Voids are permissible if total area of them in bearing surface is 5% or less of seat surface area.
Tool marks	Tool marks in bearing face are permissible if their surface roughness to JIS B 0601 is 3.2 μ mRa or less. Those in other surfaces are permissible.
Damage	Damage such as dents, scratches, nicks, and gouges are permissible if usability is not impaired.

Remarks 1. Surface discontinuities and permissible limits shall be in accordance with JIS B 1042.

2. The symbols "d", "H", "s", "dw", and "dc" in the table represent nominal diameter (mm), height of crest (mm), width across flats (mm), diameter of bearing surface (mm), and diameter of flange (mm) of nuts, respectively.

8. Material and heat treatment

8.1 Material of nuts body

Material of nut body shall be carbon steel, and mechanical properties of nuts shall satisfy the

requirements given in 4.

Further, chemical compositions of material shall be in accordance with Table 7.

Table 7 Chemical compositions of material

Property class	Chemical composition			
	C (Max.)	Mn (Min.)	P (Max.)	S (Max.)
6N ⁽¹⁾	0.50	—	0.060	0.150
8N ⁽²⁾	0.58	0.25	0.060	0.150

Note ⁽¹⁾ With respect to property class 6N, free-cutting steel may be used unless otherwise agreed between the user and the manufacturer, provided that the maximum content of phosphorus (P), sulfur (S), and lead (Pb) shall be as follows.

P: 0.11% max.

S: 0.34% max.

Pb: 0.35% max.

⁽²⁾ Other element may be added to upgrade mechanical properties of nuts.

8.2 Material of insert

Material of inserts used in the prevailing torque developing element of Type 1 nut shall be poly-amide resin.

8.3 Heat treatment

With heat treatment of nuts, quench-and-temper may be applied as occasion demands.

9. Surface treatment

Surface treatment of nuts shall in general be in accordance with **Table 8**. However, user shall give instructions when nuts are not surface treated and when applied with the other surface treatment.

Plated nuts in strength division 8N shall be

treated by removal of hydrogen embrittlement as necessary.

The requirements for the treatment shall be based on an agreement between the user and the manufacturer.

Further, lubricant may be applied to nuts based on an agreement between the user and the manufacturer.

10. Grade of finish

Grade of finish of nuts shall be in accordance with **Table 9**.

Further, threaded portion shall be finished smoothly.

Table 8 Surface treatment

Type of surface treatment		Symbol of type of plating ⁽³⁾	Applicable standard
Electroplated coating of zinc	Yellow chromate	Ep-Fe/Zn 5C(MFZn 5C) or Ep-Re/Zn 8C(MFZn 8C)	To JIS D 0201
	Green chromate	Ep-Fe/Zn 5G or Ep-Fe/Zn 8G	

Note⁽³⁾ For symbols of type of plating, symbols as indicated in parentheses, which have been used conventionally, may be used.

Table 9 Grade of finish

Classification of grade of finish		Surface roughness of bearing surface	Surface roughness of side
A	Cold forging	3.2 μ mRa	6.3 μ mRa
	Machining		
B	Hot forging	6.3 μ mRa	12.5 μ mRa

Remark: Surface roughness shall be in accordance with **JIS B 0601**.

11. Tests and measuring methods

11.1 Classification of tests

Tests for examining mechanical properties and performance shall be classified as given in **Table 10**.

11.2 Test sample nut

Test sample nuts shall be nuts to be used practically and no additional treatment is allowed for them before testing

11.3 Device and equipment for test

Devices and equipment to be used for tests given in **Table 10** shall be as follows:

- (1) **Hardened mandrel and test bolt:** Hardened mandrels, (hereinafter referred to as the "mandrels") and test bolts, (hereinafter referred to as the "bolts") used for the proof load test and the prevailing torque test shall be as specified in **Table 11**.
- (2) **Test washers:** Washers used for the prevailing torque test shall be as specified in **Table 12**.
- (3) **Torque measuring instrument:** Torque measuring instruments used for the proof load test and prevailing torque test shall be as follows:
 - (a) The torque measuring instrument shall be a hand torque wrench⁽⁵⁾ or a power-driven device for tightening nuts, and shall be accurate to $\pm 2\%$ of its maximum scale value.
Note ⁽⁵⁾ See **JIS B 4650**.
 - (b) The scale range of torque measuring instruments shall be suitable for torque values for determining compliance of nuts with this standard.
- (4) **Load measuring instrument:** Load measuring instruments used in the prevailing torque test shall be as follows:
 - (a) Load measuring instruments shall be an instrument capable of measuring the actual tension induced in the test bolt as the nut is tightened, and shall be accurate to $\pm 5\%$ of the test clamp load being used.
 - (b) The bolt clearance hole in the plate to hold the bolt shall be the same diameter as the inner diameter of the test washer used.

Table 10 Classification of tests

Division	Examination item	Classification of tests	Applicable provisions for test method
Mechanical properties	Proof load and installation and removal torques of nut	Proof load test	11.4.1
	Hardness	Hardness test	11.4.2 (*)
Performance	Prevailing torque	Prevailing torque test	11.4.3

Note (*) In this test, the relevant provision of **JIS B 1052** is quoted.

Table 11 Test mandrel and bolt

Classifi- cation of tests	Type of test sample nut	Mandrel		Bolt	
Proof load test	Type1 and Type1 with flange	Column ①	The mandrel used in the proof load test for nuts shall meet the following conditions: (a) Tolerance on pitch diameter : This shall be Class 5 h specified in JIS B 0215. (b) Tolerance on major diameter : This shall be Class 6 g specified in JIS B 0215. However, the maximum limit of the major diameter shall be the value of its minimum limit for Class 6 g plus a quarter of the tolerance on the major diameter for Class 6 g. (c) Hardness : The mandrel shall be hardened and tempered and its surface hardness shall be HV 450 or above, or HRC 45 or above.	Column ②	The bolts which meet the conditions given in Column ① may be treated as the mandrels.

Table 11 (continued)

Classifi- cation of tests	Type of test sample nut	Mandrel		Bolt	
Proof load test	Type2 and type2 with flange	Column ③	In the proof load test of nuts, the bolts specified in Column 4 shall be used in principle. However, the mandrel speci- fied in Column 1 may also be used when necessary.	Column ④	The bolts used in the proof load test of nuts shall meet the following conditions. (a) Forming of threads : Threads on the bolts shall be produced by rolling. However, when the nomi- nal thread diameter of bolts may be threaded by methods other than rol- ling. (b) Mechanical properties : The bolts shall have me- chanical properties which conform to those speci- fied in the body of JIS B 1051. However, the proof load stress of the bolt shall be not less than that of the test sample nut.