

# JIS

**JAPANESE INDUSTRIAL STANDARD**

**Sets of high strength  
hexagon bolt, hexagon nut  
and plain washers  
for friction grip joints**

 **JIS B 1186**—1995

**Translated and Published**

**by**

**Japanese Standards Association**

In the event of any doubt arising,  
the original Standard in Japanese is to be final authority.



## JAPANESE INDUSTRIAL STANDARD

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Sets of high strength hexagon bolt,  
hexagon nut and plain washers for friction grip joints

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1. Scope This Japanese Industrial Standard specifies the sets of high strength hexagon bolt, hexagon nut and plain washers for friction grip joints (Hereafter referred to as "sets") used mainly for steel structures.

Remarks	The standards cited in this Standard are given in the following:
	JIS B 0101 Screw threads and fasteners – Vocabulary (ISO 1891, 5408)
	JIS B 0205 Metric coarse screw threads (ISO 68,261,724)
	JIS B 0209 Limits of sizes and tolerances for metric coarse screw threads (ISO 965-2)
	JIS B 0251 Limit gauges for metric coarse screw threads
	JIS B 0651 Instruments for the measurement of surface roughness by the stylus method
	JIS B 0659 Roughness comparison specimens
	JIS B 4650 Torque wrenches
	JIS G 0565 Method for magnetic particle testing of ferromagnetic materials and classification of magnetic particle indication
	JIS Z 2201 Test pieces for tensile test for metallic materials
	JIS Z 2241 Method of tensile test for metallic materials
	JIS Z 2245 Method of Rockwell and Rockwell superficial hardness test
	JIS Z 2343 Method for liquid penetrant testing and classification of the indication
	JIS Z 8401 Rules for rounding off of numerical values
	JIS Z 9001 General rules for sampling inspection procedures
	JIS Z 9003 Single sampling inspection plans having desired operation characteristics by variables (standard deviation known)
	2. In this Standard, units and numerical values given in ( ) are based on the traditional units, and appended for informative reference.

2. Definitions For the purposes of this Standard, the main definitions given in JIS B 0101 apply, and others are in accordance with the following:

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- (1) axial tension That tensile force which functions in axial direction of a bolt, when the bolt is used to fasten an article with a nut.
- (2) proof load When an article is fastened by using the threaded fasteners such as bolt and nut, the permissible maximum axial tension for the threaded fasteners.
- (3) torque coefficient value When an article is fastened by the bolt and nut, the magnitude of the fastening torque is in proportionate to the product of the generating axial tension and the nominal diameter of the bolt.

This proportional constant is defined as the torque coefficient value.

- (4) header point A screw end processed with a header.
- (5) thread rolling A process to work screw threads by thread rolling die.

3. Components and classes and grades

3.1 Components The set shall be composed of one piece of the high strength hexagon bolt for friction grip joint (Hereafter, referred to as "bolt".), one piece of high strength hexagon nut for friction grip joint (Hereafter, referred to as "nut".) and two pieces of high strength plain washers for friction grip joint (Hereafter, referred to as "washers".) specified in 3.2.

3.2 Classes and grades The sets shall be classified into class 1, class 2 and class 3 according to the mechanical properties of the components of the set, and further classified into A and B respectively according to the torque coefficient values, and the grades of the components of the set shall be classified according to the respective mechanical properties given in Tables 2 to 5.

Combination of classes of the sets and the grades according to the mechanical properties of components shall be in accordance with Table 1.

Table 1. Combination of classes of sets and grades according to mechanical properties of components

Classes of sets		Grades according to mechanical properties of components to be applied		
Class according to mechanical properties	Class according to torque coefficient values	Bolt	Nut	Washer
Class 1	A	F 8T	F10	F35
	B		(F 8)	
Class 2	A	F10T	F10	
	B			
(Class 3)	A	(F11T)		
	B			

Remarks: Those which are given in parentheses in the Table should not preferably be used as far as possible.



4. Mechanical properties

4.1 Mechanical properties of bolts

4.1.1 Mechanical properties of test pieces The mechanical properties of the test pieces sampled from the bolts, when tested in accordance with the specifications of 11.1.1(1)(1.1), shall conform to the requirements of Table 2.

Further, when the impact value is required particularly, it shall be as agreed between the purchaser and supplier.

Table 2. Mechanical properties of bolt test pieces

Grade according to mechanical properties of bolt	Proof stress N/mm <sup>2</sup> {kgf/mm <sup>2</sup> }	Tensile strength N/mm <sup>2</sup> {kgf/mm <sup>2</sup> }	Elongation %	Reduction of area %
F 8T	640 min. {65.3 min.}	800 to 1000 {81.6 to 102.0}	16 min.	45 min.
F10T	900 min. {91.8 min.}	1000 to 1200 {102.0 to 122.4}	14 min.	40 min.
F11T	950 min. {96.9 min.}	1100 to 1300 {112.2 to 132.6}	14 min.	40 min.

4.1.2 Mechanical properties of products The mechanical properties of the products, when tested in accordance with the specifications of 11.1.1(1)(1.2), shall be such that these are not broken at less than the tensile load (minimum) of Table 3, and, when the tensile load has been increased, no head separation is caused.

In addition, when tested in accordance with the specifications of 11.1.1(2), the results shall conform to the requirements of the hardness of Table 3.

Table 3. Mechanical properties of bolt products

Grade according to mechanical properties of bolt	Tensile loads (minimum) (kN) {kgf}							Hardness
	Designations of screw threads							
	M 12	M 16	M 20	M 22	M 24	M 27	M 30	
F 8T	68 {6 934}	126 {12 848}	196 {19 987}	243 {24 779}	283 {28 858}	368 {37 526}	449 {45 785}	18 to 31 HRC
F10T	85 {8 668}	157 {16 010}	245 {24 983}	303 {30 898}	353 {35 996}	459 {46 805}	561 {57 206}	27 to 38 HRC
F11T	93 {9 483}	173 {17 641}	270 {27 532}	334 {34 059}	389 {39 667}	505 {51 496}	618 {63 019}	30 to 40 HRC

Remarks: As to those which have been subjected to the tension test of bolts, the hardness test may be omitted as agreed between the purchaser and supplier.

4.2 Mechanical properties of nuts The mechanical properties of the nuts, when tested in accordance with the specifications of 11.1.2, shall conform to the requirements of Table 4.

Table 4. Mechanical properties of nuts

Grade according to mechanical properties of nut	Hardness		Proof load
	Minimum	Maximum	
F 8	85 HRB	100 HRB	The same as the tensile load (minimum) of the bolt of Table 3.
F10	95 HRB	35 HRC	

4.3 Hardness of washers The hardness of the washers, when tested in accordance with the specifications of 11.1.3, shall conform to the requirements of Table 5.

Further, the washers shall not be processed with the surface hardening by the carburization quenching and tempering.

Table 5. Hardness of washers

Grade according to mechanical properties of washer	Hardness
F35	35 to 45 HRC

5. Torque coefficient value of set The torque coefficient value of the set, when tested in accordance with the specifications of 11.2, shall conform to the requirements of Table 6. In this case, the torque coefficient value shall be obtained from the following formula.

$$k = \frac{T}{d \times N} \times 1,000$$

where,  $k$  : torque coefficient value

$T$  : torque (moment to fasten the nut) (N·m) {kgf·m}

$d$  : basic dimension of screw thread major diameter of bolt (mm)

$N$  : bolt axial tension <sup>(1)</sup> (N) {kgf}

Table 6. Torque coefficient value of set

Division	Classes of set according to torque coefficient values	
	A	B
Mean value of torque coefficient values of one manufacturing lot <sup>(1)</sup>	0.110 to 0.150	0.150 to 0.190
Standard deviation of torque coefficient value of one manufacturing lot <sup>(1)</sup>	0.010 max.	0.013 max.

Note <sup>(1)</sup> The one manufacturing lot mentioned above means the lot of set in which each of bolt, nut and washer is made from an identical lot.

The identical lot of the bolts, nuts and washers mentioned herein, shall be as defined below:

- (1) The identical lot of the bolts is defined as one manufacturing lot composed of the bolts, which are identical in:
- (a) melt number of material (steel),
  - (b) grade according to mechanical properties,
  - (c) designation of screw threads,
  - (d) length  $l$ ,
  - (e) machining process,
  - (f) heat treatment conditions, and
  - (g) surface treatment conditions, if the bolts are subjected to surface treatment.

However, the bolts having slight variations of length  $l$  may be considered to be of an identical lot.

- (2) The identical lot of the nuts is defined as one manufacturing lot composed of the nuts which are identical in:
- (a) melt number of material (steel),
  - (b) grade according to mechanical properties,
  - (c) designation of screw threads,
  - (d) machining process,
  - (e) heat treatment condition, and
  - (f) surface treatment condition, if the nuts are subjected to surface treatment.



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- (3) The identical lot of the washers is defined as one manufacturing lot composed of the washers which are identical in:
- (a) melt number of material (steel),
  - (b) grade according to mechanical properties,
  - (c) designation of washer,
  - (d) machining process,
  - (e) heat treatment condition, and
  - (f) surface treatment condition, if the washers are subjected to surface treatment.

Remarks: The measure when the torque coefficient value test of the set is impossible due to shorter length  $l$ , it shall be as agreed between the purchaser and supplier.

6. Shapes and dimensions The shapes and dimensions of the bolts, nuts and washers shall be in accordance with Attached Tables 1 to 3.

7. Screw threads The screw threads of the bolts and nuts shall be the metric coarse screw threads specified in JIS B 0205, and the grade thereof shall be 6H/6g of JIS B 0209.

Further, the screw threads of the bolts shall be those which have been processed by the thread rolling.

## 8. Appearance

8.1 Appearance of bolts The appearance of the bolts shall conform to the requirements of Attached Table 1 in surface roughness, and in addition shall be free from quenching cracks and such defects harmful to use as flaws, burrs, rust and damage of screw threads.

8.2 Appearance of nuts The appearance of the nuts shall conform to the requirements of Attached Table 2 in surface roughness, and in addition shall be free from quenching cracks and such defects as flaws, burrs and rust injurious in use.

8.3 Appearance of washers The appearance of the washer shall conform to the requirements of Attached Table 3 in surface roughness, and in addition shall be free from quenching cracks and such defects as flaws, flashes and rust injurious in use and remarkable curves.

9. Material The material of the bolts, nuts and washers shall be such that the products of which satisfy the requirements of 4. to 8.

10. Surface treatment The bolts, nuts and washers may be processed with any surface treatment which will not give injurious influence on their qualities.



11. Tests and measuring methods

11.1 Tests on mechanical properties

11.1.1 Tests on mechanical properties of bolts The tests on mechanical properties of the bolts shall consist of the tension test and hardness test, and shall be in accordance with the following:

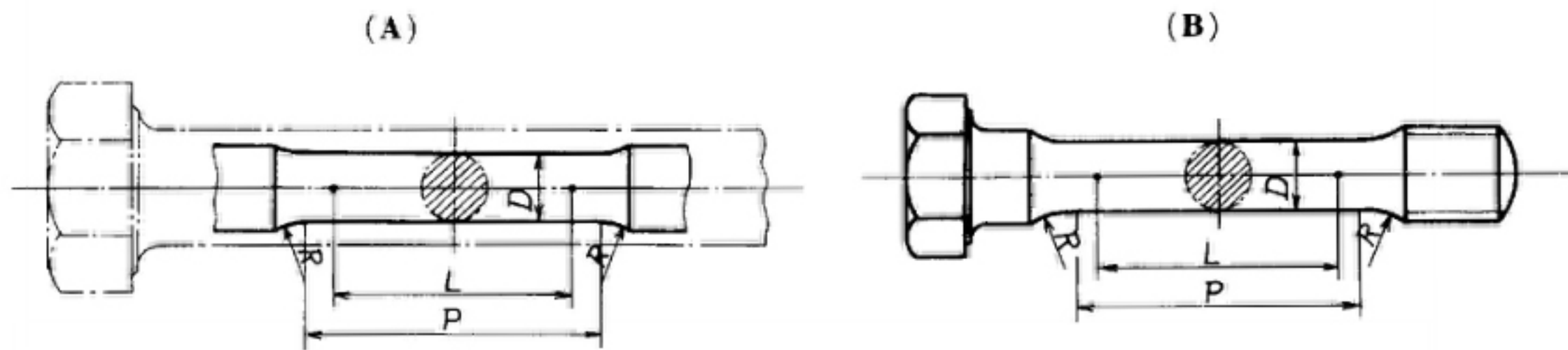
(1) Tensile test of bolts The tensile test of bolts shall be carried out on the test piece and product.

(1.1) Tensile test of test piece The tensile test of the test piece shall be in accordance with the each item of the following:

(1.1.1) Test piece The test piece shall be in accordance with the following:

(1.1.1.1) The test piece shall be the No. 4 test piece specified in JIS Z 2201 sampled from the bolt as given in (A) of Fig. 1 or (B) of Fig. 1.

Fig. 1. Sampling method of bolt test piece



Gauge length	$L = 50 \text{ mm}$
Diameter	$D = 14 \text{ mm}$
Length of parallel	$P = \text{Approx. } 60 \text{ mm}$
Radius of fillet	$R = 15 \text{ mm min.}$

However, for M12 to M24, when the dimensions given above are unable to be sampled,  $L$  and  $D$  shall be determined by assuming that  $L = 3.54D$ , and  $P$  shall be determined by assuming that  $P = L + \text{approx. } 10 \text{ mm}$ .

In this case,  $D$  shall not be less than the value given in Table 7.

Table 7. Minimum dimension of diameter of bolt test piece

Designation of screw threads	<i>D</i> (mm)
M12	6
M16	8
M20	8
M22	10
M24	12

- (1.1.1.2) When it is unable to sample the test piece, due to shorter length *l* of the bolt, a test bar collected from the material of the identical lot <sup>(2)</sup> with the material of the bolt is mixed into the same heat treatment lot with the bolt, and after heat treatment has been carried out, the No. 4 test piece specified in JIS Z 2201 shall be sampled from the test bar. In this case, the *D* dimension of test piece shall be the value of *D* given in Table 7.

Note <sup>(2)</sup> The identical lot mentioned herein means that the lot of which melt number of material (steel) and diameter are identical to the bolt.

- (1.1.2) Test method The test method shall be in accordance with the test method specified in JIS Z 2241.
- (1.2) Tensile test of product In the tensile test of the product, use a jig having an appropriate structure, shape and dimensions, as well as sufficient rigidity, insert the wedge (see Fig. 3) of HRC 45 or over in hardness at the bearing surface of the bolt as given in Fig. 2, allow its inclined surface to be in contact with the side of hexagon head, and allow a jig or nut to engage so that about six threads of the complete threads remains at the head side of the bolt, on the other side of the threaded portion. Apply a tensile load in axial direction to examine whether the bolt breaks or not under the tensile load (minimum) given in Table 3, and, further, increase the tensile load until the bolt breaks to examine whether the separation of the head of the bolt takes place or not.

Further, in this case when the bolt comes out due to collapse of the screw threads, retest shall be made after improving the thread accuracy of the jig or nut, or increasing the length of engagement.

Fig. 2. Tensile test methods of bolt product

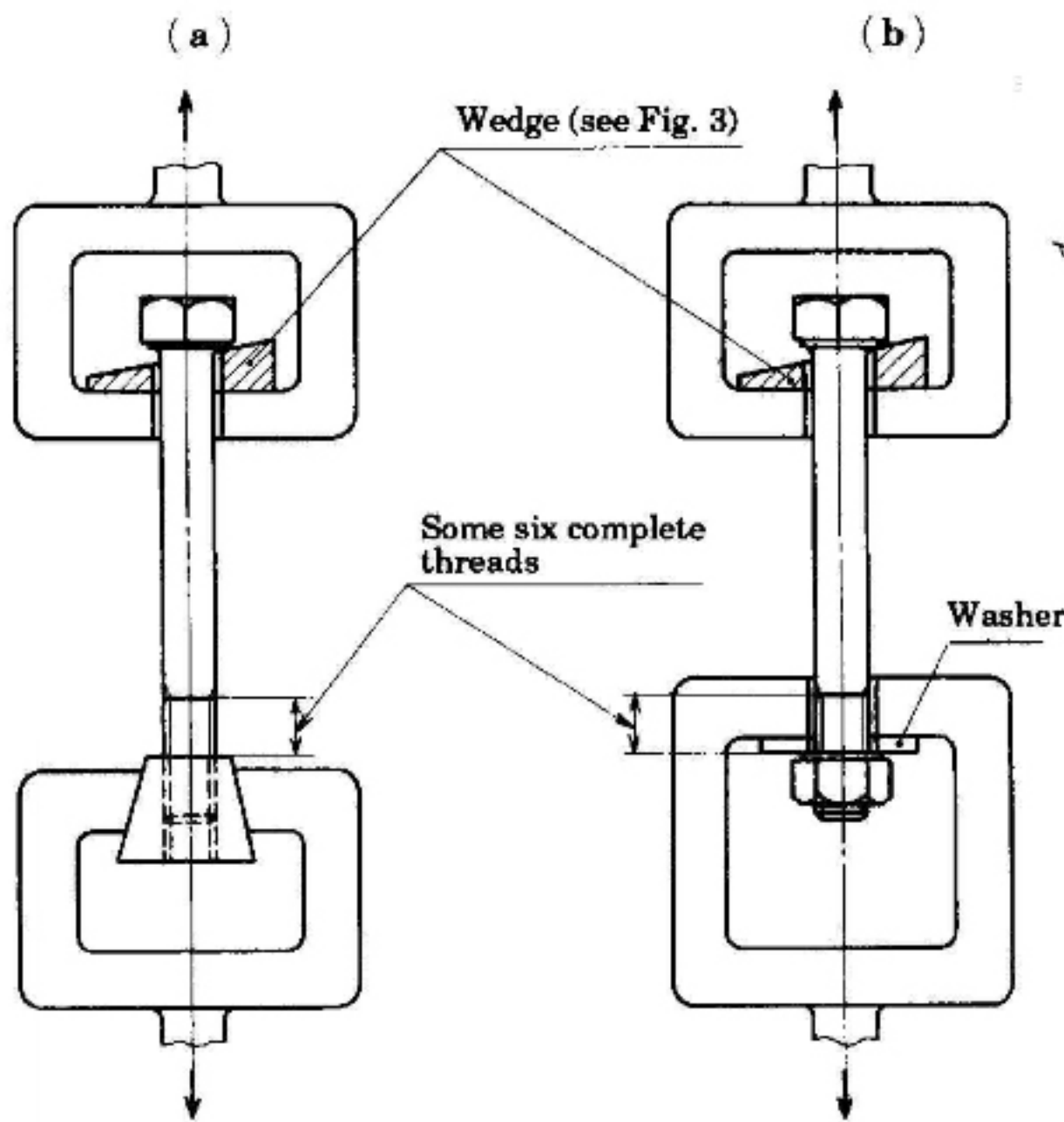
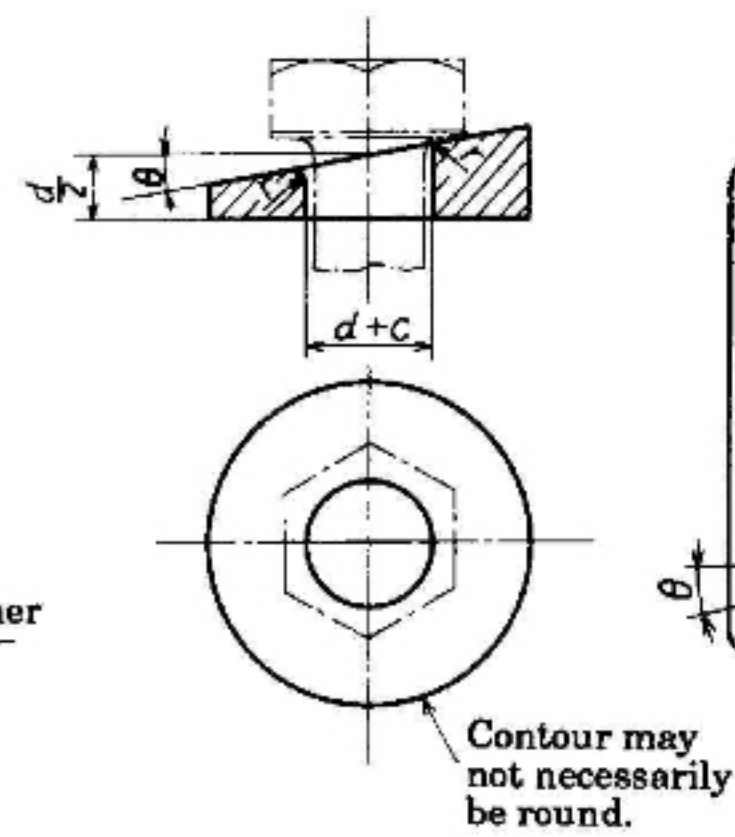
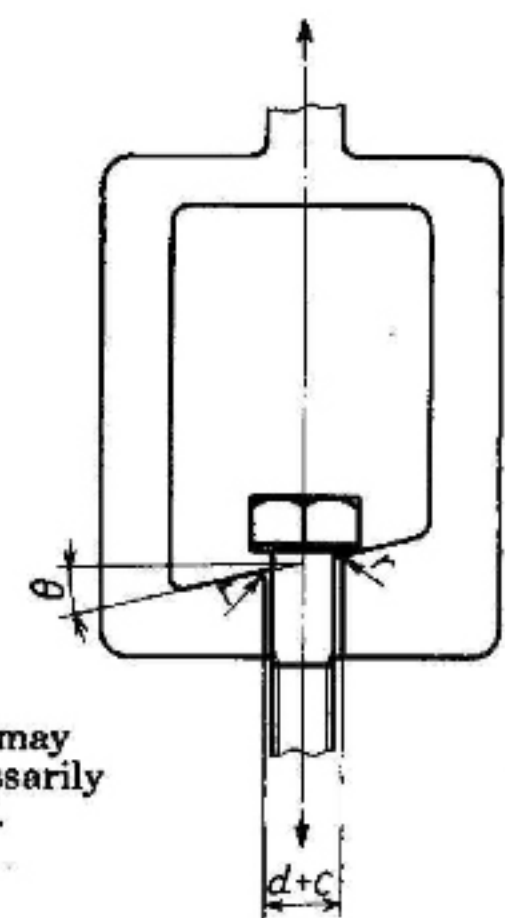


Fig. 3. Shape and dimensions of wedge



Letter  $d$  indicates the basic outside diameter of bolt thread, and  $c$  the clearance between the inside diameter of wedge and dimension  $d$ .

Fig. 4. Tensile jig having inclined face



Division	Length of body	
	Under $2d$	$2d$ and over
$\theta$	$6 \pm 0.5^\circ$	$10 \pm 0.5^\circ$

Unit: mm

Division	Designation of screw threads		
	M12	M16 to M22	M24 to M30
$r$	1.6	2.0	2.4
$c$	1.2	1.6	2.0

Remarks: As given in Fig. 4, if the portion of the jig for tensile test in contact with the bearing surface of the bolt has the same inclination as that of the wedge given in Fig. 3, and its hardness and rigidity are conforming to the requirements of 11.1.1(1) (1.1.1), the jig may not necessarily be provided with wedge.

- (2) Hardness test of bolt The hardness test of the bolt shall be carried out in accordance with the test method specified in JIS Z 2245. In this case, the measuring places shall be the side faces of head, and three places be measured per one piece of the sample, and the mean value thereof be rounded off to an integer in accordance with the method specified in JIS Z 8401, and take this to be the hardness of its sample.



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**11.1.2 Tests on mechanical properties of nut** The tests on mechanical properties of the nut shall consist of the hardness test and the proof load test, and be in accordance with the following.

- (1) **Hardness test of nut** The hardness test of the nut shall be carried out in accordance with the test method specified in JIS Z 2245. In this case, the measuring places shall be on the bearing surface of the nut, and three places be measured per one piece of the sample, and the mean value thereof be rounded off to an integer in accordance with the method specified in JIS Z 8401, and take this to be the hardness of the sample.
- (2) **Proof load test of nut** The proof load test of nut shall be carried out in the same method as the tensile test of bolt product specified in 11.1.1(1)(1.2), by engaging the sample of nut instead of the internal thread jig and applying the proof load given in Table 4, and examine the presence of abnormality on the sample. In this case, wedge shall not be used.

In addition, an external thread jig for testing may also be used instead of the bolt.

**11.1.3 Hardness test of washer** The hardness test of the washer shall be carried out in accordance with the test method specified in JIS Z 2245. However, the measuring places shall be on the bearing surface of the washer, and three places be measured per one piece of the sample. The mean value thereof shall be rounded off to an integer in accordance with the method specified in JIS Z 8401, and take this to be the hardness of the sample.

**11.2 Test on torque coefficient value of set** The test on torque coefficient value of the set shall be in accordance with the following:

- (1) The test on torque coefficient value of the set shall be carried out under the service conditions, and the repeated tests on the same sample shall not be carried out.
- (2) The test shall be carried out using a torque tester or axial force meter.

When the torque tester is used, the torque and axial tension shall be read to the numerical values of 1/2 the respective scale intervals from the torque-axial tension diagram recorded on the measuring apparatus which has been connected to the tester.

In addition, when it is carried out using a meter other than the torque tester, mount a sample to the axial tension meter, apply torque to the nut gradually so as not to cause error, and measure the torque by the torque meter [see JIS B 4650] and the bolt axial tension by the axial tension meter to the numerical values of 1/2 the scale intervals of respective meters.

Further, in this case, the washer shall not be rotated.

In addition, when the hardness of the jig being in contact with the bolt bearing surface is equal to or harder than the washer, the washer of the bolt bearing surface may also be omitted.



- (3) The measurements of the torque being applied to the nut and the bolt axial tension generated by the torque shall be carried out on three places where the value of the bolt axial tension is within the range of the values given in Table 8. However, in the case of the measurement by the torque tester, it may also be made on one place near the median of the values given in Table 8.

Table 8. Axial tension for measuring torque coefficient value

Unit: kN (kgf)

Grade according to mechanical properties of bolt	Axial tension of bolts						
	Designations of screw threads						
	M 12	M 16	M 20	M 22	M 24	M 27	M 30
F 8T	38 to 51 {3 875 to 5 201}	71 to 95 {7 240 to 9 687}	110 to 148 {11 217 to 15 092}	136 to 184 {13 868 to 18 763}	159 to 214 {16 214 to 21 822}	206 to 279 {21 006 to 28 450}	252 to 341 {25 697 to 34 772}
F10T	54 to 72 {5 506 to 7 342}	99 to 134 {10 095 to 13 664}	155 to 209 {15 806 to 21 312}	191 to 259 {19 477 to 26 411}	223 to 301 {22 740 to 30 694}	290 to 392 {29 572 to 39 973}	354 to 479 {36 098 to 48 845}
F11T	57 to 76 {5 812 to 7 750}	105 to 141 {10 707 to 14 378}	163 to 221 {16 621 to 22 536}	202 to 273 {20 598 to 27 838}	235 to 318 {23 963 to 32 427}	306 to 414 {31 203 to 42 216}	374 to 506 {38 138 to 57 598}

- (4) The mean value of three calculated values obtained by substituting the torque and bolt axial tension measured in accordance with the method specified in (3) and the basic dimension of major diameter of bolt into the calculation formula given in 5. (when only one point has been measured by using torque tester, its calculated value) shall be rounded off to three decimal places in accordance with the method specified in JIS Z 8401, and take this to be the torque coefficient value of that sample.
- (5) The scale intervals of the torque – axial tension diagram obtained by torque tester shall be 10 N·m {1 kgf·m} or under for the torque, and 1% or under the axial tension to be measured for the axial tension.
- (6) The scale interval of the torque meter shall be 10 N·m {1 kgf·m} or under, and its instrumental error shall be 1% or under the value indicated by each scale within the range of the values of the torque to be measured.
- (7) The scale interval of the axial tension meter shall be 1% or under the axial tension to be measured, and its instrumental error shall be 2% or under the value indicated by each scale within the range of the values of the axial tension to be measured.

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11.3 Surface defect test of bolt The cracks, flaws and the like on the surfaces of the bolt shall be examined in accordance with the method for liquid penetrant testing specified in JIS Z 2343 or the method for magnetic particle testing of ferromagnetic materials specified in JIS G 0565.

## 12. Inspections

12.1 Shape and dimensional inspection When the shape and dimensional inspection has been carried out on the components of the bolt, nut and washers, by the direct measurement, limit gauges and other methods, the results shall conform to the requirements of 6. respectively.

12.2 Screw-threads inspection The screw-threads inspection shall be carried out by using the limit gauges (for 6H and for 6g) for metric coarse screw threads specified in JIS B 0251 or the screw threads inspecting instruments instead of these, and the results shall conform to the requirements of 7.

12.3 Appearance inspection When the appearance inspection has been carried out on the components i.e. the bolts, nuts and washers, in accordance with 11.3 and by using the roughness comparison specimens conforming to the requirements of JIS B 0659 or the surface roughness measuring instrument conforming to the requirements of JIS B 0651, as well as by visual inspection, the results shall conform to the requirements of 8.1 to 8.3 respectively.

## 12.4 Inspections on mechanical properties

12.4.1 Inspection on mechanical properties of bolt test pieces When the inspection on the mechanical properties of bolt test pieces is carried out on the proof stress, tensile strength, elongation and contraction of area in accordance with the specifications of 11.1.1 (1) (1.1), the results shall conform to the requirements of 4.1.1.

In addition, the certified quality level of the inspection lot <sup>(3)</sup> in this inspection shall be  $P_0 \leq 0.125\%$  <sup>(4)</sup> ( $\alpha \doteq 0.05$ ) and  $P_1 \leq 12.5\%$  <sup>(5)</sup> ( $\beta \doteq 0.10$ ).

Further, the sampling inspection system should preferably be in accordance with the single sampling inspection system specified in JIS Z 9003.

Notes <sup>(3)</sup> One inspection lot mentioned herein means the one manufacturing lot specified in (1) of Note <sup>(1)</sup> of 5.

<sup>(4)</sup> The 0.125% of the value of  $P_0$  is a representative value, and it represents the value of  $P_0$  within the range of 0.113% to 0.140%.

<sup>(5)</sup> The 12.5% of the value of  $P_1$  is a representative value, and it represents the value of  $P_1$  within the range of 11.3% to 14.0%.

Remarks: The meanings of the symbols  $P_0$ ,  $P_1$ ,  $\alpha$  and  $\beta$  shall be in accordance with the specifications of JIS Z 9001.



**12.4.2 Inspection on mechanical properties of bolt products** When the inspection on the mechanical properties of the bolt products is carried out on the tensile load and hardness in accordance with specifications of 11.1.1 (1) (1.2) and 11.1.1 (2), the results shall conform to the requirements of 4.1.2.

In addition, the certified quality level of the inspection lot (6) in this inspection shall be  $P_0 \leq 0.125\%$  (4) ( $\alpha \doteq 0.05$ ) and  $P_1 \leq 8\%$  (7) ( $\beta \doteq 0.10$ ).

Further, the sampling inspection system should preferably be in accordance with the single sampling inspection system specified in JIS Z 9003.

Notes (6) One inspection lot mentioned herein means the one manufacturing lot specified in (1) of Note (1) of 5.

(7) The 8% of the value of  $P_1$  is a representative value, and it represents the value of  $P_1$  within the range of 7.11% to 9.00%.

**12.4.3 Inspection on mechanical properties of nuts** When the inspection on the mechanical properties of the nuts is carried out on the hardness and proof load in accordance with 11.1.2, the results shall conform to the requirements of 4.2.

In addition, in this inspection, the certified quality level of the inspection lot (8) shall be in accordance with the following:

(1) The certified quality level of the inspection lot (8) in the hardness inspection of the nuts shall be  $P_0 \leq 0.125\%$  (5) ( $\alpha \doteq 0.05$ ),  $P_1 \leq 8\%$  (7) ( $\beta \doteq 0.10$ ).

Further, the sampling inspection system should preferably be in accordance with the single sampling inspection system specified in JIS Z 9003.

(2) In the proof load inspection of the nuts, the check inspection shall be carried out on two pieces or over in sample size for one inspection lot (8), and the total number of samples shall conform to the requirements of 4.2.

Note (8) One inspection lot mentioned herein means the one manufacturing lot specified in (2) of Note (1) of 5.

**12.4.4 Inspection on hardness of washers** When the inspection on hardness of the washers is carried out in accordance with the specifications of 11.1.3, the results shall conform to the requirements of 4.3.

In addition the certified quality level of the inspection lot (9) in this inspection shall be  $P_0 \leq 0.125\%$  (5) ( $\alpha \doteq 0.05$ ),  $P_1 \leq 8\%$  (7) ( $\beta \doteq 0.10$ ).

Further, the sampling inspection system should preferably be in accordance with the single sampling inspection system specified in JIS Z 9003.

Note (9) One inspection lot mentioned herein means the one manufacturing lot specified in (3) of Note (1) of 5.

**12.5 Inspection on torque coefficient value of sets** When the inspection on the torque coefficient value of the sets is carried out in accordance with the specification of 11.2, the results shall conform to the requirements of 5.

In addition, the certified quality level of the inspection lot <sup>(10)</sup> in this inspection shall be in accordance with the following:

- (1) The certified quality level of the standard deviation on the torque coefficient value of the inspection lot <sup>(10)</sup> shall be 5% or under in risk ratio and 8% or under in standard relative error.

**Remarks:** In the application of 12.5 (1), when the process is in a stable conditions, the recent  $\bar{x} - R$  control diagram or inspection data including the inspection lot may also be used.

In addition, when particularly required, the size of the sample may also be reduced, taking the standard relative error a little larger than the specified value, upon agreement between the purchaser and supplier.

- (2) The certified quality level of the mean value of the torque coefficient values of the inspection lot <sup>(10)</sup> shall be not less than the value given in Table 9.

**Note <sup>(10)</sup>** One inspection lot mentioned herein means the one manufacturing lot specified in Note <sup>(1)</sup> of 5.

**Table 9. Certified quality level of mean value of torque coefficient values**

Type according to torque coefficient values	Values in respect to lower limit		Values in respect to upper limit	
	$m_0''$ ( $\alpha \div 0.05$ )	$m_1''$ ( $\beta \div 0.10$ )	$m_0'$ ( $\alpha \div 0.05$ )	$m_1'$ ( $\beta \div 0.10$ )
A	0.110	0.100	0.150	0.160
B	0.150	0.140	0.190	0.200

- Remarks**
- 1. The meanings of  $m_0''$ ,  $m_1''$ ,  $m_0'$ ,  $m_1'$  shall be as specified in JIS Z 9003.
  - 2. The standard deviation used shall be the obtained value in accordance with the specifications of 12.5 (1).



13. Designation The set shall be designated by the Standard No. or title of this Standard, class according to mechanical properties of set, type according to torque coefficient values of set, designation of screw threads × bolt length (*l*) and specified item <sup>(11)</sup>.

Note <sup>(11)</sup> When there is a specified item particularly, it is indicated in the parentheses:



Example: JIS B 1186  Set of high strength hexagon bolt, hexagon nut and plain washers for friction grip joints	Class 1	B	M16 × 50	
( Standard No. or title of Standard )	Class 2	A	M20 × 60	(Flat point)
( Standard No. or title of Standard )	( Class according to mechanical properties of set )	( Type according to torque coefficient value of set )	( Designation of screw thread × bolt length <i>l</i> )	( Specified matter )

14.1 Marking of products The marking in respect to the components of the set shall be in accordance with the following:

- (1) The following information shall be marked in relief or by stamping on the upper face of the bolt head.
  - (1.1) The marking symbol indicating the grade according to the mechanical properties of bolt (F8T, F10T or F11T)
  - (1.2) Registered trade mark or symbol of manufacturer
- (2) On the upper face of the nut, the marking symbol indicating the grade according to the mechanical properties of nut shall be marked in relief or by stamping by using the marking symbol of Table 10.

Further, upon agreement between the purchaser and supplier, the registered trade mark or symbol of the manufacturer may also be marked.

Table 10. Marking symbols of nuts

Grade according to mechanical properties of nut	Marking symbol
F 8	
F10	

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- (3) On the washer, the symbol indicating the grade of mechanical properties is exempt from marking.

Further, upon agreement between the purchaser and supplier, the registered trade mark or symbol of the manufacturer may also be marked.

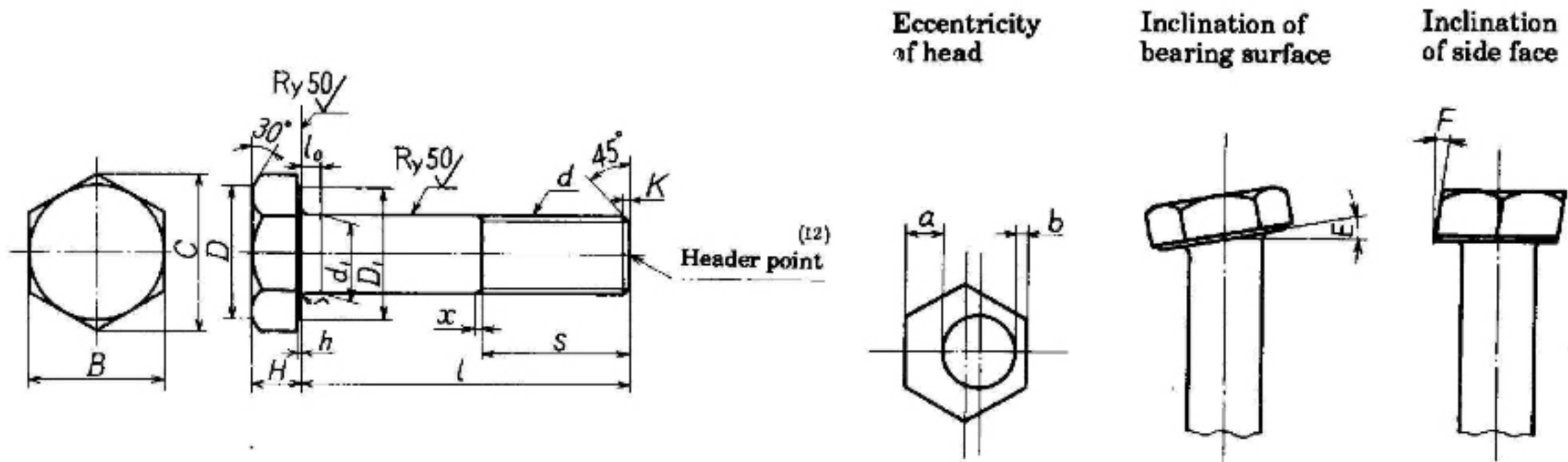
14.2 Marking on package The package shall be clearly marked with the following information:

- (1) Title of this Standard
- (2) Class according to the mechanical properties of set
- (3) Type according to the torque coefficient value of set
- (4) Designation of screw threads  $\times$  bolt length (*l*)
- (5) Quantity
- (6) Specified item
- (7) Manufacturer's name or registered trademark
- (8) Manufacturing lot number of set
- (9) Year and month of inspection of set

15. Matters to be attended at the time of contract It should be preferable that the following matters are included in the contract.

- (1) The designation of submission of the control charts and other data on quality control or inspection results sheets from the manufacturer of the sets, bolts, nuts or washers.
- (2) The designation of the packaging standard to the manufacturer of the sets.

Attached Table 1. High strength hexagon bolts for friction grip joints



Unit: mm

Designation of screw threads (d)	$d_1$ (13)		H		B		C	D	$D_1$	r	K	a-b	E	F	h	s	
	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension	Tolerance	Approx.	Approx.	Min.		Approx.	Max.	Max.	Max.		Basic dimension	Tolerance
M 12	12	+0.7 -0.2	8	±0.8	22	0 -0.8	25.4	20	20	0.8 to 1.6	2	0.7	1	2	0.4 to 0.8	25	+5 0
M 16	16		10		27		31.2	25	25	1.2 to 2.0		0.8				30	
M 20	20	+0.8 -0.4	13	±0.9	32	0 -1	37	30	29		2.5	0.9				35	+6 0
M 22	22		14		36		41.6	34	33			1.1				40	
M 24	24		15		41		47.3	39	38	1.6 to 2.4	3	1.2				45	
M 27	27		17		46		53.1	44	43			1.3				50	
M 30	30		19	±1.0	50		57.7	48	47	2.0 to 2.8	3.5	1.5				55	

Designation of screw threads (d)	Basic dimension																																							
	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	190	200	210	220					
M 12	○	○	○	○	○	○	○	○	○	○	○	○	○	○																										
M 16			○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○																				
M 20				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○																	
M 22					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
M 24						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
M 27							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
M 30								○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Tolerance on l	+1.0				+1.4										±1.8																									

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Notes (12) The screw end may be either of flat end or of rounded end.

(13) The position for measurement of the dimension  $d_1$  shall be determined so that  $l_0 \cong d_1/4$ .

- Remarks
1. The length  $x$  of incomplete threads shall be about two threads and that of continuous threads about three threads.
  2. The dimension  $d_1$  may be made so as to be approximately the same as the pitch diameter of screw thread, as agreed between the purchaser and supplier.

In this case, the radius  $r$  under the head may be made as follows:

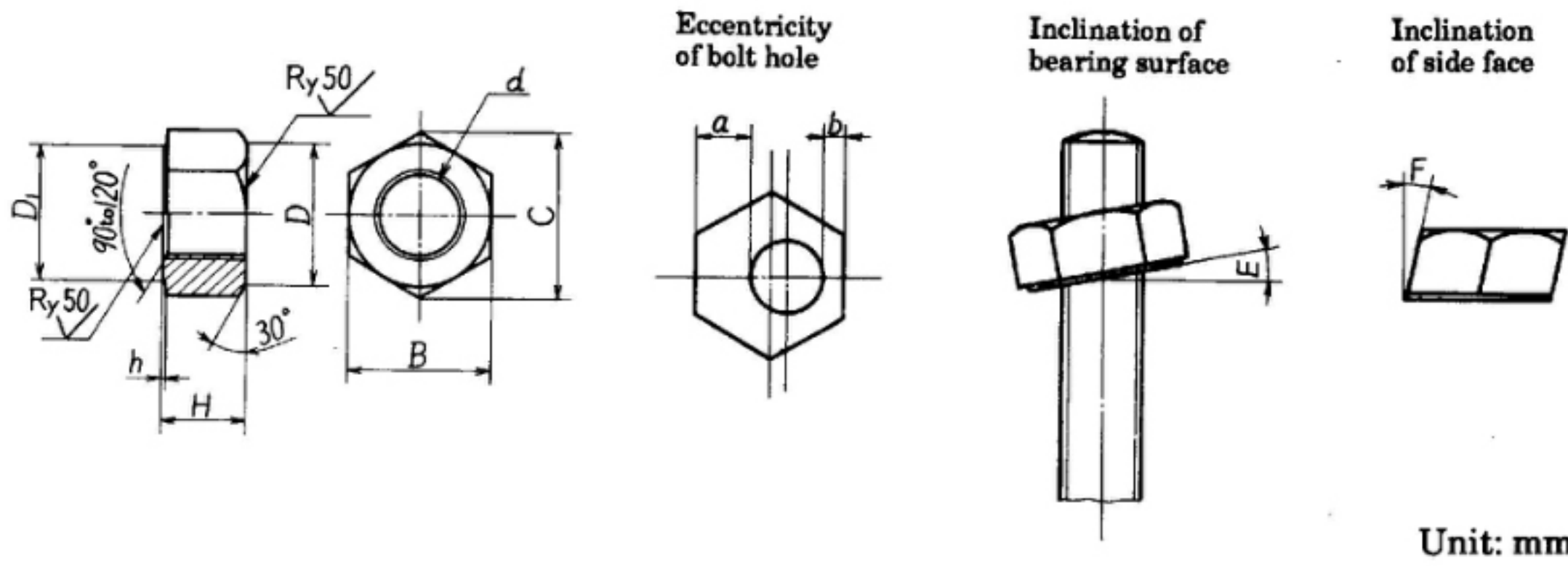
Unit: mm

Designation of screw threads	M12	M16	M20	M22	M24	M27	M30
$r$	1.2 to 2.4		2.0 to 3.3		2.5 to 3.8		

3. The dimensions  $l$  marked with  $\bigcirc$  indicate the preferable lengths  $t$ .
4. The dimensions  $l$  and  $s$  other than given in the table above, if particularly required, may be used by designation.



Attached Table 2. High strength hexagon nuts for friction grip joints

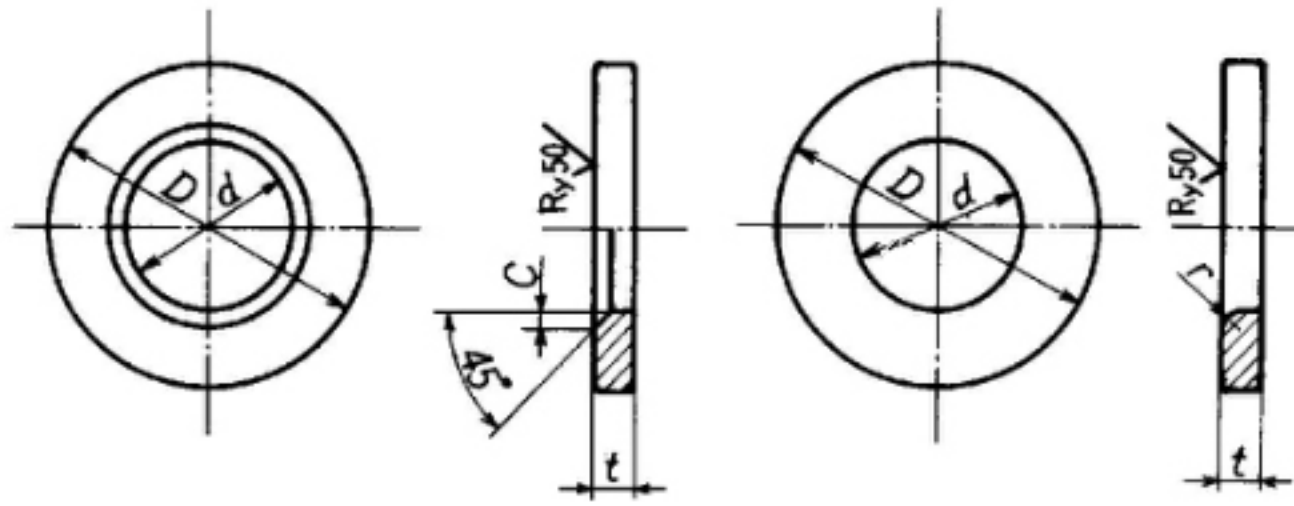


Designation of screw threads (d)	Major diameter of external threads	H		B		C	D	D <sub>1</sub>	a-b		E	F	h
		Basic dimension	Tolerance	Basic dimension	Tolerance	Approx.	Approx.	Min.	Max.	Max.	Max.		
M 12	12	12	±0.35	22	0 -0.8	25.4	20	20	0.7	1°	2°	0.4 to 0.8	
M 16	16	16		27		31.2	25	25	0.8				
M 20	20	20	±0.4	32	0 -1	37	30	29	0.9				
M 22	22	22		36		41.6	34	33	1.1				
M 24	24	24		41		47.3	39	38	1.2				
M 27	27	27		46		53.1	44	43	1.3				
M 30	30	30		50		57.7	48	47	1.5				

Remarks: Chamfering of the threaded portion of nut bearing surface side shall be of 1.0 d to 1.05 d in diameter.

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Attached Table 3. High strength plain washers for friction grip joints



Unit: mm

Designation of washer	$d$		$D$		$t$		$c$ or $r$
	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension	Tolerance	Approx.
12	13	+0.7 0	26	0 -0.8	3.2	$\pm 0.4$	1.5
16	17	+0.8 0	32	0 -1	4.5	$\pm 0.5$	2
20	21		40				
22	23	+0.8 0	44	0 -1.2	6	$\pm 0.7$	2.4
24	25		48				
27	28		56				
30	31	+1.0 0	60		8		2.8

Remarks: The figures above show a plain washer with 45° chamfer and that with radius  $r$ , and either chamfer or radius may be used.

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