

Hexagon Flange Bolt

KES E-A007

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Attached Table

1. Scope of Application

This standard specifies the steel hexagon flange bolt and the steel hexagon flange bolt and washer assembly for automobiles (hereinafter referred to as the bolt).

- Remarks 1. In this standard, only the bolt itself is called bolt proper and only the washer itself is called washer.
2. Bolts required to have weldability, heat resistance at 300°C or more and cold resistance at -50°C or less shall be excluded.

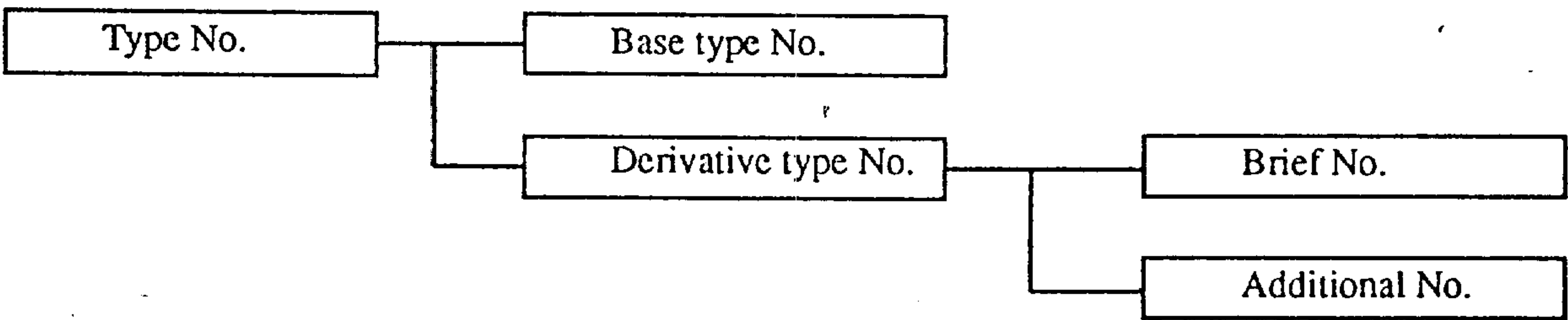
2. Purpose

This standard aims at giving commonness to part of the bolt and at securing their proper quality.

3. Type Number

3.1 Structure of type number: The structure of the type number of the bolt shall conform to Fig. 1.

Fig. 1 Structure of type number



- 3.2 Base type number: The base type number shall be as Table 1 according to the strength division and the shape.
- 3.3 Derivative type number: The derivative type number consists of a brief number and an additional number. Its structure shall be in accordance with KES A-A006 (Refer to 16. Structure of Part Number).
- 3.3.1 Brief number: The brief number is a number made by shortening the base type number to three digits. The combination of brief number and base type number is shown in Table 1.
- 3.3.2 Additional number: The additional number shall be used when other surface treatment than the basic surface treatment specified in 10.1 is required, and its structure shall be in accordance with KES A-A006.

Table 1

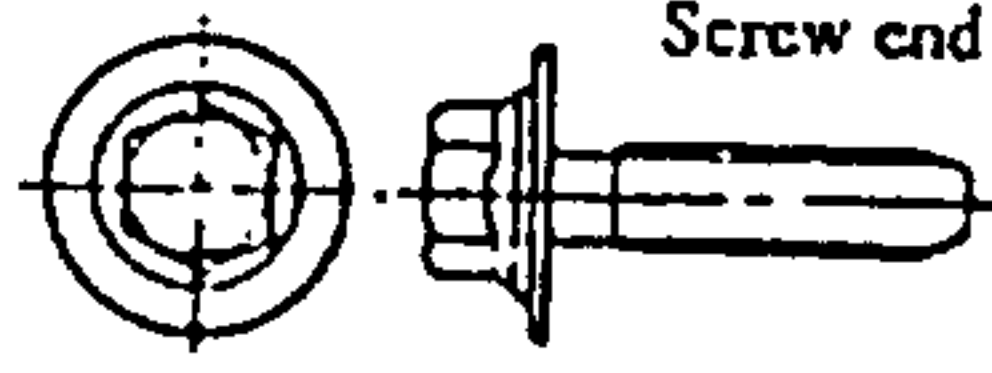
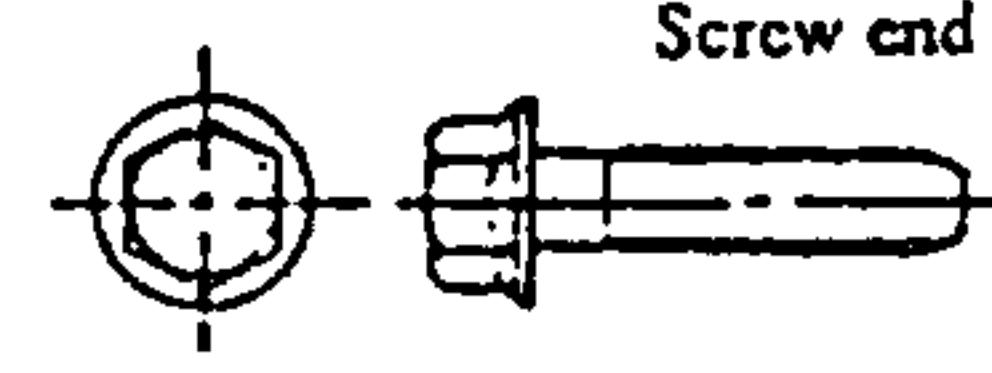
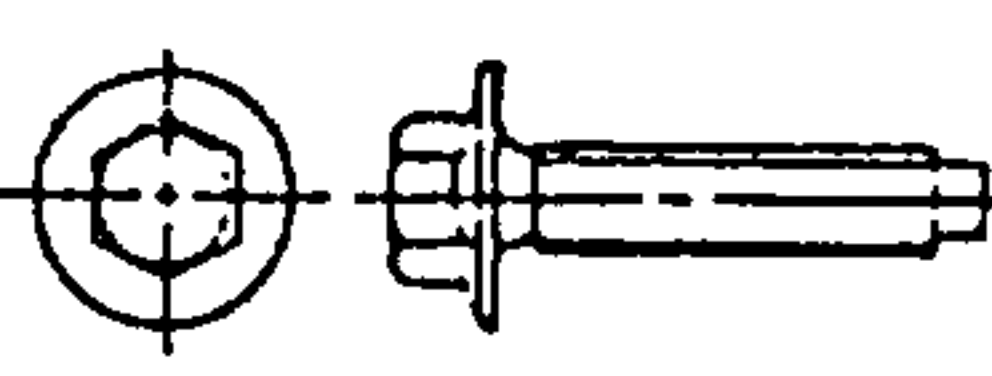
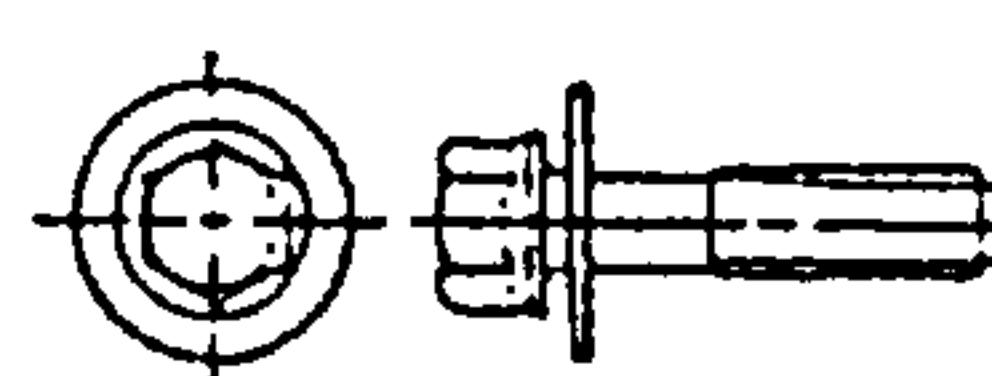
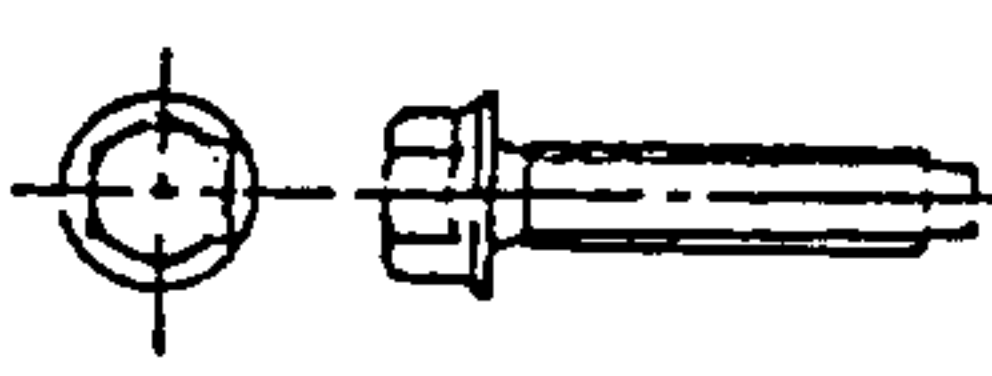
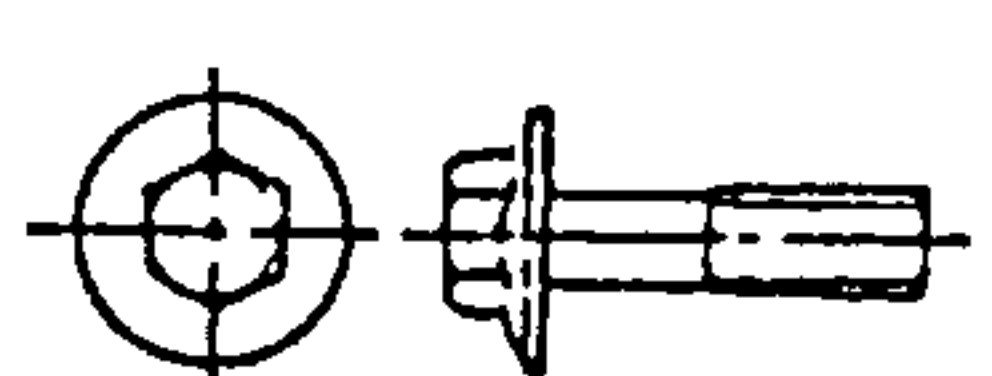
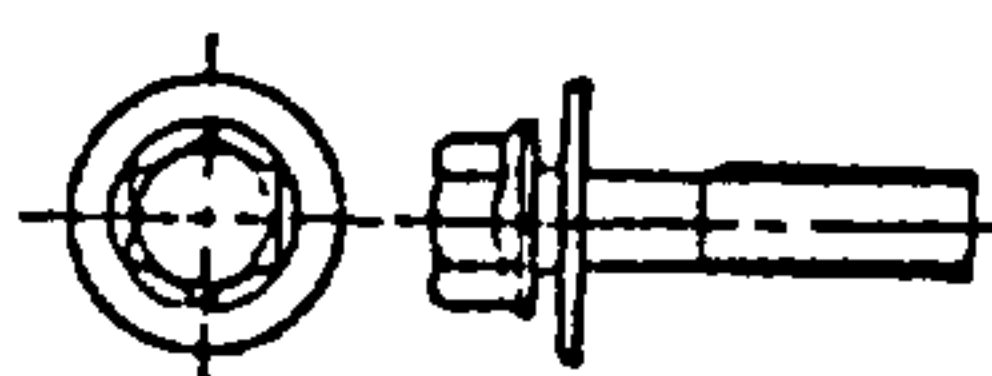
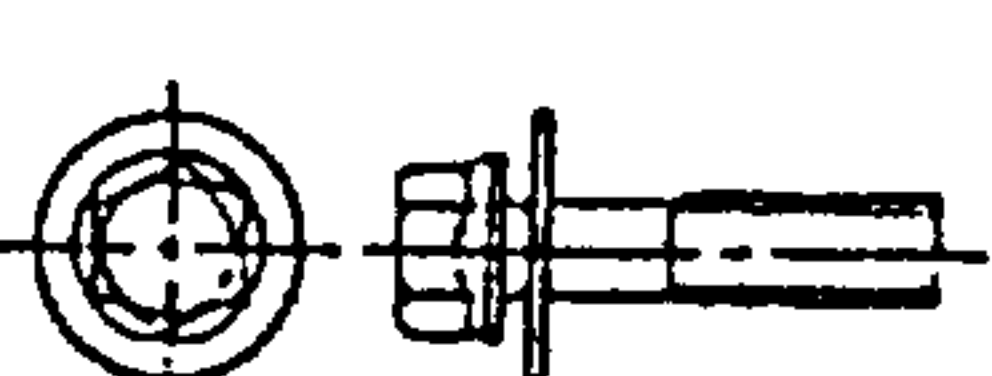
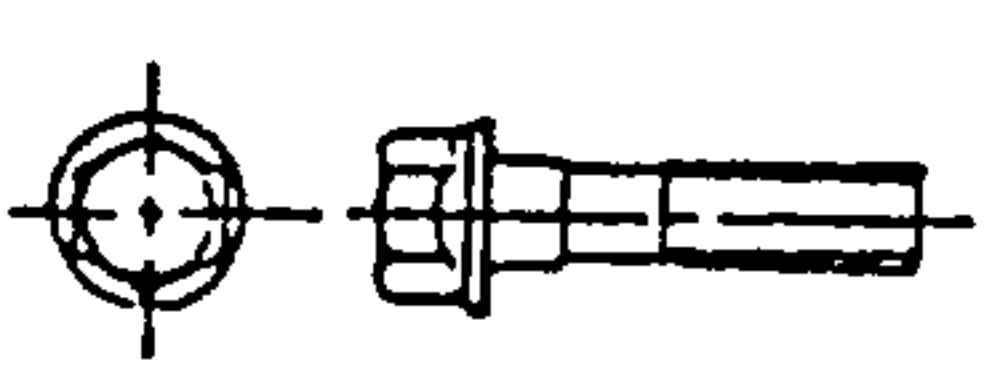
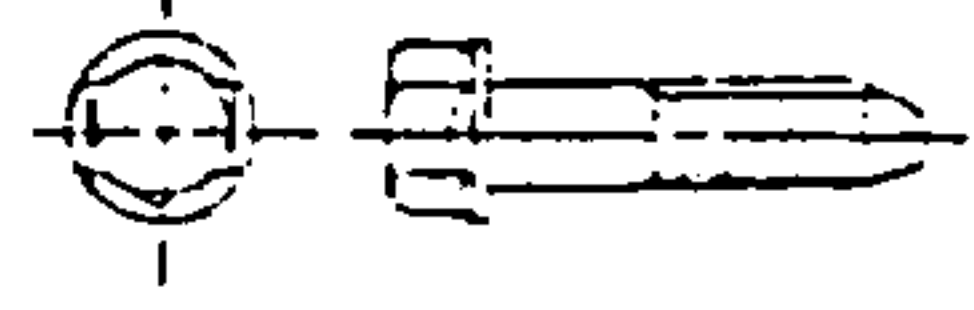
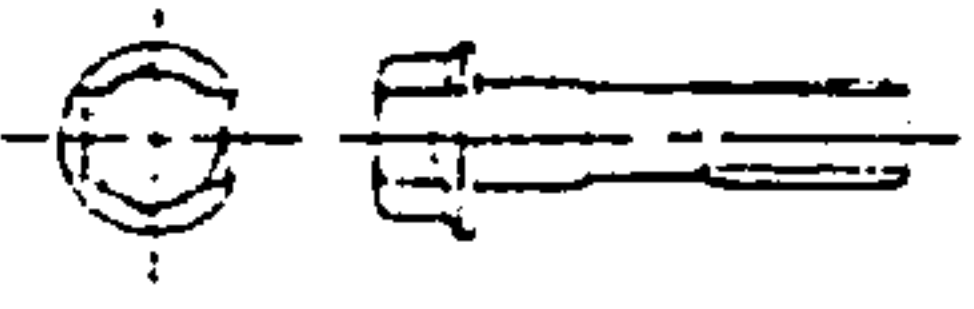
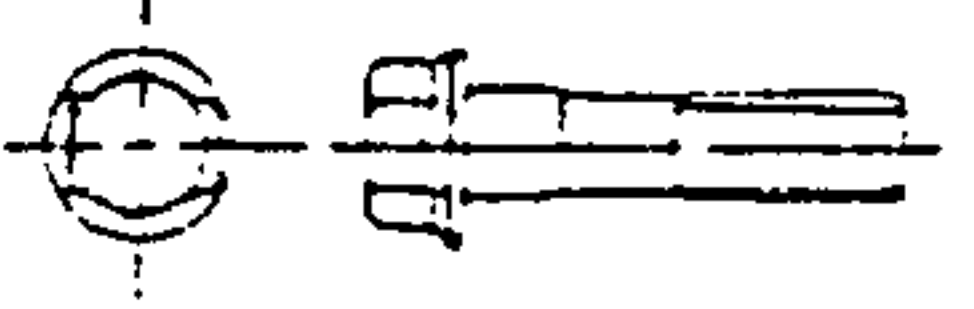
Strength Division	Base Type No. (Brief No.)	Applicable Size of Thread						Shape	Washer Assemblies	Diameter of Flange		At- tached Table
		M5	M6	M8	M10	M12	M14			Std.	Large	
6.7 6.8	90720 (9AA)		○	○	○			 Screw end	○ (Standard size)	○		1
	99720 (9A0)		○	○	○			 Screw end	—	○		2
	90794 (9HE)		○	○					—		○	3
	907941 (9HL)		○	○					○ (Large size)	○		4
	99794 (9H4)		○	○	○	○			—	○		5
	90796 (9HG)		○	○					—		○	6
	907961 (9HM)		○	○	○				○ (Standard size)	○		7
	907962 (9HN)		○						○ (Large size)	○		8
	99796 (H6)	○	○	○	○	○	○		—	○		9
	99800 (9J0)			○	○	○	○		—	○		10

Table 1 (Continued)

Strength Division	Base Type No. (Brief No.)	Applicable Size of Thread						Shape	Washer Assemblies	Diameter of Flange		At-tached Table
		M5	M6	M8	M10	M12	M14			Std.	Large	
8.8	90784 (9GE)		○	○					—		○	11
	99780 (9G0)		○	○	○	○			—	○		12
	$l < 100$ 99784 (9G4)		○	○	○	○	○		—	○		13
	$l 100$ 99787 (9G7)											
10.9	99756 (9D6)			○	○	○			—	○		14

- Remarks 1. The bolt marked with a circle in applicable size of thread column have been specified.
2. The shape of the hexagon head of the bolt of M6 or less shall be of standard type and that of M8 or more shall be of small-sized type.
3. Generally, the thread of M8 or less shall be of metric coarse screw thread and the thread of M10 or more shall be of metric fine screw thread.

4. Mechanical Properties

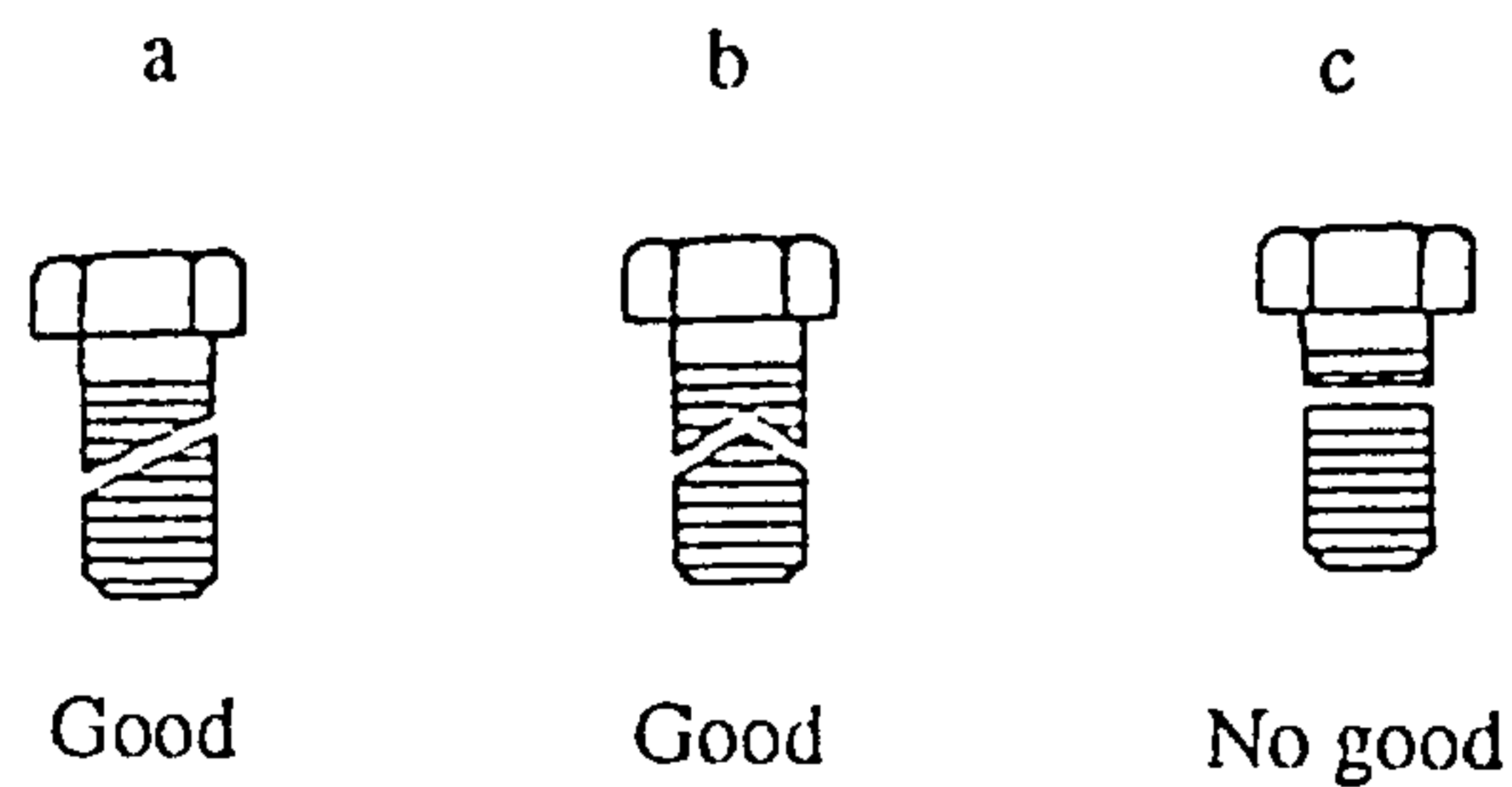
The mechanical properties of the bolt shall be in accordance with Table 2.

Table 2

Test Item					Strength division		6.7	6.8	8.8	10.9
					*1	*1				
					$l > 50$	$l \leq 50$		d 16		
	Product	Wedge tensile strength *3	kgf/mm ² {N/mm ² }	min.	60 {588}		80 {785}	100 {981}		
		Smooth tensile strength		max.	80 {785}		100 {981}	120 {1177}		
	Test piece	Smooth tensile strength								
	Product	Both ends measurement	kgf/mm ² {N/mm ² }	min.	42 {412}	48 {471}	64 {628}	90 {883}		
	Test piece	Both ends measurement								
		Gauge length measurement (JIS method)								
	Stress ratio *5			—	0.91		0.91	0.88		
	Stress *6		kgf/mm ² {N/mm ² }	—	38.2 {412}	43.7 {428}	58.2 {571}	79.2 {777}		
	Core hardness	Brinell hardness	HB	min.	170		—			
				max.	245					
		Rockwell hardness	HRB	min.	88		—			
				max.	102					
			HRC	min.	—		21	30		
				max.	—		32	38		
	Surface hardness *7		HV	max.	—		320	372		
Elongation after rupture		%	min.	8		12	9			
Impact energy		kgf•m {J}	min.	—		3.1 {30.4}	2.0 {19.6}			
Head hitting strength				—	No cracks at the joint of head and body. *8					
	Height of non-decarbonized portion E			min.	—		1/2H ₁	2/3H ₁		
	Depth of ferritic decarbonized layer G mm			max.	—		0.015			
Rupture due to tightening (plated parts)					—				No occurrence of rupture nor crack	

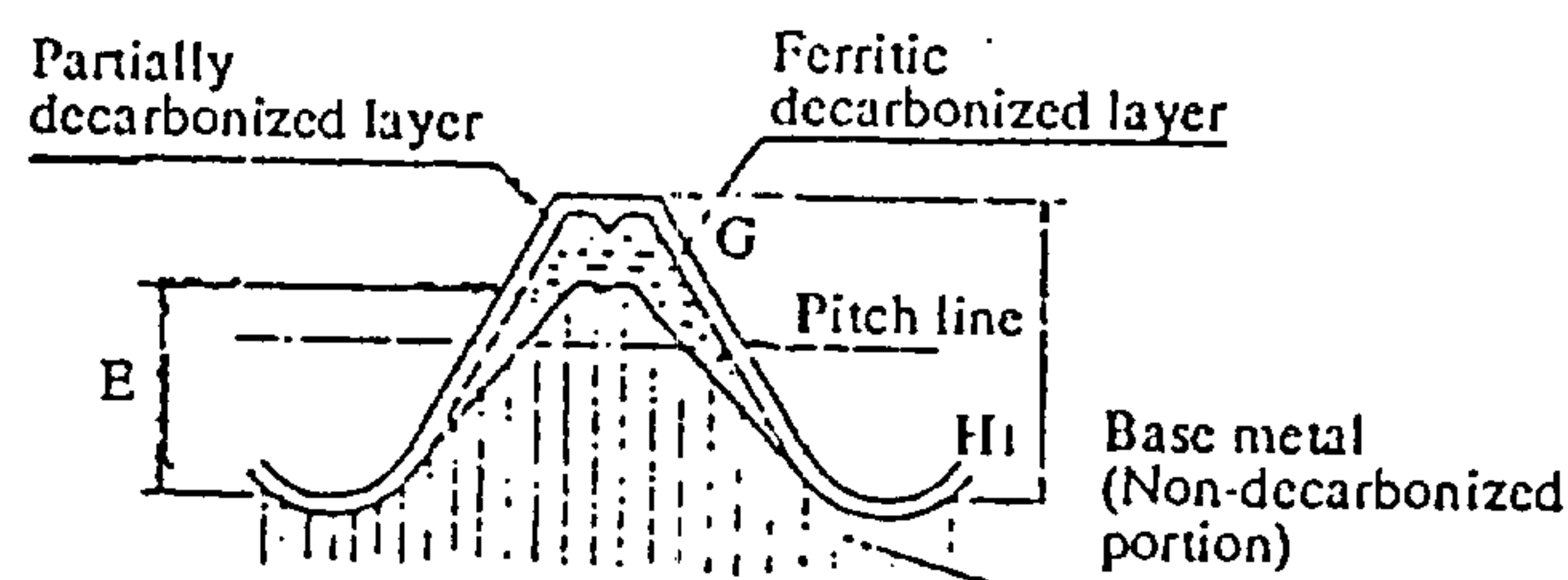
- *1 l shows the nominal length (mm).
- *2 The rupture of a product shall occur in the threaded portion or in the body, and shall not occur at the joint of the head and the body.
- *3 The shape of rupture shall be of a or b in Fig. 2.

Fig. 2 Shape of rupture



- *4 When the yield point of a threaded part is clear and accurate, it may be adopted.
When the yield point is not clearly given, it shall be according to the proof stress at 0.2% in permanent set.
- *5 Ratio of the proof load stress and the minimum yield point (or the minimum proof stress). 6.7 and 6.8 are only references.
- *6 The permanent set to the proof load stress shall be 12.5 μ m or less. 6.7 and 6.8 are only references.
- *7 Except for doubts, the surface hardness may be measured by converting into HR30-N according to SAE J417.
- *8 In case of full threaded bolt, crack may occur at the first ridge of head side as far as no crack occur at the joint of head and shank.
- *9 Refer to Fig. 3. Heat treatment in carburizing atmosphere shall not be performed since it causes lag rupture.

Fig. 3 Decarbonization of threaded portion



H_1 : Height of the thread in the maximum body of the external thread
[As for H_1 and E (minimum), refer to the Table below]

Table Values of H₁ and E (minimum)

Unit: mm

Pitch of Thread			0.8	1	1.25	1.5
H ₁			0.491	0.613	0.767	0.920
E (min.)	Strength division	8.8	0.245	0.307	0.384	0.460
		10.9	0.327	0.409	0.511	0.613

5. Shapes and Dimensions

The shapes and dimensions of the bolt shall be in accordance with Attached Table 1 to the shape of the head shall be upset type. However, when the quantity of the bolt is a little, the head may be of trim type.

6. Thread

The threads of the bolts shall be in accordance with Table 3.

Table 3 Threads

Type of Threads	Limits of Sizes	
	Before plating	After plating
Metric coarse screw thread of KS B 0201 * ³	6 g in KS B 0211* ¹	4 h in KS B 0211* ¹
Metric fine screw thread of KS B 0204 * ⁴	6 g in KS B 0214* ²	4 h in KS B 0214* ²

*¹ JIS B 0209 *² JIS B 0211 *³ JIS B 0205 *⁴ JIS B 0207

7. External Appearance

The appearance of the bolt shall conform to the requirements of 10 in surface roughness and also shall be in accordance with the following (1) to (4).

- (1) The washer assembled to the bolt proper shall be rotatable freely and shall not easily slip out of the threaded portion. In use of it, no harmful interference shall exist between the underhead fillet of the bolt proper and the inside diameter of the washer.
- (2) The surface discontinuity of the bolt proper shall be in accordance with KES C-C018.
- (3) There shall be no defects harmful for use, such as flush, burr, rough surface, rust etc. on the surface of the bolt proper.
- (4) The surface of the washer shall be smooth and no defects such as cracks, remarkable flaws, burrs, rough surface, rust, etc. shall exist on the surface.

8. Materials

8.1 Materials of bolt proper: The materials of the bolt proper shall be in accordance with Table 4.

Table 4 Materials of bolt proper

Strength Division	Tempering temperature	Material	
		Symbol	Applicable standard
6.7	—	SWCH25K	* ¹ KS D 3697
6.8		S25C	* ² KS D 3752
		TS25C-6B-C	KES B-B017
8.8	Above 490°C	SWCH38A	Maker's standard (Sumitomo Metal Ind., Ltd., Kobe Steel Ltd.)
	Above 520°C	S43C	* ² KS D 3752
	Above 530°C	SWCH45K	* ¹ KS D 3697
		S45C	* ² KS D 3752
10.9	Above 500°C	SCr430	* ³ KS D 3707
		TSCr430	KES B-B007
	Above 520°C	SCM435	* ⁴ KS D 3711

*¹JIS G 3539 *²JIS G 4051 *³JIS G 4104 *⁴JIS G 4105

8.2 Materials of washer: The materials of the washer shall be in accordance with Table 5.

Table 5 Materials of washer

Type of Washer	Material	
	Symbol	Standard
Plain washer	SPCC	* ¹ KS D 3512
	SPHC	* ² KS D 3501

*¹JIS G 3141 *²JIS G 3131

9. Surface Treatment

The surface treatment of the bolt consists of the standard surface treatment (hereinafter referred to as standard treatment) and the derivative surface treatment (hereinafter referred to as derivative treatment). They shall be in accordance with the followings.

9.1 Standard treatment: The standard treatment is applied to the bolt conforming with the base type number and this treatment shall be in accordance with Table 6.

Remark: Plated bolts shall be treated with the process to remove brittleness before applying chromate finishing according to KES C-F002.

Table 6

Standard Treatment	Description of part	Applicable Standard
MFZnT1 -C	9 digits part number (Example: 90720 0816)	KES C-F002 (Plating)

9.2 Derivative treatment: The derivative treatment is applied to the bolt conforming with the derivative type number and this treatment shall be in accordance with KES A-A006.

10. Finishing Condition

As for the finishing condition, the surface roughness of the bearing surface of the bolt shall conform to KES C-A013, 3.2a, and the surface roughness of the top face, of the head, side of the head and the body shall conform to KES C-A013, 6.3a.

Also, the threaded portion shall be finished smoothly.

11. Quality Rank

The quality rank of the bolt shall be in accordance with Table 7.

Table 7

Inspection Item		Quality Rank
Mechanical properties	Wedge tensile strength	A
	Smooth tensile strength of products	
	Yield point (or proof stress)	
	Proof load stress	
	Core hardness	
	Surface hardness	
	Head hitting strength	
	Decarbonization	
Shapes and dimensions	Radius under head	B
Surface discontinuity	Forging crack	
	Transverse discontinuity	
	Seam	
	Burst	
	Nick or gauge	
	Lap	

12. Inspection

12.1 Inspection of mechanical properties: The inspection of the mechanical properties of the bolt proper shall be carried out according to KES C-C001 and its results shall satisfy 4.

12.2 Inspection of shapes and dimensions: The inspection of the shapes and dimensions shall be carried out according to the method for measuring the dimension of each portion specified in JIS Z 1071 or another method equivalent to this, and the results shall satisfy 5. Furthermore, in the inspection of the effective height (g) of the hexagon head, the head may be considered to conform to the requirement if the top face of the bolt head does not stick out of the ring when putting a check ring gauge specified in Table 8 on the bolt head without inclining it as shown in Fig. 4.

Table 8 Ring gauge

Unit: mm

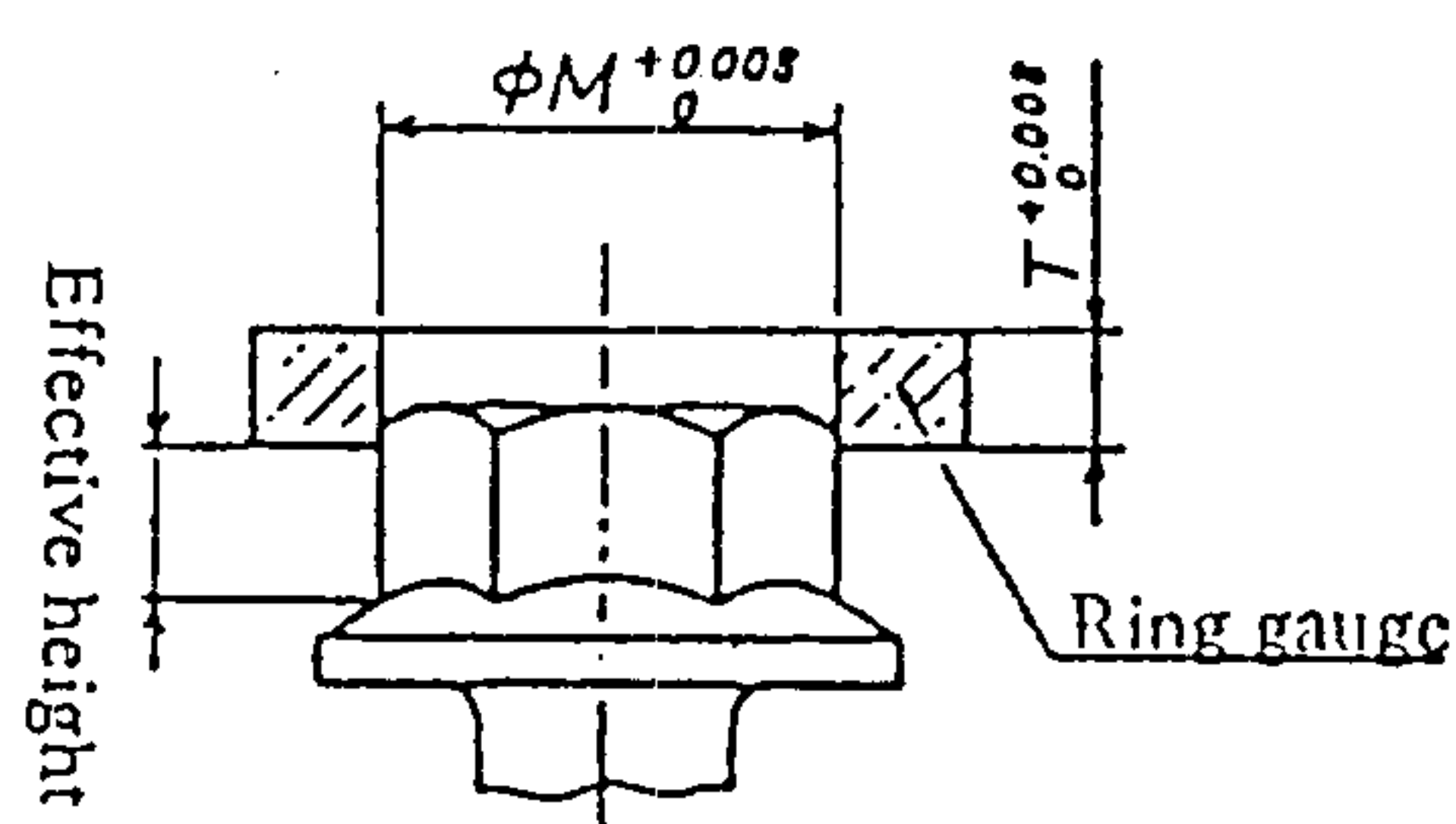
Nominal Diameter of Thread	5	6	8	10	12	14
Width across flats	8	10	12	14	17	19
M	8.87	11.05	13.25	15.51	18.90	21.10
T	0.9	1.08	1.44	1.80	2.16	2.52

Remarks 1. The outside diameter of the ring gauge may be optional.

2. The edge of the hole shall be of a right angle and with no roundness nor chamfer.

Fig. 4

Unit: mm



12.3 Inspection of thread: The inspection of threads shall be carried out according to the method of verification for size and geometry of threaded fasteners specified in *1KS B 0239 or another method equivalent to this, and the results shall satisfy 6. For a GO thread ring gauge used for an electroplated thread, one of 4 h shall be used.

*1JIS B 1071

Remark: The time when changing the gauge with the change of limits of size shall be determined by mutual consent of the contractor and our inspection department.

12.4 Inspection of appearance: The inspection of appearance shall be carried out according to the following (1) to (4), and the results shall satisfy 7.

(1) The rotation and slipout of washer shall be inspected visually.

(2) For the surface discontinuity, check the presence of discontinuity visually or through a magnifying glass. The width and the depth of the defect shall be measured under a microscope.

However, the depth shall be measured on the cross section if necessary.

(3) The surface roughness shall be inspected by *¹KS B 0507 or *²KS B 0501.

(4) Defects such as flush, burr, rust, etc. shall be inspected visually.
*¹JIS B 0659 *²JIS B 0651

12.5 Inspection of surface treatment: The inspection of surface treatment shall be carried out according to Table 9, and the results shall satisfy the applicable requirements.

Table 9

Surface Treatment	Applicable Standard
Standard treatment	KES C-F002
Derivative treatment	Applicable KES * ¹

*¹ When no standard has been established as KES, this treatment shall be done according to the standards agreed upon by the contractor and Kia such as minimum acceptable samples.

13. Submission of Test Results

The test results of bolts shall be submitted to the Kia Inspection Department in charge of it according to KES C-C001.

14. Alteration of Specification

The bolt specifications may be altered only after the revision of this standard. This standard is revised following the specified proceedings and in accordance with the KES Proposal System.

15. Designation of Part

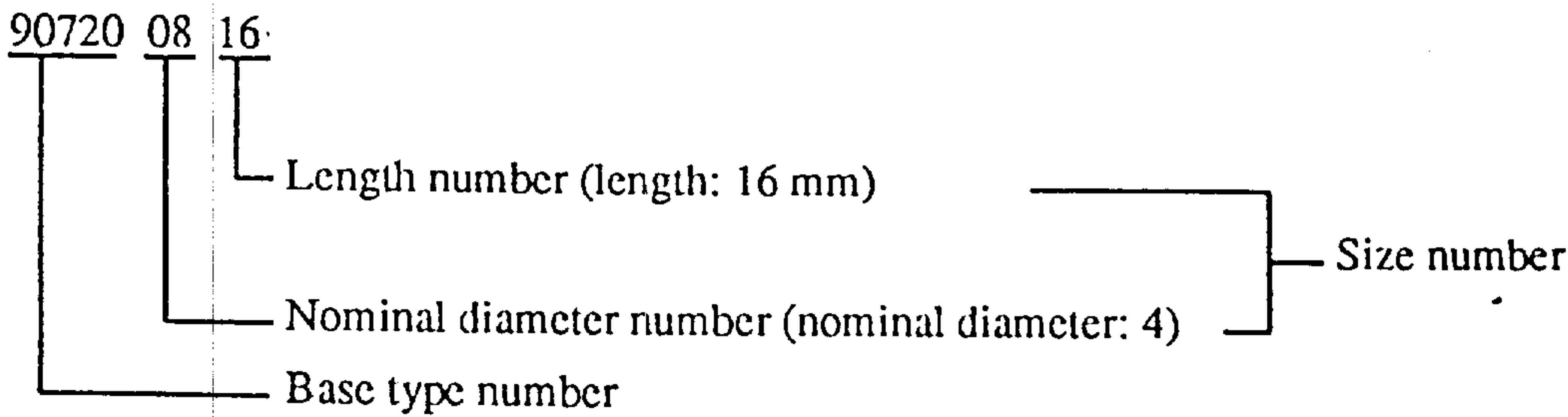
The designation of the hexagon flange bolt and the hexagon flange bolt and washer assembly mentioned in a drawing and a related document shall be BOLT, and Washer and Bolt respectively.

16. Structure of a Part Number

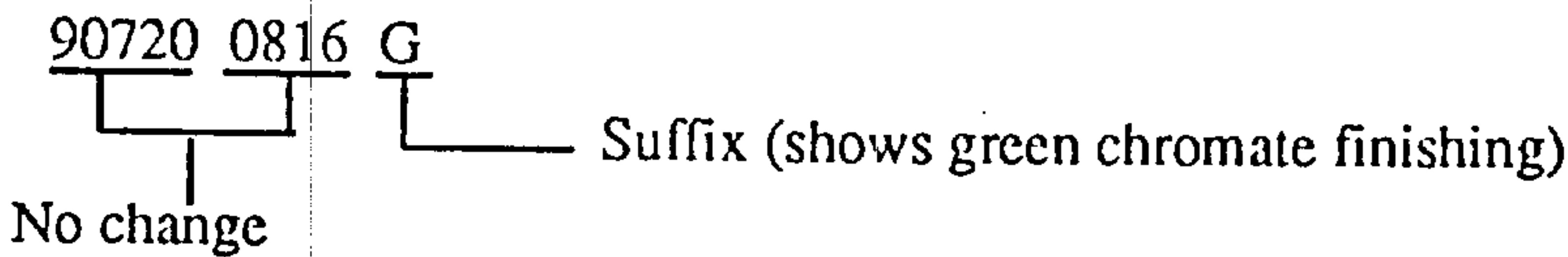
The structure of a part number shall conform to the following examples.

Remark: The details of the structure and the application of the part numbers shall be in accordance with KES A-A006.

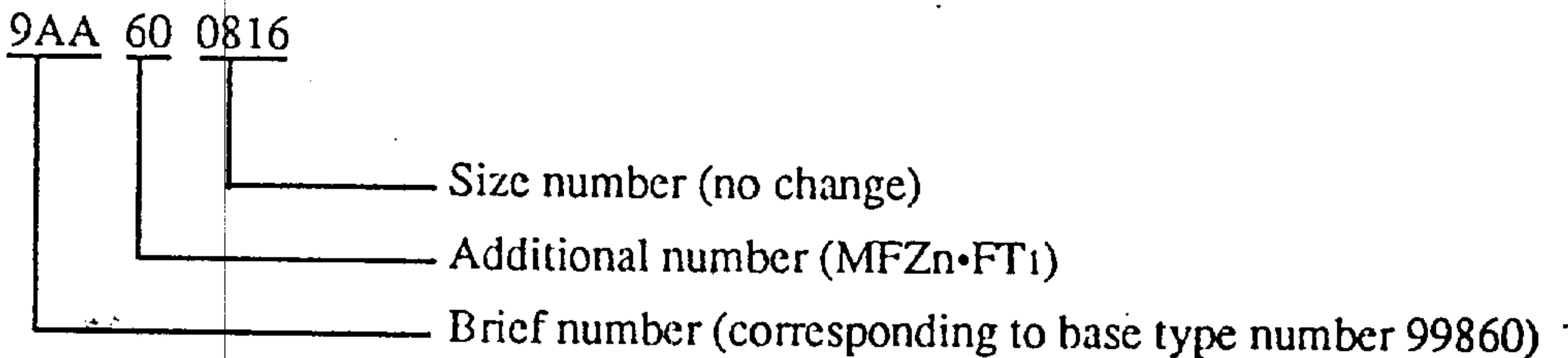
Example 1. In case of the standard treatment (MFZnT1 -C)



Example 2. In case of changing the only chromate finishing of the standard treatment.



Example 3. In case of derivative treatment (changing into MFZn•FT1 -C)



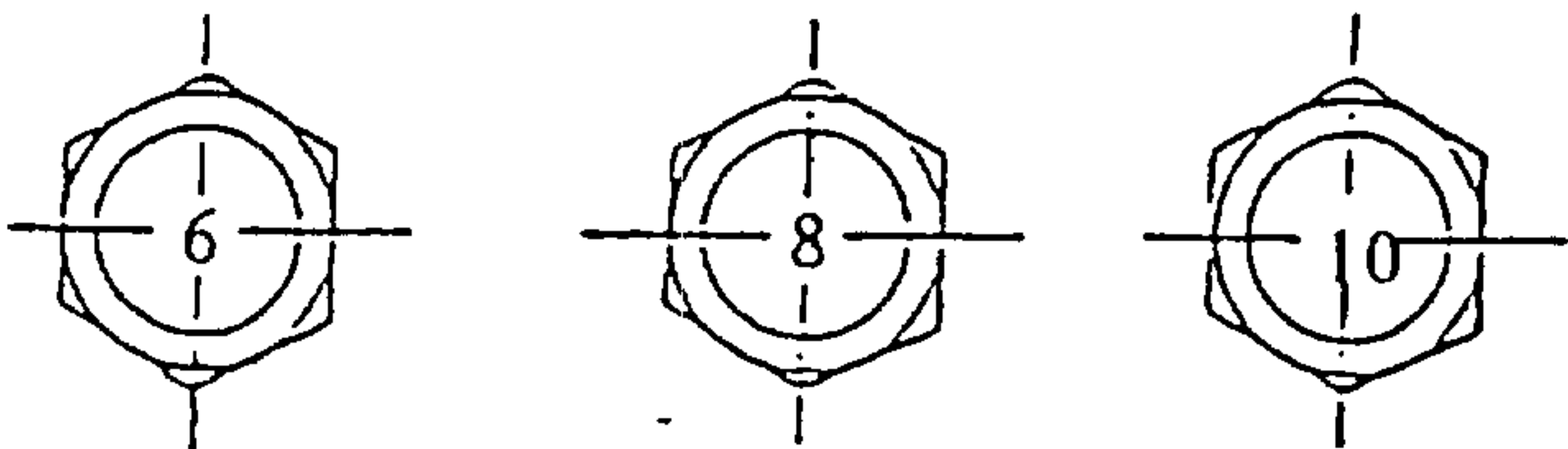
17. Indication of Strength Division

The strength division of bolts shall be indicated according to Table 10. The symbol may be marked by either of embossed printing and stamping, providing that it is marked clearly.

Table 10

Strength Division	6.7	8.8	10.9
Indication Symbol	6	8	10

Symbols for upset type heads



18. Report of Effective Date

Delivery schedule concerning the following (1) shall be submitted to Development Standardization Group within one month from the standard revision. And delivery notice concerning the same shall be submitted to Development Standardization Group on first delivery and on competition of changing all parts. However, when the effective date must be decided concretely, it shall be decided on consulting between the customer and Development Standardization Group.

(1) Indication symbol b at strength division of 6.8 or 6.7 bolt has been changed into 6.

19. Quoted Standard

SAE J 417	(HARDNESS TESTS AND HARDNESS NUMBER CONVERSIONS)
JIS B 0101	(Glossary of Terms Relating to Fasteners)
JIS B 0205	(Metric Coarse Screw Threads)
JIS B 0207	(Metric Fine Screw Threads)
JIS B 0209	(Limits of Sizes and Tolerances for Metric Coarse Screw Threads)
JIS B 0211	(Limits of Sizes and Tolerances for Metric Fine Screw Threads)
JIS B 1021	(Tolerance System for Threaded Fasteners)
JIS B 1071	(Method of Verification for Size and Geometry of Threaded Fasteners)
JIS B 1180	(Hexagon Head Bolts Hexagon and Head Screws)
JIS B 1251	(Spring Lock Washers)
JIS G 3131	(Hot-Rolled Mild Steel Plates, Sheets and Strip)
JIS G 3141	(Cold Rolled Carbon Steel Sheets and Strip)
JIS G 3505	(Low Carbon Steel Wire Rods)
JIS G 3506	(High Carbon Steel Wire Rods)
JIS G 3539	(Carbon Steel Wires for Cold Heading and Cold Forging)
JIS G 4051	(Carbon Steels for Machine Structural Use)
JIS Z 2244	(Method of Vickers Hardness Test)
JIS Z 2245	(Method of Rockwell and Rockwell Superficial Hardness Test)
JASO F 101	(Hexagon Head Bolt)
JASO F 109	(Hexagon Head Bolt and Screw and Washer Assemblies)
KES A-A006	(Structure and Application of Standard Part No.)
KES C-A013	(Surface Roughness)
KES C-C001	(Mechanical Properties of Bolts and Screws)
KES C-C018	(Surface Discontinuity of Threaded Fastener)
KES C-F002	(Plating)
KES C-F004	(Chromium-Contained Zinc Coating)
KES E-A001	(Sealing Coat)
KES B-B017	(Steel for Cold Forging (Coil Material))