

Hexagon Bolt and Washer Assemblies

KES E-A030

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1. Scope of Application

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

Remarks 1. In this standard, only the bolt itself is called bolt proper and only the washer itself is called washer.

2. As for bolts other than hexagon head bolts, refer to KES E-A019 (Cross Recessed Head Machine Screw and Washer Assembly).

3. Bolts required weldability, heat resistance at 300℃ or more and cold resistance at -50℃ or less shall be excluded.

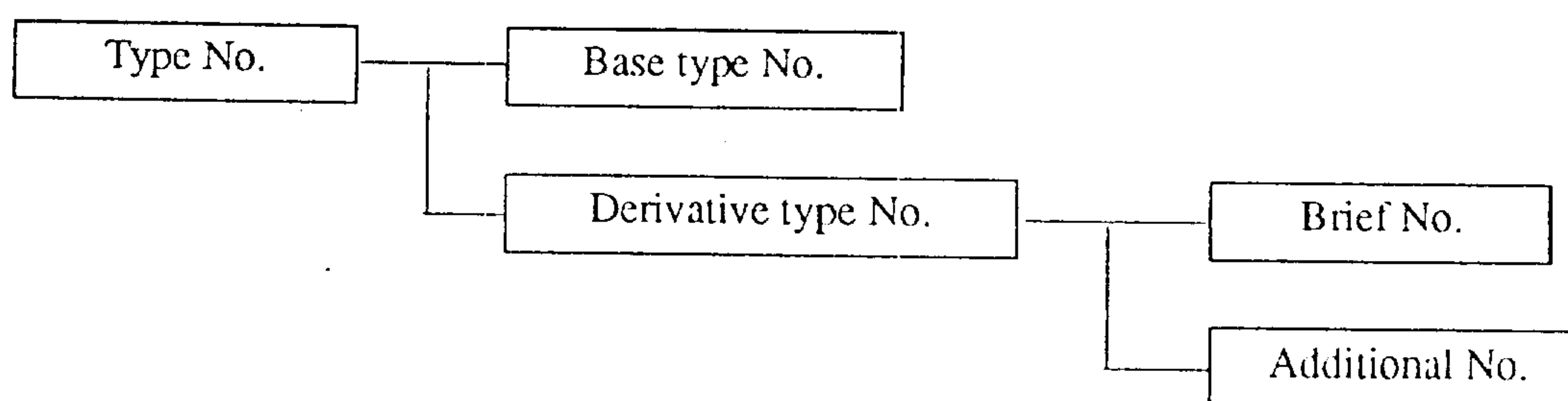
2. Purpose

This standard aims at giving commonness to part of the bolt and at securing the 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 17. 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-A 006

Table 1

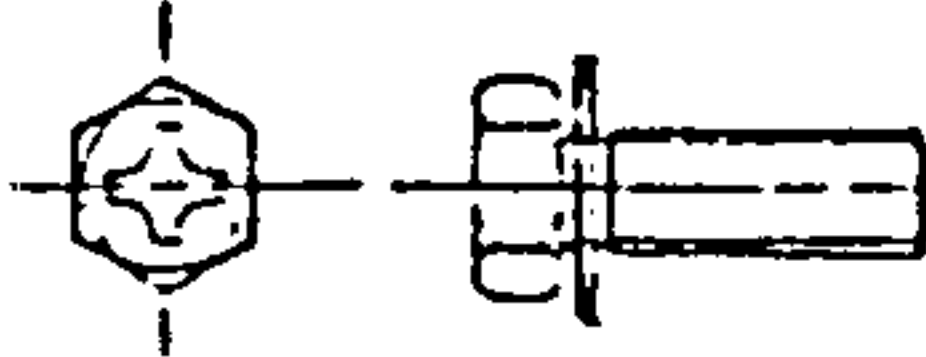
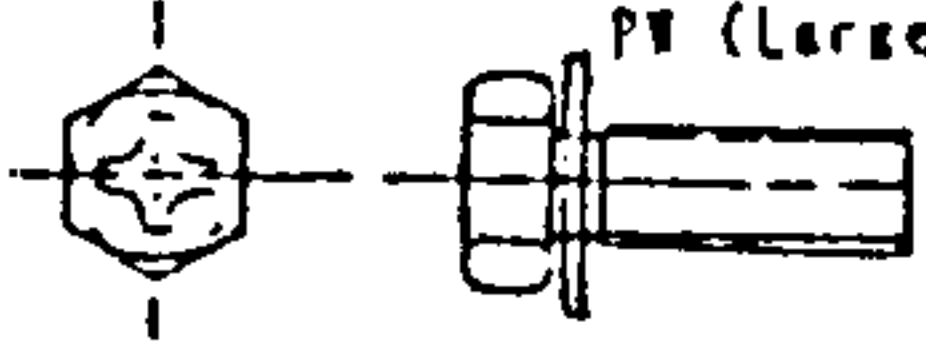
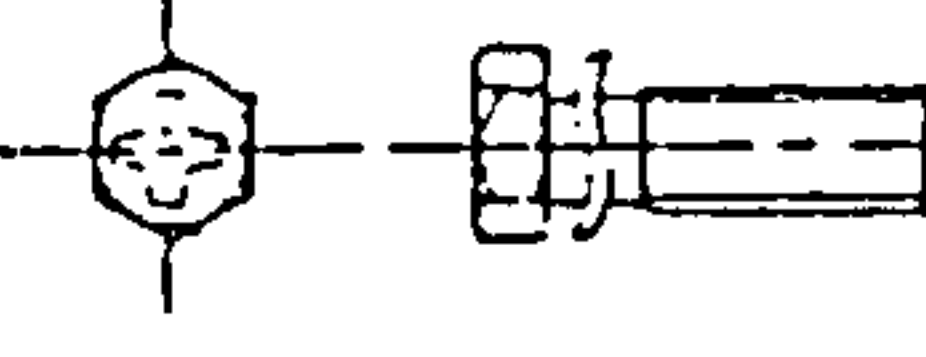
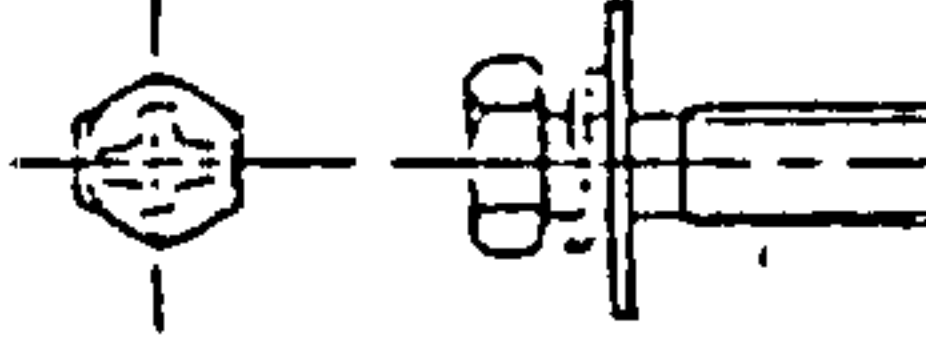
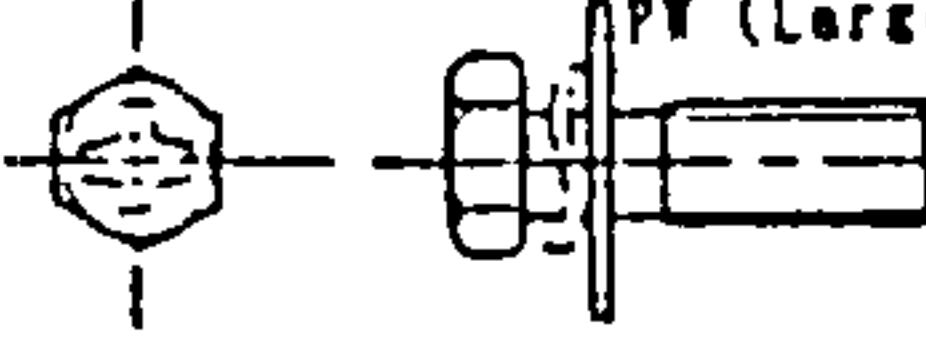
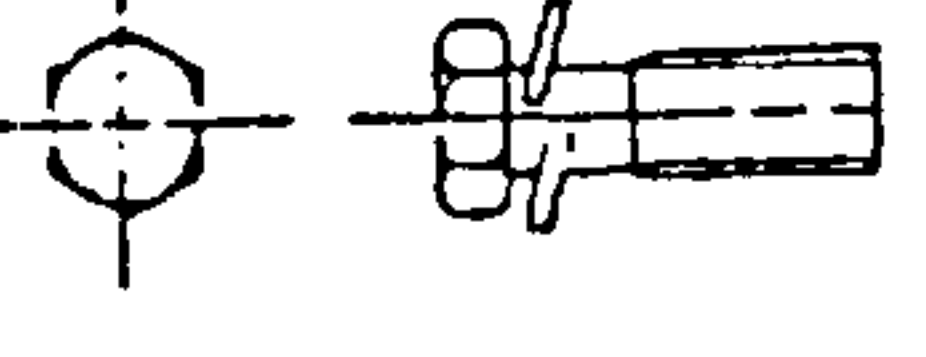
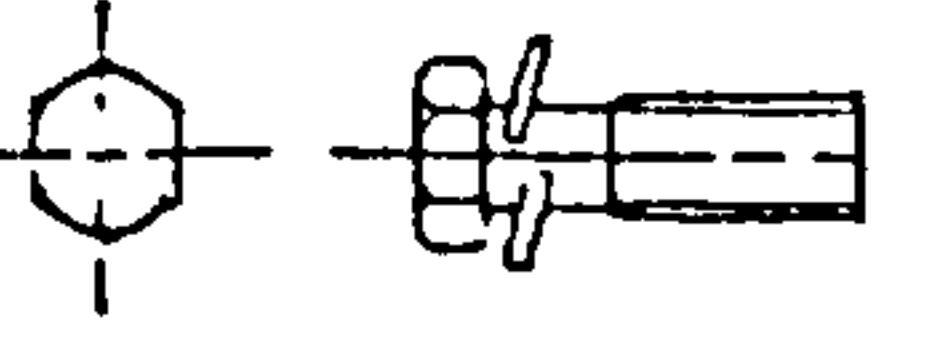
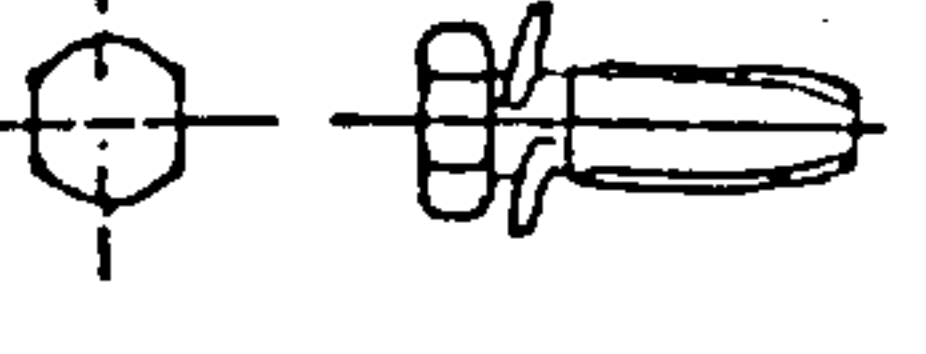
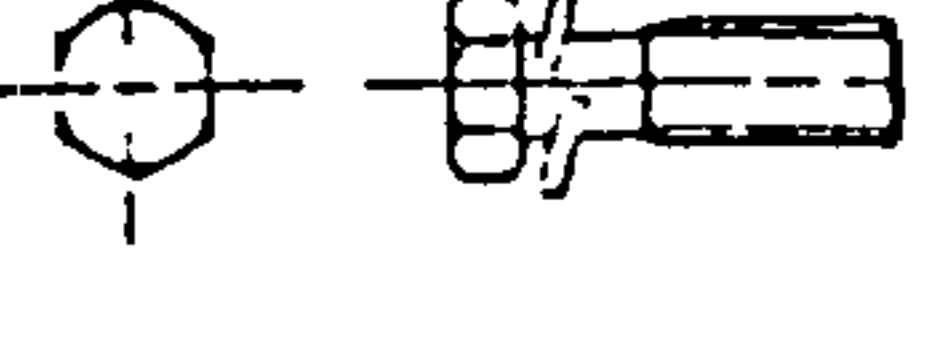
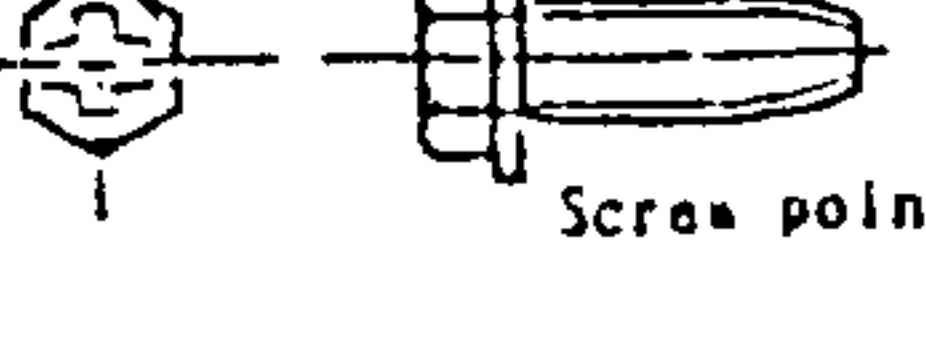
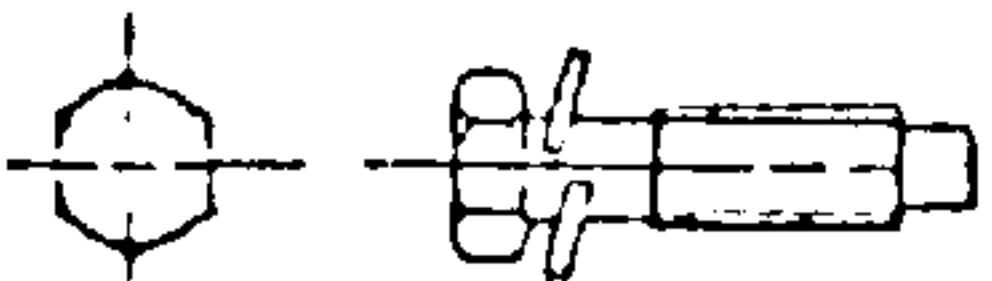
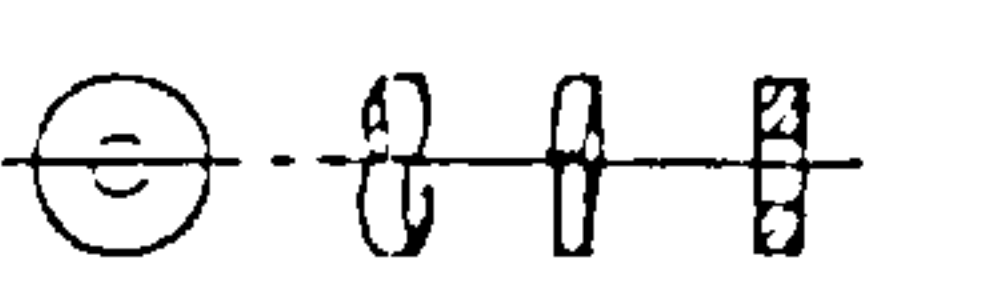
Strength Division	Base Type No. (Brief No.)	Applicable Size of Thread					Shape	Working Standard	At- tached Table	Page
		M4	M5	M6	M8	M10				
4.8	907971 (9IIP)	○	○					Generally used.	1	20
	90797 (9IHI)			○				To be used for a large (clearance hole)mating hole or a long mating hole	2	21
	907972 (9IHR)		○	○				Conform to a working standard of attached Table 3.	3	22
	907976 (9HS)		○	○				Conform to a working standard of attached Table 4.	4	23
	907977 (9HT)		○	○				Conform to a working standard of attached Table 5.	5	24
6.7 6.8	908012 (9JL)				○			Generally used.	6	25
	908062 (8JR)			○				Generally used.	7	26
	90810 (9KA)					○		To be used where seizure of thread often occurs in tightening.	8	27
	90811 (9KB)				○			Generally used.	9	28
	90721 (9AB)			○	○			1. To be used where seizure of thread often occurs in tightening. 2. To be used where a large bolt hole is closed.	10	29

Table 1 (Continued)

Strength Division	Base Type No. (Brief No.)	Applicable Size of Thread					Shape	Working Standard	At- tached Table	Page
		M4	M5	M6	M8	M10				
6.7 6.8	908042 (9JN)			○	○			1. To be used where many bolts are tighten with a nut runner at the same time. 2. It is used when a position of a mating internal thread is difficult to be found and the end Point is unpointed.	11	30
	908016 (9JM)				○			Generally used.	12	31
	908066 (9JS)			○				Generally used.	13	32
	908017 (9JU)				○			To be used for a large (clearance hole)mating hole or a long mating hole	14	33
8.8	908067 (9JT)			○				To be used for a large (clearance hole)mating hole or a long mating hole	15	34
	907812 (9GM)			○	○			Generally used.	16	35
	907816 (9GN)			○	○			Generally used.	17	36
	907832 (9GR)				○			To be used to tighten a door hinge	18	37
Shape and Size of Washer		—						—	19	38
Geometrical Tolerance		—					—	—	20	39

Remarks 1. The bolt marked with a circle in the applicable size of thread column are specified in this standard.

2. The shape of 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

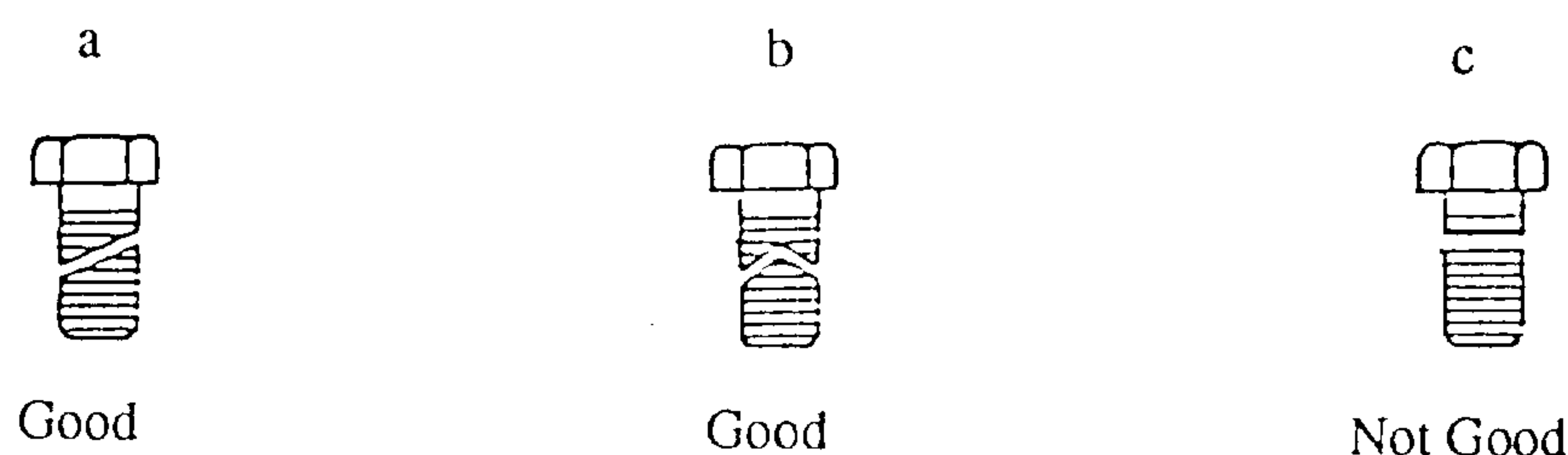
4.1 Mechanical properties of bolt

Table 2

Strength Division					4.8	6.7	6.8	8.8
Test Item						$l > 50^{*1}$	$l \leq 50^{*1}$	$d \leq 16$
Tensile strength *2	Product	Wedge tensile strength *3	kg f/mm^2 (N/mm^2)	Min.	40 {392}	60 {588}		80 {785}
		Smooth tensile strength						
	Test piece	Smooth tensile strength		Max.	55 {539}	80 {785}		100 {981}
Yield Point (or Proof Stress)	Product	Both ends measurement	kg f/mm^2 (N/mm^2)	Min.	32 {314}	42 {412}	48 {471}	64 {628}
	Test piece	Both ends measurement						
		Gauge length measurement (JIS method)						
Proof Load Stress	Stress ratio *5			—	0.91			
	Stress *6			—	29.1 {285}	38.2 {412}	43.7 {428}	58.2 {571}
Hardness	Core hardness	Brinell hardness	HB	Min.	116	170		—
				Max	229	245		
		Rockwell hardness	HRB	Min.	62	88		—
				Max.	88	102		
			HRC	Min.	—			21
				Max.	—			32
	Sureface hardness *7			HV	Max.	—		320
Elongation after rupture			%	Min.	14	8		12
Impact energy			$\text{kg f} \cdot \text{m}$ (J)	Min	—	—		3.1{30.4}
Head hitting strength				—	No cracks at the joint of the head and the body. * 8			
Decarbo- nization of Thread * 9	Height of non-decarbonized Portion E			Min.	—			1/2 Hr
	Depth of ferritic decarbonized layer G mm			Max.	—			0.015

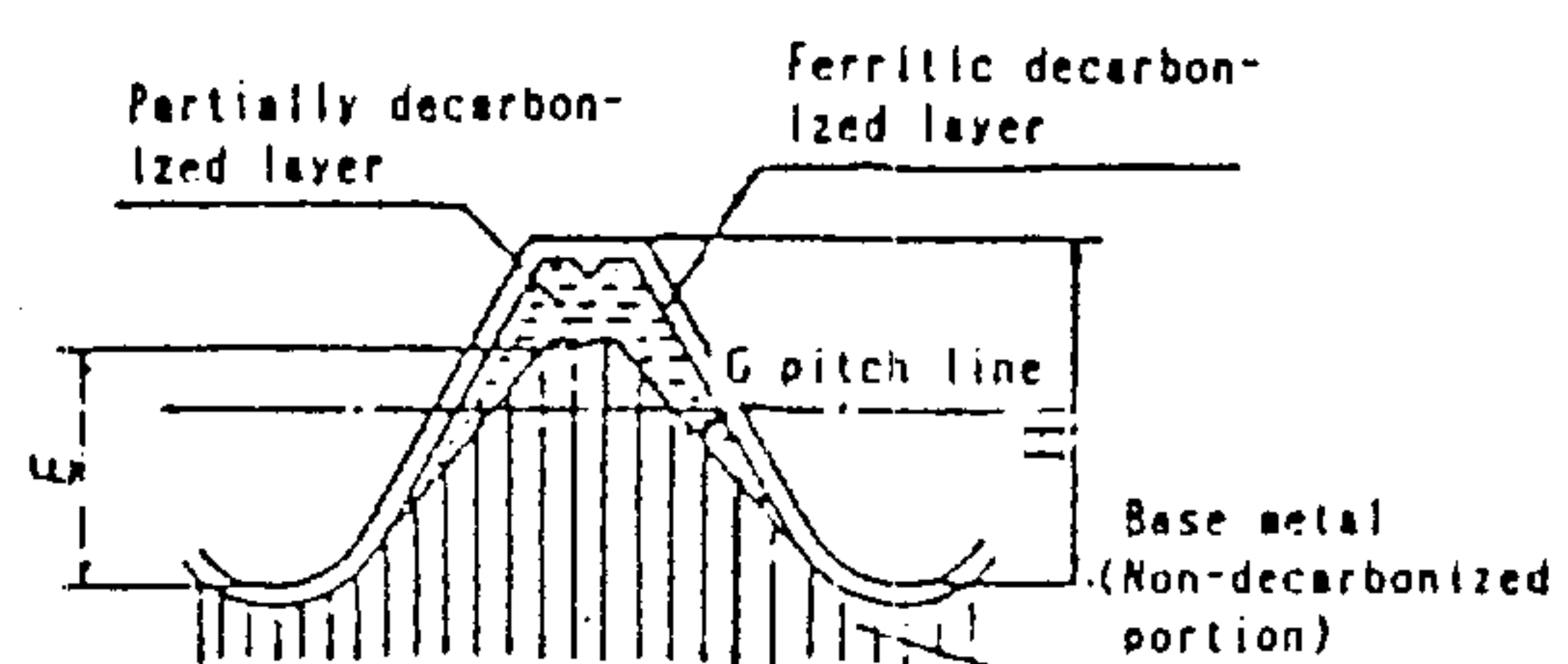
- *1 l Shows the nominal length(mm).
- *2 The rupture of a product shall occur in the threaded portion or in the body, and shall not occur at the joint of the head and the body.
- *3 The shape of rupture shall be of a or b in Fig. 2.

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 stress at 0.2% in permanent set.
- *5 Ratio of the proof load stress and the minimum yield point (or minimum proof stress) 6.7 and 6.8 are only references.
- *6 The permanent set to the proof load stress shall be $12.5\mu\text{m}$ or less. 6.7 and 6.8 are only references.
- *7 Except For doubts, the surface hardness may be measured by converting into HR 30-N according to SAE J 417.
- *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 the carbonizing atmosphere shall not be performed since it causes the 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]

Unit : mm

Pitch of Thread			0.7	0.8	1	1.25
H ₁			0.429	0.491	0.613	0.767
E (min)	Strength division	8.8	0.215	0.245	0.307	0.384

4.2 Mechanical properties of washer : Mechanical properties of the washer shall conform to Table 3.

Table 3

Type of Washer Mechanical Properties	Plain Washer	Spring washer	Wave Spring Washer
Hardness	—	HRC42 to 50	HRC42 to 48
Spring function		Free height shall be 1 2/3 times min. as large as thickness in testing by JIS B 1251.	Free height shall be 1 1/3 times min. as large as thickness in testing by JIS B 1251.
Toughness		These shall not break at torsion angle below 90° in testing by JIS B 1251.	

5. Shapes and Dimensions

- (1) The shapes and dimensions of the bolt except for a cross recess shall conform to Attached Table 1 to 18. The shape of the head shall be upset type. However, when the quantity of the bolts is a little, the head may be of trim type.
- (2) The shapes and dimensions of the cross recess formed on the bolt head shall be of H-type JIS B 1012. However, the length of a cross recess M and the gauge sinking depth Q and Q1 shall conform to Attached Table 1 to 5 and 9.
- (3) The shapes and dimensions of the washer shall conform to Attached Table 19.

6. Thread

The thread of the bolt shall conform to Table 4.

Table 4

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

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

7. Geometric Tolerance

Geometric tolerance of the bolt shall conform to Attached Table 20.

8. External Appearance

As for the external appearance of the bolt, its surface roughness shall conform to the following (1) to (4) as well as the requirement of 11.

- (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 conform to KES C-C018
- (3) There shall be no defects harmful to use, such as flush, burr, rough surface rust, etc. on the surface of bolt proper.
- (4) The surface of the washer shall be smooth and have no defects such as crack, remarkable flaw, burr, rough surface, rust, etc.

There shall be no remarkable burr on the cut edge of a spring washer, and there shall be no lap in fully compressing the washer.

9. Materials

9.1 Materials for bolt proper: Materials of the bolt proper shall conform to Table 5.

Table 5

Strength Division	Tempering Temperature	Material	
		Symbol	Pertinent standard
4.8	—	SWRM10	* ¹ JIS D 3505
		S10C, S12C	* ¹ KS D 3752
6.7 6.8	—	SWCH25K	* ² KS D 3697
		S25C	* ¹ KS D 3752
		TS25C-6B-C	KES B-B017
8.8	490℃ min	SWCH38A	Maker' s standard (Sumitomo Metal Ind., Lts., Kobe Steel Ltd.)
	520℃ min	S43C	* ¹ KS D 3752
	530℃ min	SWCH45K	* ² KS D 3697
		S45C	* ¹ KS D 3752

*¹JIS G 4051 *²JIS G 3539

9.2 Materials for washer: Materials for the washer shall conform to Table 6. Table 5.

Table 6

Type of Washer	Material	
	Symbol	Standard
Plain washer	SPCC	* ¹ KS D 3512
	SPHC	* ² KS D 3501
Spring washer	SWRH57 to SWRH77	* ³ KS D 3559
Wave spring washer	SWRH62 to SWRH72	

*¹JIS G 3141 *²JIS G 3131 *³JIS G 3506

10. Surface Treatment

The surface treatment of the bolts 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 conform to the following.

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

10.1 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 7.

Table 7

Standard Treatment	Description of Part	Pertinent Standard
MFZnT1-C	9 digits part No. (Example:90721 0816)	KES C-F002 (Plating)

10.2 Derivative Treatment: The derivative treatment is applied to the bolt conforming with the derivative type number and this treatment shall be according to KES A-A006

11. 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, the head side, and the body shall conform to KES C-A013, 6 3a

Also, the threaded portion shall be finished smoothly.

12. Quality Rank

The quality rank of the bolt shall be according to Table 8.

Table 8

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	

Table 8(Continued)

Inspection Item		Quality Rank
	Head hitting strength	A
	Decarbonization	
Shapes and dimensions	Radius under head	
Surface Discontinuity	Forging crack	B
	Transverse discontinuity	
	Scam	
	Burst	
	Nick of gouge	
	Lap	

13. Inspection

13.1 Inspection of mechanical properties

13.1.1 Inspection of mechanical properties of bolt proper: The inspection of the mechanical properties of the bolt proper shall be carried out according to KES C-C001 and its results shall satisfy 4.1.

13.1.2 Inspection of mechanical properties of washer: The inspection of the mechanical properties of the washer is as follows. The washer used for the test shall be the one cutting and pulling out the shank of the thread proper.

(1) Hardness: The inspection of hardness shall be carried out according to KS B 0806*¹ and its results shall satisfy 4.2.

*¹JIS Z 2245

(2) Spring function and toughness: The inspections of spring function and toughness shall be carried out according to JIS B 1251 and their results shall satisfy 4.2.

Remarks 1. For the inspection of hardness, hardness may be measured after grinding the surface of the Washer Slightly.

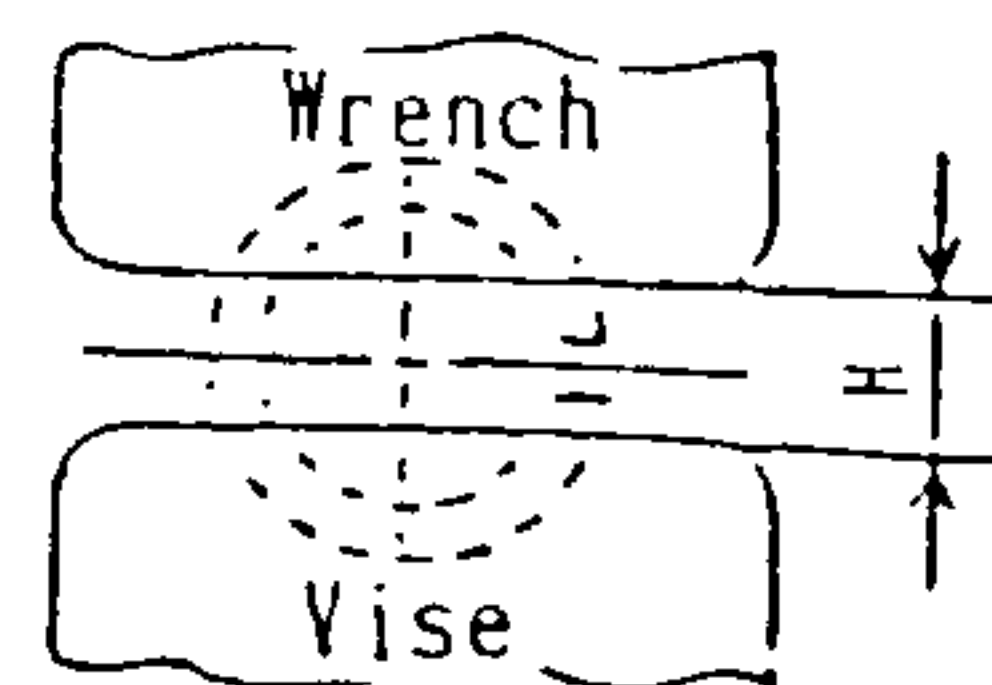
2. In the torsion test of the wave spring washer, an interval H between the vice and the wrench is according to Table 9. (Refer to Fig.4.)

Table 9

Unit : mm

Nominal Designation of thread	M4	M5	M6	M8	M10
H	3.5	4.5	6	7	8.5

Fig. 4



- 13.3 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 KS^{*1} B 0239 or other method equivalent to this, and the results shall satisfy 5.

However, as for cross recess, the inspection shall be carried out according to the method specified in KS B 0230^{*2}

- 13.4 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 ^{*1}KS B 0239 or other 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.

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

- 13.5 Inspection of geometric deviation: The inspection of geometric deviation shall be carried out according to method for measuring the geometric deviations specified in KS B 0239^{*1} or other method equivalent to this, and the results shall satisfy 7.

- 13.6 Appearance Inspection: The appearance inspection shall be carried out according to the following (1) to (4), and the results shall satisfy 8.

(1) The rotation and slip out of a 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 ^{*3}KS B 0507 or ^{*4}KS B 0501.

(4) Defects such as flush, burr, rust, etc. shall be inspected visually.

- 13.7 Inspection of surface treatment: The inspection of surface treatment shall be carried out according to Table 10, and the results shall satisfy pertinent requirements.

^{*1}JIS B 1071 ^{*2}JIS B 1012 ^{*3}JIS B 0659 ^{*4}JIS B 0651