

Cross-Recessed Head Machine Screw and Washer Assembly

KES

KES E-A019

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1. Scope of Application

This standard specifies the steel cross-recessed head machine screw and washer assembly for general use. The cross-recessed head machine screw and washer assembly (hereinafter referred to as the "assembled machine screw") is so threaded by rolling that the washer can not slip out after the washer is assembled on the blank of the cross-recessed head machine screw (hereinafter referred to as the "machine screw proper").

Remark: Machine screws having a hexagon head shall be specified in KES E-A004 (Hexagon Head Bolt), KES E-A007 (Hexagon Flanged Bolt) and KES E-A030 (Bolt and Washer Assembly).

2. Purpose

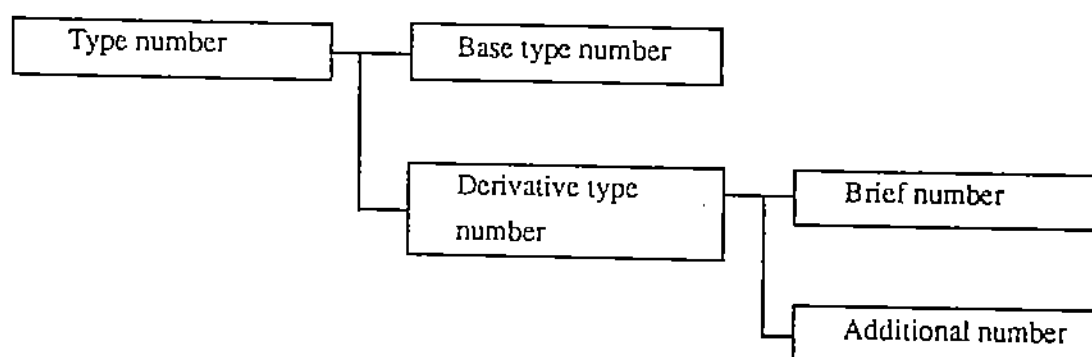
This standard aims at standardizing the assembled machine screw and securing the proper quality.

3. Type and Type Number

3.1 Type: The types of the assembled machine screw shall be 13 types as shown in Table 1.

3.2 Structure of type number: The structure of type number of the assembled machine screw shall conform to Fig. 1.

Fig. 1



3.3 Base type number: The base type number of the assembled machine screw, consisting of 5 English and numeral figures, shall be used when the standard surface treatment will be applied to the assembled machine screw. The base type number shall conform to Table 1.

3.4 Derivative type number: The derivative type number of the assembled machine screw, consisting of 5 English and numeral figures, shall be used when the surface treatment except for the standard surface treatment will be applied to the assembled machine screw. The derivative type number shall consist of the brief number and the additional number.

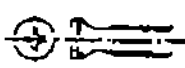
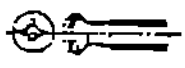
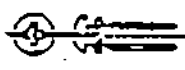
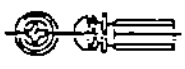
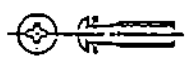
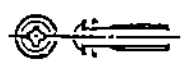
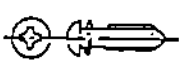
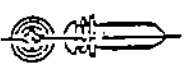
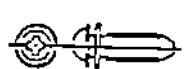
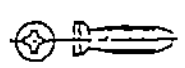
3.4.1 Brief number: The brief number is the shortening of the base number to 3 figures. The combination with the base type number is shown in Table 1.

3.4.2 Additional number: The additional number consists of 2 figures and represents the surface treatment except for the standard surface treatment. The combination of the additional

number and various surface treatments shall conform to KES A-A006 (Structure and Application of Standard Parts Number).

Table 1

The number in paranthese shows the brief number.

Material	Strength Division	Shape of Head	Shape of End	Combination of Washer*			Type Number	Attached Table	Page	Shape
				Toothed	Wave	Plain				
Carbon steel	4.8	Countersunk head	Unpointed end	○			908314 (9ML)	1	10	
		Oval countersunk head	Unpointed end	○			908324 (9MM)	2	13	
		Round head	Unpointed end		○		908332 (9MN)	3	16	
		Round head	Unpointed end		○	○	908336 (9MP)	4	19	
		Round head	Unpointed end		○	○	908337 (9MR)	5	22	
		Truss head	Unpointed end	○			908344 (9MS)	6	25	
		Flanged pan head	Unpointed end			○	90830 (9MA)	7	28	
		Oval countersunk head	Cone point	○			908374 (9MT)	8	31	
		Round head	Cone point		○		908382 (9MU)	9	34	
		Round head	Cone point		○	○	908386 (9MV)	10	37	
		Round head	Cone point		○	○	908387 (9MW)	11	40	
		Flanged pan head	Tapered point			○	90740 (9CA)	12	43	
	8.8	Flat head	Tapered point	○			907614 (9EL)	13	46	

* Toothed = Toothed washer

Wave = Wave spring washer

Plain = Plain washer

4. Mechanical Properties and Test Method

4.1 Machine screw proper: The mechanical properties and the test method of the machine screw proper shall conform to Table 2.

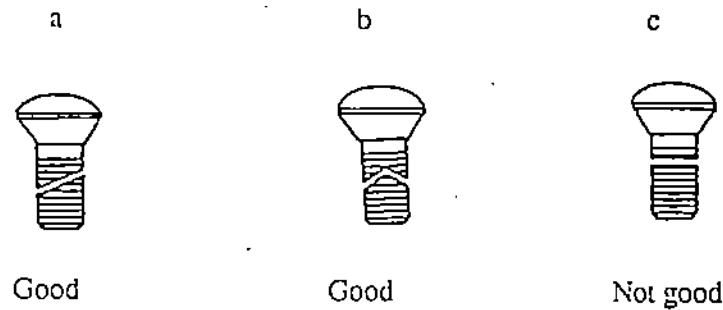
Table 2

Item		Test Method for Strength Division			4.8	8.8	Test Method
Tensile strength *1	Wedge tensile strength *2	kgf/mm ² {N/mm ² }	min.	40 {392}	80 {785}	KES C-C001	
	Even tensile strength		max.	55 {539}	100 {981}	KES C-C001	
Yield point or proof stress *3		kgf/mm ² {N/mm ² }	min.	32 {314}	64 {628}	KES C-C001	
Proof load stress		Stress ratio *4	—	0.91	0.91	KES C-C001	
		Stress *5	—	29.1 {285}	58.2 {571}	KES C-C001	
Hardness	Core hardness	Brinell hardness	min.	116	—	KES C-C001	
			max.	229	—	KES C-C001	
		Rockwell hardness	min.	62	—	KES C-C001	
			max.	88	—	KES C-C001	
			HRC	min.	—	21	KES C-C001
				max.	—	32	KES C-C001
	Surface hardness *6	HV	—	—	320	KES C-C001	
Elongation after rupture		%	min.	14	12	KES C-C001	
Impact energy		kgf·m {J}	min.	—	3.1 {30.4}	KES C-C001	
Head percussion strength			—	No cracks shall occur at the joint of the head and the body.		KES C-C001	
Decarbonization of threaded portion *8	Height of non-decarbonized portion E	min.	—	H1	KES C-C001		
	Depth of ferritic decarbonized layer G mm	max.	—	0.015	KES C-C001		

*1 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.

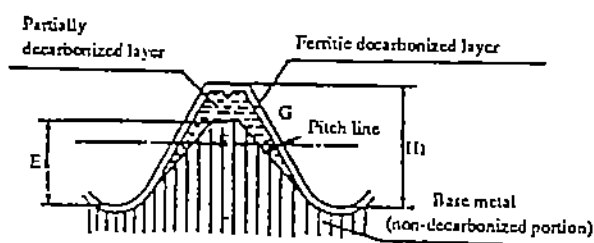
*2 The shape of rupture shall be of a or b in Fig. 1.

Fig. 1



- *3 When the yield point of a threaded fastener is clear and accurate, the value may be adopted. If the yield point is not clearly given, the proof stress corresponding to 0.2% permanent set shall be adopted.
- *4 Ratio of the proof load stress and the minimum yield point (or the minimum proof stress).
- *5 The permanent set to the proof load stress shall be 12.5 μ m or less.
- *6 Except for doubts, the surface hardness may be measured by converting into HR 30-N according to SAE J 417.
- *7 In case of complete screw thread, crack may occur at the first thread ridge of head side as far as no cracks occur at the joint of the head and the shank.
- *8 See Fig. 2. Heat treatment in the carburizing atmosphere shall not be performed since it causes the lag rupture.

Fig. 2 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 Table 3.]

Table 3 Values of H_1 and E (minimum)

(Unit: mm)

Pitch of Thread		1	1.25
H_1		0.613	0.767
E minimum	Strength division 8.8	0.307	0.384

4.2 Washer: The mechanical properties and the test method of washer shall conform to Table 4.

Table 4

Kind of Washer	Mechanical Properties and Applicable Standard of Test Method
Wave spring washer	MES GC102A
Toothed washer	KES E-C004
Plain washer	KES E-C008

5. Material

5.1 Machine screw proper: The materials of the machine screw proper shall conform to Table 5.

Table 5

Strength Division	Material	Material standard
4T	SWCH8 to 17R SWCH8 to 20A SWCH10 to 20K	* KS D 3697 (Carbon Steel Wires for Cold Heading and Cold Forging)
8T	SWCH38 to 45K	

* JIS G 3539

5.2 Washer: The materials of the washer shall conform to Table 6.

Table 6

Kind	Material	Material Standard
Plain washer	SPCC	*1 KS D 3512 (Cold Rolled Carbon Steel Sheets and Strip)
Wave spring washer	SWRH 62A or 72A	*2 KS D 3559 (High Carbon Steel Wire Rods)
Toothed washer	S50CM to S70CM SK5	KS D 3311 (Cold Rolled Special Steel Strip) *3 KS D 3751 (Carbon Tool Steels)

*1 JIS G 3141 *2 JIS G 3506 *3 JIS G 4401

6. Shapes and Dimensions

6.1 Shapes and dimensions of cross recess: The shapes and dimensions of the cross recess provided on the head of the machine screw proper shall be according to the type H specified in KS B 0230-1 (Cross-Recesses for Screws).

*1 JIS B 1012

However, the length M of the cross recess and the gauge sinking depth Q shall conform to Attached Tables 1 to 13.

- 6.2 Washer: The shapes and dimensions of the washer, unless they are specified in the Attached Tables, shall conform to MES GC102A (Wave Spring Washer), KES E-C004 (Toothed Washer) and KES E-C008 (Plain Washer).
- 6.3 Shapes and dimensions except for cross recess and washer: The shapes and dimensions except for the cross recess and the washer of the assembled machine screw shall conform to Attached Tables 1 to 13.

7. Surface Treatment

The surface treatment of the assembled machine screw consists of the standard surface treatment (hereinafter referred to as the "standard treatment") and the derivative surface treatment (hereinafter referred to as the "derivative treatment") and shall conform to the following.

Remark: The plated assembled machine screw shall be treated with the process to remove brittleness before applying chromate finishing according to Table 7. The procedure of the treatment to remove brittleness shall conform to KES C-F002 (Plating).

Table 7

Kind of Assembled Washer	Treatment to Remove Brittleness
Toothed washer	Necessary
Wave spring washer	Necessary
Plain washer + wave spring washer	Necessary
Plain washer	Unnecessary

- 7.1 Standard treatment: The standard treatment is applied to the assembled machine screw according to the base type number. The standard treatment shall conform to Table 8.

Table 8

Standard Treatment	Part Number	Applicable Standard
MFZnT ₁ -C	9 figures part number 908324 661	KES C-F002

- 7.2 Derivative treatment: The derivative treatment is applied to the assembled machine screw according to the derivative type number. The derivative treatment shall conform to KES A-A006.

8. Quality Rank

The quality rank of the machine screw shall conform to Table 9.

Table 9

Inspection Item		Quality Rank
Mechanical properties	Tensile strength	A
	Hardness	
	Yield point or proof stress	
	Proof load stress	
	Wedge tensile strength	
	Head percussion strength	
	Decarbonization of threaded portion	
Shapes and dimensions	Radius under head r	A

9. Thread

The machine screw shall be the metric coarse screw thread specified in *1 KS B 0201 (Metric Coarse Screw Threads), and its accuracy shall be 6 g of the metric coarse screw thread specified in *2 KS B 0211 (Limits of Sizes and Tolerances for Metric Coarse Screw Threads).

*1 JIS B 0205 *2 JIS B 0209

10. External Appearance

10.1 Machine screw proper: As for the external appearance of the machine screw proper, there shall be no crack, remarkable flaw, burr, etc. The surface roughness except for the end shall conform to 6.3a specified in KES C-A013 (Surface Roughness).

10.2 Washer: The external appearance of the washer shall be smooth. There shall be no crack, flaw harmful to use, rough surface, rust, etc., and there shall also be no sharp edge on the outer circumference.

11. Inspection

The inspection of the assembled machine screw shall conform to the requirements mentioned in 4 to 10.

12. Presentation of Test and Inspection Results

The test and inspection results of the assembled machine screw shall be presented to the Inspection Department of KIA according to KES C-C001 (Mechanical Properties of Bolts and Screws).

13. Alteration of Specification

The specifications of the assembled machine screw may be altered only after the revision of the

drawings or this standard. This standard is revised following the specified proceedings and according to the KES Proposal System.

14. Designation of Part

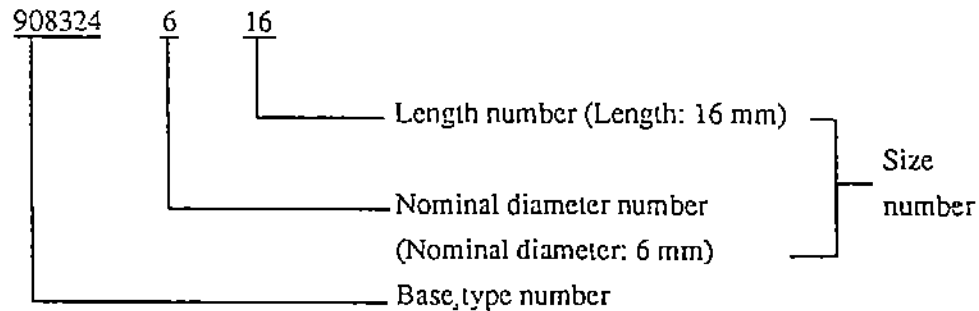
The designation of the cross-recessed head machine screw and washer assembly shall be SCREW AND WASHER.

15. Structure of Part Number

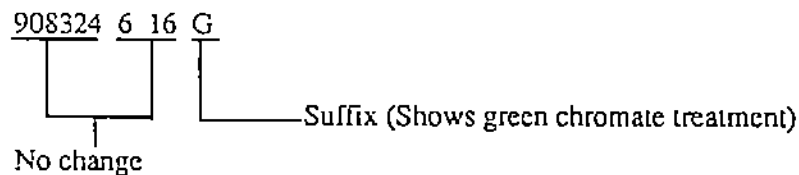
The structure of the part number of the assembled machine screw shall conform to the following examples.

Remark: The details of the structure and the application of the part number shall conform to KES A-A006.

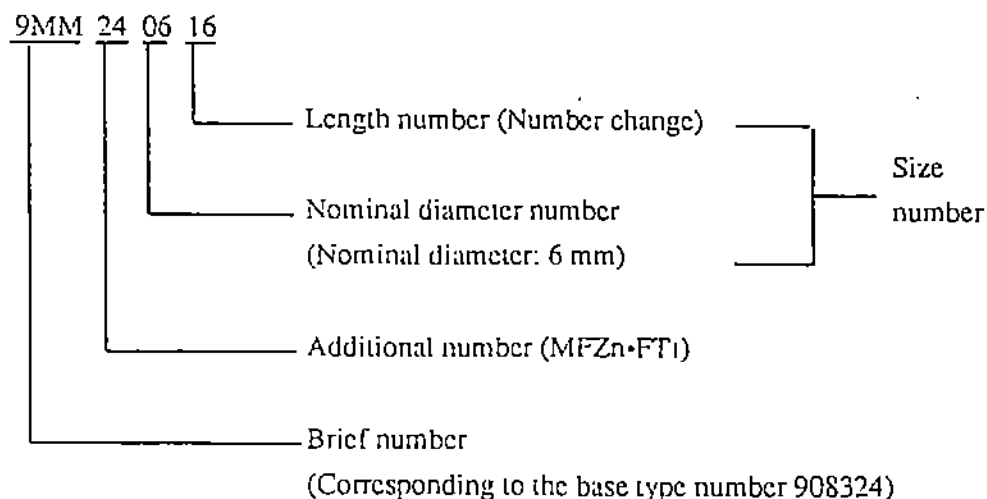
Example 1. In the case of standard treatment (MFZnTi -C)



Example 2. Only the chromate finishing is changed in contrast with the standard treatment.



Example 3. In the case of derivative treatment (The plating specification is changed.)



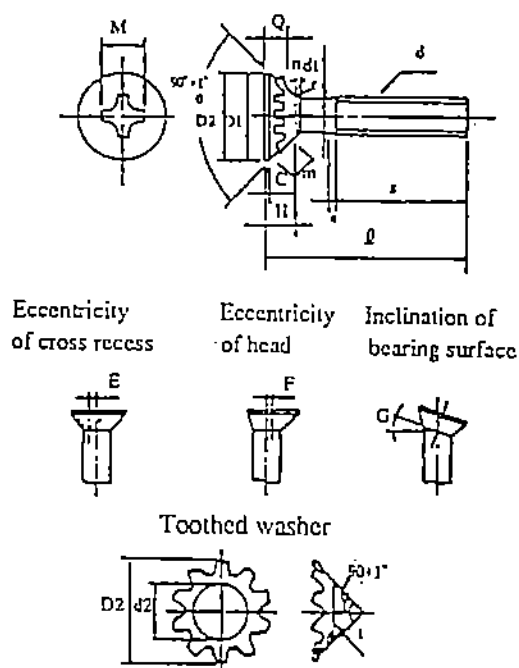
16. Report of Effective Date

No items to be reported.

17. Quoted Standards

SAE J 417	(Hardness Tests and Hardness Number Conversions)
JIS B 0205	(Metric Coarse Screw Threads)
JIS B 0209	(Limits of Sizes and Tolerances for Metric Coarse Screw Threads)
JIS G 3141	(Cold Rolled Carbon Steel Sheets and Strip)
JIS G 3311	(Cold Rolled Special Steel Strip)
JIS G 3506	(High Carbon Steel Wire Rods)
JIS G 3539	(Carbon Steel Wires for Cold Heading and Cold Forging)
JIS G 4401	(Carbon Tool Steels)
KES A-A006	(Structure and Application of Standard Parts Number)
KES C-A013	(Surface Roughness)
KES C-C001	(Mechanical Properties of Bolts and Screws)
KES C-F002	(Plating)
KES E-A004	(Hexagon Head Bolt)
KES E-A007	(Hexagon Flanged Bolt)
KES E-A030	(Bolt and Washer Assembly)
KES E-C005	(Wave Spring Washer)
KES E-C004	(Toothed Washer)
KES E-C008	(Plain Washer)

Attached Table 1. Shapes and Dimensions of Assembled Machine Screws
908314 (9ML)



- *1 Head height H shall be measured from the intersection of the extended line of the outside diameter of the threaded portion and the flat face or its extension.
- *2 Q shows the gauge sinking depth of the cross recess.
- *3 Since the screws of which the length number columns are filled with the weights have been actually used, these sizes shall be recommended.

When the mark  is entered in the length column, the screws shall be used after consultation with the supplier.

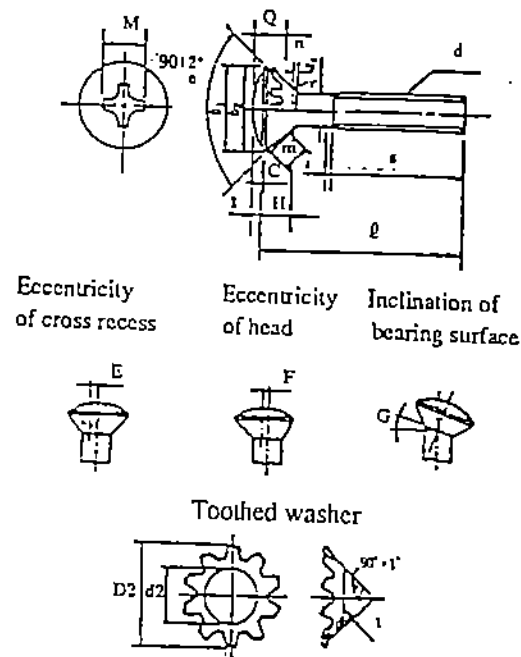
Nominal Diameter Number	908314	5	6
	9ML	05	06
Nominal diameter d		5	6
Pitch		0.8	1
Cross recess number		2	3
D_1	Basic dimension	10	12
	Tolerance	0 -0.6	0 -0.7
C	approximately	0.3	0.4
M	max.	5.0	6.6

(Continued)

H *1	Basic dimension		2.8	3.4
	Tolerance		0 -0.3	0 -0.4
Q *2	Max.		2.93	3.26
	Min.		2.38	2.70
r	max. approximately		0.5	0.6
m	max.		1.0	1.2
n	approximately		1	
S			20	25
E	max.		0.35	0.4
F	max.		0.25	0.3
G	max.		2°	
Tooth- ed washer	D2	Basic dimension	10	12
		Tolerance	+0 -0.5	
	d2	Max.	4.73	5.72
		Min.	4.48	5.32
	t	Max.	0.535	
		Min.	0.465	
	No. of teeth		12	
Length number		l	Unit: g *3	
10		10		—
12		12		
16		16		
20		20	4.3	
25		25		
30		30		
35		35		
40		40		
Tolerance of l		To 10	0 -0.8	
		Over 10 to 20	0	
		Over 20 to 40	-1	

- Remarks 1. As a rule, the diameter d_1 of the unthreaded portion shall be approximately equivalent to the pitch diameter of the thread. In this case, d_1 shall be more than the minimum value of the pitch diameter of the thread.
2. "X" is the length of the incomplete thread and shall be approximately 2 ridges. When the thread is cut to the underhead ($S + 3P > l$), the incomplete thread may remain under head.
3. Tolerances of the thread length S shall be $+ 3P$. However, P shall be the pitch of the thread.
0
4. Unless the shapes and dimensions and the properties of the assembled washers are specified, they shall be according to KES E-C004.

Attached Table 2. Shapes and Dimensions of Assembled Machine Screws
908324 (9MM)



- *1 Head height H shall be measured from the intersection of the extended line of the outside diameter of the threaded portion and the flat face or its extension.
- *2 Q shows the gauge sinking depth of the cross recess.
- *3 Since the screws of which the length number columns are filled with the weights have been actually used, these sizes shall be recommended.

When the mark  is entered in the length column, the screws shall be used after consultation with the supplier.

Nominal Diameter Number		908324	5	6
		9MM	05	06
Nominal diameter d			5	6
Pitch			0.8	1
Cross recess number			2	3
D ₁	Basic dimension		10	12
	Tolerance		0 -0.6	0 -0.7
C	approximately		0.3	0.4
K	approximately		1.2	1.4
M	max.		5.2	6.8
H+K*1	Basic dimension		4	4.8
	Tolerance		0 -0.5	0 -0.6
Q *2	Max.		3.13	3.46
	Min.		2.58	2.9
m			3.1	3.8
n	approximately		1	
r	max.		1.2	1.4
S			20	25
E	max.		0.35	0.4
F	max.		0.25	0.3
G	max.		2°	
Tooth- ed washer	D ₂	Basic dimension	10	12
		Tolerance	+0 -0.5	
	d ₂	Max.	4.73	5.72
		Min.	4.48	5.32
	t	Max.	0.535	
		Min.	0.465	
	No. of teeth		12	
Length number		l	Unit: g *3	
10		10	20	—
12		12		3.9
16		16		4.6
20		20		5.2
25		25		
30		30		
35		35		
40		40		
Tolerance of l		To 10	0 -0.8	
		Over 10 to 20	0	
		Over 20 to 40	-1	