

[For reference]

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Class	M E S	Control No.	MES B 007
Title	Part Standard Cross Recessed Head Screws with Steel Captive Washer	Edition No.	08
		Mitsuba Corporation	

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1. Scope of application

This standard specifies the cross-recessed head screws with steel captive washer (hereinafter referred to as “steel screws with washer”) used in Mitsuba Corporation.

The steel screw with washer is a screw of which the threads are rolled after a washer has been assembled on the screw blank so as to prevent the disassembly of the washer from the screw.

Note: The steel screw with washer shall not be used for fastening steel sheets of thickness less than {(thickness of spring lock washer) + (two pitches of screw thread)} (See Item 8. “Notice on using spring lock washer”).

Remark: For the cited standards used in this document, their issue years and titles are omitted in the main text. Refer to item 9. “Cited standards” for the years and titles.

2. Terms and definitions

Steel screw with washer: Abbreviation of steel made cross-recessed head screws assembled with steel captive washer. Other terms are in accordance with JIS B 0101.

3. Types

The steel screws with washer used in Mitsuba Corporation shall be classified as given in Table 1.

Table 1.

Shape of head	Type of steel screw with washer
Binding head	Cross recessed binding head screw with steel spring lock washer
Pan head	Cross recessed pan head screw with steel spring lock washer

Note: The spring lock washers to be assembled on the screws shall be made of steel No. 2 for assembly. No. 2 washers for assembly are the same as No. 2 washers specified in JIS B 1251 in sectional shape and dimensions, but different in inside diameter.

4. Qualities

The qualities of steel screws with washer shall be based on Table 2 when tested in accordance with the provisions of Table 3.

Table 2. Quality of screws

Type of steel screw with washer		Binding head screw with washer	Pan head screw with washer
Shapes and dimensions		Attached table 1	Attached table 2
Screw	Type JIS B 0205	"Metric coarse thread" provided in JIS B 0205-2	
	Grade JIS B 0209	6g provided in JIS B 0209-2. However, the maximum permissible dimensions for 4h should be used for electroplated screw.	
Mechanical properties	Steel screw	Strength class JIS B 1051	"4.8" provided in JIS B 1051
		Strength of head JIS B 1051	- <u>There shall be no breakage on the head.</u> - <u>For bolts and screws with an unthreaded cylindrical body, there shall be no breakage in the transitional area between the head portion and shaft portion.</u> (Conform to JIS B 1051)
	Spring lock washer Conform to JIS B 1188	- Hardness: HRC 42 – 50 - Spring function: When tested in accordance with the provisions of Table 3, the free height shall reach the "free height after compression test" specified in Attached tables 1 and 2. - Toughness: When tested in accordance with the provisions of Table 3, it shall not fracture at torsion angle less than 90°	
	Engagement of cross recess Type H with gauge	When tested in accordance with the provisions of Table 3, ensure that the screw does not fall due to its weight. The size subjected to this test shall be agreed upon between the parties concerned in the delivery. (Conform to JIS B 1012)	
Conditions of washer assembled Conform to JIS B 1188		The washer assembled on screw shall be capable of freely rotating but shall not be easily disassembled from the threaded portion of the screw. There shall be no harmful interference, which might adversely affect the serviceability between the underhead fillet of the screw and the inside diameter of the washer.	
Surface treatment conditions	Screw Conform to JIS B 1188	The surface roughness except the thread end shall be 25 <u>µmRz</u> as specified in JIS B 0601 and the surface shall be free from harmful defects such as flaws, flashes and burrs, which might adversely affect the serviceability. Unless otherwise specified, the quality shall be in accordance with JIS B 1041.	
	Spring lock washer Conform to JIS B 1251	The appearance shall be smooth in surface and free from any quenching cracks and harmful defects such as flaws, burrs, rough surface and rust that might adversely affect the serviceability. The cut ends of the spring lock washer shall never lay one upon another, when the washer is fully compressed.	

- Remarks: 1. Qualities except in Table 2 shall be in accordance with JIS B 1188.
2. When electroplating is performed, it shall be in accordance with JIS B 1044.
3. When the tensile strength is over 1000N/mm² or hardness is over 320HV, the treatment of hydrogen embrittlement elimination shall be conducted.
4. The length shall be in accordance with Attached table 3.

5. Tests

The mechanical properties of steel screw with washer shall be as given in Table 3.

Table 3. Test method of mechanical properties

Item		Test method
Steel screws	Tensile strength	Conform to 9.2 (Tensile test) of JIS B 1051
	Hardness	Conform to 9.9 (Hardness test) of JIS B 1051
	Proof load stress	Conform to 9.6 (Proof load test) of JIS B 1051
	Head robustness to percussion	Conform to 9.8 (Head percussion test) of JIS B 1051
Spring lock washer	Hardness, HRC	Conform to JIS Z 2245
	Spring function	Conform to 12.2.5 (Compression test) of JIS B 1251
	Toughness	Conform to 12.2.6 (Torsion test) of JIS B 1251
Engagement of cross recess with gauge	Conform to 3.2.3 (Engagement of cross recess type H with gauge) of JIS B 1012	

6. Designation of part name of the screws with steel washer

Designation of part name of the screws with steel washer shall be written by “Subject 1), Modifier 2), Supplemental words 3), 4), 5)” shown in Table 4. The total number of letters including comma (,) shall be 30 or less.

Table 4.

Subject	Modifier	Supplemental words		
1) General name	2) Shape of head *1	3) Dimension (Nominal diameter X length), cross recessed(+)*2	4) Surface treatment *3	5) Strength class of material *4
(Ex.1) Cross recessed pan head screws with steel washer, nominal diameter M5, length 20 mm, surface treatment Ep-Fe/Zn5B, strength class of material 4.8:				
SCREW-WASHER	PAN	M5X20(+)	5B	4
Designation of the screws with steel washer: SCREW-WASHER, PAN, M5X20(+), 5B, 4				
(Ex.2) Cross recessed binding head screws with steel washer, nominal diameter M5, length 20mm, no surface treatment, strength class of material 4.8 :				
SCREW-WASHER	BIND	M5X20(+)	(Blank)	4
Designation of the screw with steel washer: SCREW, BIND , M5X20(+), 4				

Remarks: *1. For shape of head, use the abbreviation in Table 5.

Table 5.

Abbreviation	Shape of head	Abbreviation	Shape of head
PAN	Pan head	BIND	Binding head

*2. Use (+) for “Cross recessed”.

*3. For surface treatment, use the abbreviation in Table 6. **Moreover, for details of plating, refer to MES E 001.**

Table 6.

Abbreviation	Surface treatment	Abbreviation	Surface treatment
(Blank)	Original surface	5C	Ep-Fe/Zn5C
5B	Ep-Fe/Zn5B	5C(CF)	Ep-Fe/Zn5C(CF)

Note: Omit the attached symbols (“HB” for hydrogen brittlement baking etc.) of surface treatment.

*4. For strength class of material, use the abbreviation in Table 7.

Table 7.

Abbreviation	Material and its strength class	Abbreviation	Material and its strength class
4	Steel 4.8	A2	Stainless A2-50
6	Steel 6.8	-	-

7. Shapes and dimensions of standard parts

The shapes and dimensions of standard parts for screws with steel washer shall be in accordance with Attached table 1 to 3.

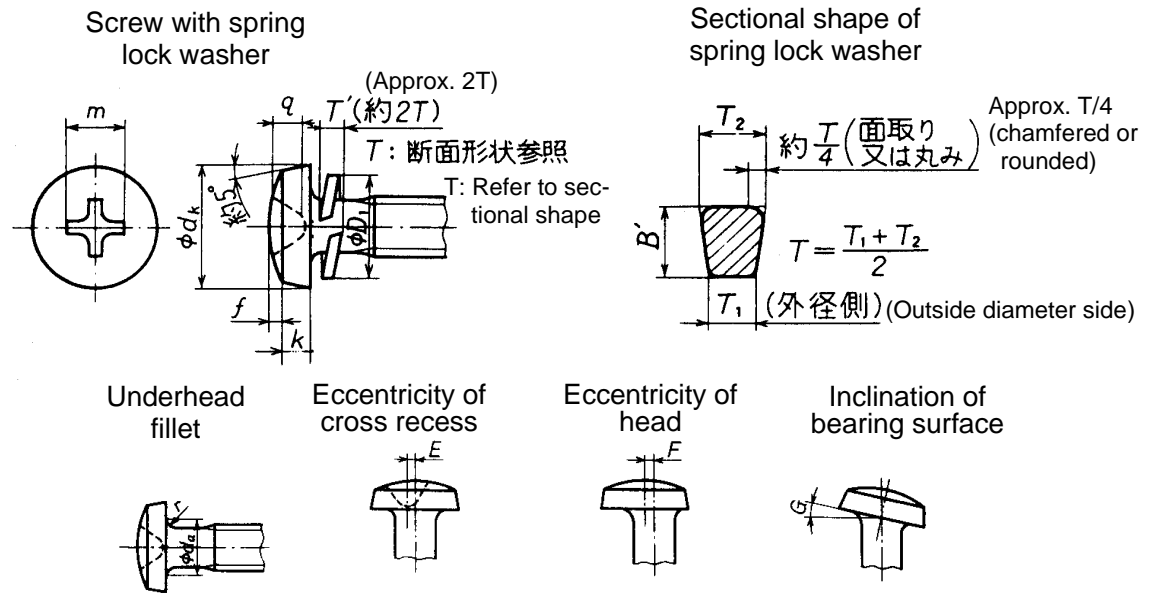
8. Notice on using spring lock washer

- (1) In the case of head screw with captive washer (which includes two pitches of incomplete screw threads)
It must not be used for fastening steel sheets of thickness less than {(thickness of spring lock washer) + (two pitches of screw thread)}.
- (2) Note that face pressure is high, because the inside and outside diameters of spring lock washer of screws with spring lock washer are smaller than those of ordinary spring lock washer.

9. Cited standards

JIS B 0101- 2013	Screw threads and fasteners – Vocabulary
JIS B 0205- 2-2001	General purpose metric screw threads – Part 2: General plan
JIS B 0209- 1-2001	General purpose metric screw threads – Tolerances – Part 1: Principles and basic data
JIS B 0209-2-2001	General purpose metric screw threads – Tolerances – Part 2: Limits of sizes for general purpose external and internal screw threads – Medium quality
JIS B 0601- 2013	Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions, and surface texture parameters
JIS B 1012-1985	Cross recesses for screws
JIS B 1041-1993	Fasteners – Surface discontinuities - Part 1: Bolts, screws and studs for general requirements
JIS B 1044- 2001	Fasteners – Electroplated coatings
JIS B 1051- 2014	Mechanical properties of carbon steel and alloy steel – Part 1: Bolts, screws and studs
JIS B 1188- 2017	Cross recessed head screws with captive washer
JIS B 1251- 2018	Spring lock washers
JIS Z 2245- 2016	Rockwell hardness test – Test method

Attached table 1. Cross recessed binding head screw with washer

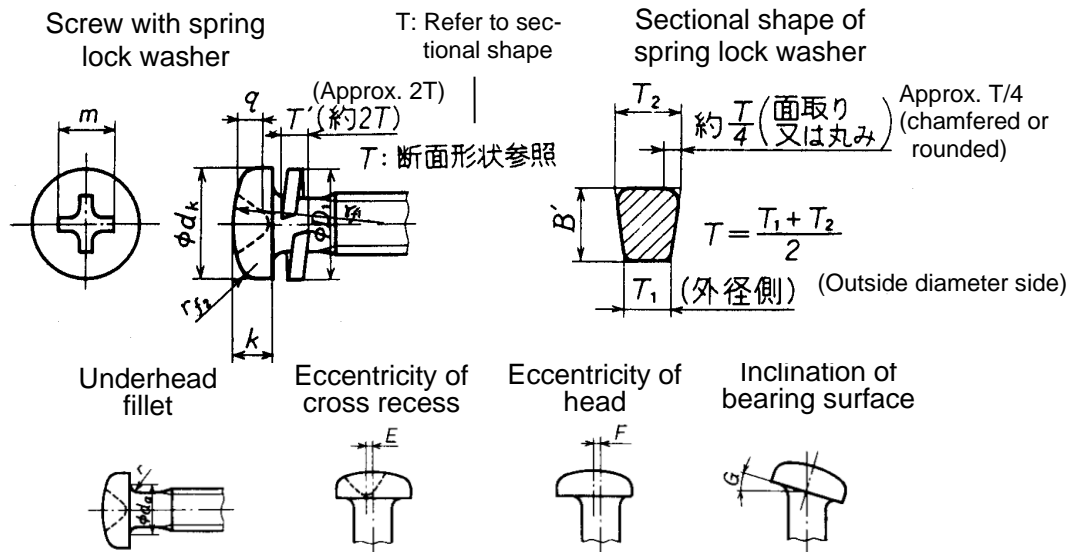


Unit: mm

Designation of thread	d	M3	M4	M5	M6	
Screw	dk	6.3	8.3	10.3 ⁰ _{-0.5}	12.4	
	K (Approx.)	1.3	1.7	2.1	2.4	
	f	0.6±0.1	0.8±0.15	1±0.15	1.3±0.15	
	k + f	1.9±0.15	2.5±0.2	3.1±0.2	3.7±0.2	
	Cross recess	Cross recess No.	2	2	2	3
		m (Ref.)	3.7	4.3	5.0	6.3
		q (1)	1.01 ~ 1.53	1.60 ~ 2.13	2.29 ~ 2.83	2.31 ~ 2.86
	r (Min.) ⁽²⁾	-	-	-	-	
	da (Max.)	2.8	3.8	4.7	5.6	
	E (Max.) ⁽³⁾	0.25	0.3	0.35	0.4	
F (Max.) ⁽³⁾	0.2	0.2	0.25	0.3		
G (Max.)	2°	2°	2°	2°		
Spring lock washer (No. 2 for assembly)	Di (Max.)	5.5	7	8.5	11.5	
	B' (Min.) x T (Min.)	1.1x0.7	1.4x1	1.7x1.3	2.7x1.5	
	Free height after compression test (Min.)	1.2	1.7	2.2	2.5	

- Notes: (1) The letter q indicates the penetration depth of the gauge into the cross recess.
 (2) The minimum value of the radius (r) for the designation of screw threads M3 to M6 is not specified, but the underhead fillet shall be slightly rounded.
 (3) The letters E and F indicate the eccentricity to the axis of screws.

Attached table 2. Cross recessed pan head screw with washer



Unit: mm

Designation of thread		d	M3	M4	M5	M6	
Screw	dk		5.5	7	9 ⁰ _{-0.5}	10.5	
	k		2±0.15	2.6±0.15	3.3±0.15	3.9±0.2	
	rf ₁ (Approx.)		7	9	12	14	
	rf ₂ (Approx.)		1.0	1.3	1.6	1.9	
	Cross recess	Cross recess No.		2	2	2	3
		m (Ref.)		3.6	4.2	4.9	6.3
		q ⁽¹⁾		0.86 ~ 1.43	1.45 ~ 2.03	2.14 ~ 2.73	2.26 ~ 2.86
	r (Min.) ⁽²⁾		-	-	-	-	
	d _a (Max.)		2.8	3.8	4.7	5.6	
	E (Max.) ⁽³⁾		0.25	0.3	0.35	0.4	
F (Max.) ⁽³⁾		0.2	0.2	0.25	0.3		
G (Max.)		2°	2°	2°	2°		
Spring lock washer (No. 2 for assembly)	D ₁ (Max.)		5.5	7	8.5	11.5	
	B' (Min.) x T (Min.)		1.1x0.7	1.4x1	1.7x1.3	2.7x1.5	
	Free height after compression test (Min.)		1.2	1.7	2.2	2.5	

Notes: ⁽¹⁾ The letter q indicates the penetration depth of the gauge into the cross recess.

⁽²⁾ The minimum value of the radius (r) for the designation of screw threads M3 to M6 is not specified, but the underhead fillet shall be slightly rounded.

⁽³⁾ The letters E and F indicate the eccentricity to the axis of screws.

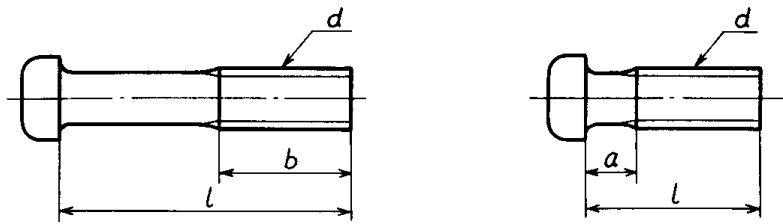
Remarks: 1. The diameter of unthreaded portion (d_s) shall be approximately equal to the pitch diameter of screw thread.

2. The nominal length (ℓ) and thread length (b) shall be in accordance with Attached table 3.

3. The dimension x, the length of incomplete threads, shall be about two threads. The maximum value of the distance (a) from **the bearing surface to the complete thread in full thread screws shall be in accordance with** Attached table 3.

4. The inside diameter of washer is not specified, but it shall satisfy the requirements of Table 2 of the body of this standard.

5. The end of screw shall be as-rolled.

Attached table 3. Dimensions ℓ and b of steel screws

Designation of screw thread d	Unit: mm			
	M3	M4	M5	M6
Nominal length ℓ	Thread length b			
5				
6			Not applicable	
8				
10				
12				
14				
16				
20	12			
25		16		
30			20	
35				25
40				
45	Not applicable			
50				
a	2.4	3.5	4.3	5.1

Note: "a" is the maximum value of distance from **the bearing surface to the complete thread in full thread screws with a steel washer.**

Remarks: 1. The nominal lengths (ℓ) within the range of bold lines placed for each designation of screw threads indicate the preferable nominal length, and the numerical values within the range of bold lines indicate the preferable thread length (b). The screws with thread lengths corresponding to the blocks with oblique lines shall be threaded for their full length.

2. Tolerance of ℓ shall be in accordance with the table below.

Range of ℓ	Unit: mm	
	M3, M4	M5, M6
Under and incl. 10	0 -0.6	0 -0.8
Over 10 up to and incl. 20	0 -0.6	0 -1
Over 20 up to and incl. 40	0 -0.8	0 -1
Over 40	0 -1	0 -1

Explanation

1. Description of revision for "Edition 02"

Contents of revision for "Edition 02" are as follows:

- (1) Standard name "SEMS screws" is changed to "Cross recessed head screws with captive washer" in accordance with JIS.
- (2) A note that prohibits the use of the steel screw with washer for fastening steel sheets of thickness less than {(thickness of spring lock washer) + (two pitches of screw thread)} is added to "Scope of application".
- (3) "Steel screws with washer" is added to "Terms and definitions". Other terms are in accordance with JIS B 0101 "Screw threads and fasteners – Vocabulary"
- (4) Types, shapes of head and strength class are not changed from the previous version of MES.
- (5) Because screws are standardized in JIS, and their qualities and test methods are apparent, numbers and titles of cited JIS and their provisions are displayed in tables instead of citing contents of JIS. Furthermore, not specified in JIS, surface roughness 12.5S of spring lock washer is eliminated.
- (6) Designation is specified in two ways; one is for "In the case stated in drawings" and the other is for "In the case used for external parts". Nothing has changed from 01 edition for "In the case stated in drawings". "In the case used for external parts" shall be in accordance with the designation in JIS.

2. Description of revision for "Edition 06"

(1) Features of revision

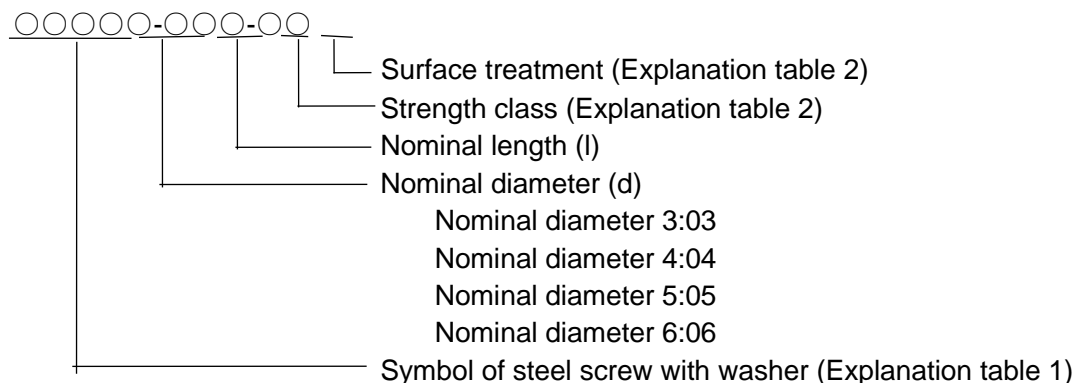
The revision this time is only by randomizing (being meaningless) the code numbers of the parts and the change of the name setting rule for materials, subsidiary materials and standard parts. Refining examination for revision of cited standards is done next time. (See following (4).)

(2) Main revised points

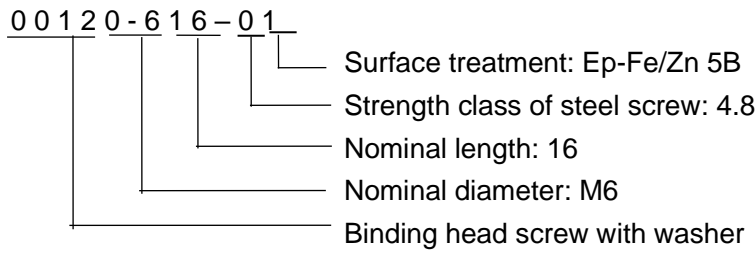
- 1) By randomizing (being meaningless) the code numbers, "6. (2) Standard part number" is omitted from the main text of this MES.
And for the time being, the repealed standard part number is described in (3) "Repealed standard number".
- 2) By changing the name setting rule for standard parts, "6. (1) Designation of bolt" is totally changed.

(3) Repealed standard part number

Standard part number of steel screw with washer shall be composed as follows:



(Ex.)



Explanation table 1.

Type		No. showing the screw type ●●●●○-○○○-○○
Name	Abbreviation	
Cross recessed binding head screw with steel spring lock washer	Binding head screw with washer (+)	0012
Cross recessed pan head screw with steel spring lock washer	Pan head screw with washer (+)	0013

Explanation table 2.



Strength class of steel screws		No. for strength class ○○○○○-○○○-●○	Surface treatment for steel screw with washer	No. for surface treatment ○○○○○-○○○-○●
Steel	4.8	0	No surface treatment	0
	6.8	1	Ep-Fe/Zn 5B	1
Stainless steels		5	Ep-Fe/Zn 5C	2
-		-	Ep-Fe/Zn 5C(CF*)	4

Note: *The symbol (CF) for free from hexavalent chromium shall be temporary.

- (4) The cited standards in this MES are partly revised at this time. Refining examination for revision of these cited standards shall be done next time. Expression is described in Note: of "9. Cited standards".

History of original, revision, and repeal			
Edition	Original or revised date	Enforcement date	Contents
00	May 1, 1978	May 15, 1978	Original
01	Dec. 26, 1983	Dec. 26, 1983	Revised (Add Steel 6.8, eliminate Upset type)
02	Mar. 28, 1997	Apr. 14, 1997	The contents are shown in Explanation.
03	Aug. 27, 2001	Sep. 3, 2001	Revised (Revision years and titles of cited standard by the revision. Item 8 is added.)
04	Dec. 11, 2001	Dec. 11, 2001	Revised (English name is added to item 6. Designation and standard part Number (1) Designation (a). "Ep-Fe/Zn 5C(CF): 4" and "Note" is added to Table 4 of item 6. (2) Standard part number.)
05	Jan. 7, 2002	Jan. 7, 2002	Revised (Addition of "Use the English designation in case described in drawings, parts lists and etc.")
06	Oct. 25, 2004	Nov. 1, 2004	Revised (The revision contents are shown in Explanation 2.)
07	Jun. 17, 2009	Jun. 25, 2009	Revision: Reflection of JIS revision, review of written expressions, etc.
08	Dec. 19, 2018	Dec. 19, 2018	Revision: Reflection of JIS revision, review of written expressions, etc.

Superordinate rule	Rules for MES Management
Subordinate rule	_____
Form used	_____

Enactment department	Business Planning Dept.		Control department	Business Planning Dept.	
Decision maker	Business Planning Dept., General Manager		Person in charge of control department	Development Control Sec. Manager	
	Niichi Yoshida			Koji Nara	