

Cross-Recessed Head Machine Screws

KES E-A016

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1. Scope of Application

This standard specifies steel cross recessed head machine screw (hereinafter referred to as “ steel machine screw”) and the stainless steel cross recessed head machine screw (hereinafter referred to as “ stainless steel machine screw”) generally purpose.

- Remarks 1. When giving a general term to the steel machine screw and the stainless steel machine in this standard, they shall be called machine screw.
2. Hexagon head machine screws is specified in KES E-A004(Hexagon head bolt and screws.) KES E-A007 (Hexagon flange bolt)and KES E-A030(Hexagon bolt and washer assemblies).

2. Purpose

This standard aims at the commonization of machine screw and at securing the proper quality.

3. Type and Type Number

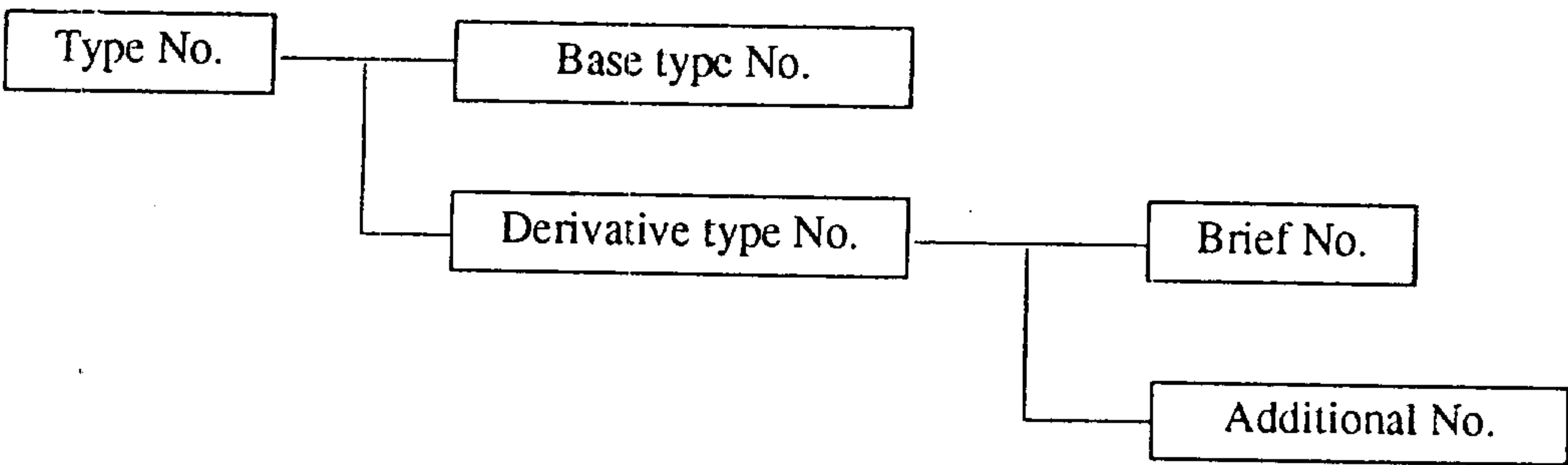
3.1 Type

The type of the machine screw shall conform to Table1.

3.2 Structure of Type Number

The type number structure of machine screws shall conform to Fig.1.

Fig.1



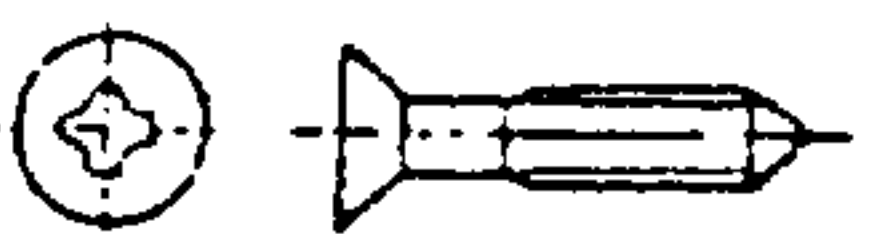
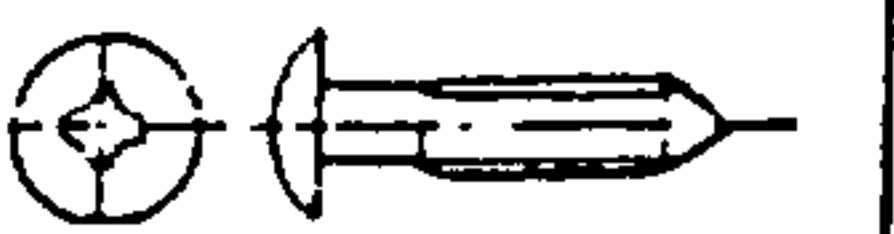
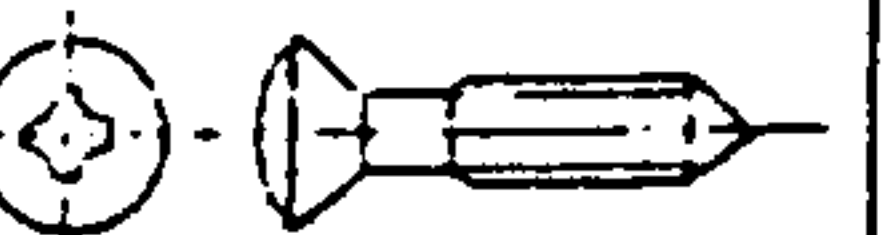
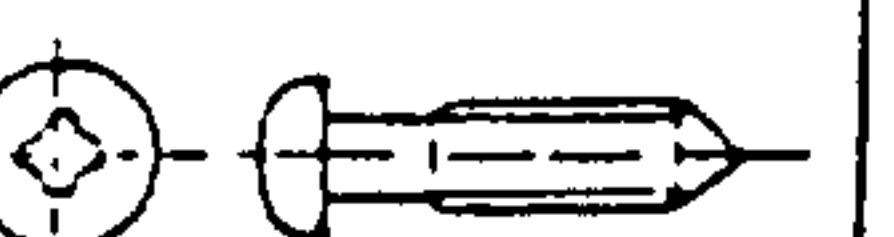
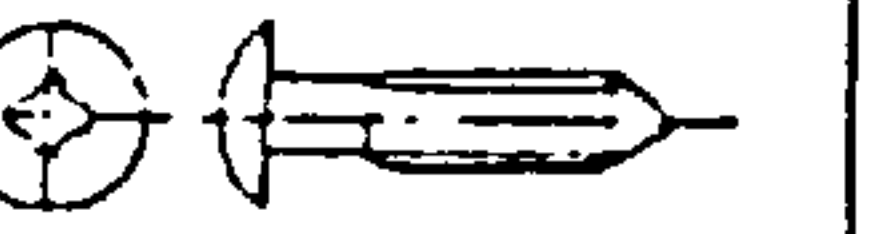
- 3.3 Base type number : The base type number, consisting of five numeral figures, shall be used when the standard surface treatment will be done on machine screws. The base type number shall conform to Table 1.
- 3.4 Derivative type number : The derivative type number, consisting of five English and numeral figures, shall be used when the surface treatment except for the standard surface treatment will be done on machine screws. The derivative type number consists of the brief number and the additional number.

3.4.1 Brief number : The brief number is a number made by shortening the base type number to digits. The combination with base type number is shown in Table 1.

3.4.2 Additional number : The additional number consists of two figures and shows 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.

Table 1

Material	Strength division	Head shape	End shape	Type number (Brief number)	Attached Table	Page	Shape
Carbon steel	4.8	Countersunk head	Unpointed end	99831(9M1)	1		
		Oval countersunk head	"	99832(9M2)	2	10	
		Round head	"	99833(9M3)	3	11	
		Truss head	"	99834(9M4)	4	12	
		countersunk head	Cone point	99836(9M6)	5	13	
		Oval countersunk head	"	99837(9M7)	6	14	
		Round head	"	99838(9M98)	7	15	
		Truss head	"	99839(99829) (9M9)*	8	16	

Material	Strength division	Head shape	End shape	Type number (Brief number)	Attached Table	Page	Shape
Carbon steel	4.8	Pan head	Unpointed end	99835(9M5)	9	17	
		Flanged pan head	Tapered Point	99740(9C0)	10	18	
		"	"	99830(9M0)	11	19	
	8.8	Counter-sunk head	Cone point	99761(9E1)	12	20	
Stain less steel	50	"	Unpointed end	99771(9P1)	13	21	
		Oval countersunk head	"	99772(9P2)	14	22	
		Pan head	"	99773(9P3)	15	23	
		Truss head	"	99774(9P4)	16	24	
		Countersunk head	Cone point	99776(9P6)	17	25	
		Oval countersunk head	"	99777(9P7)	18	26	
		Pan head	"	99778(9P8)	19	27	
		Truss head	"	99778(9P9)	20	28	

* The machine screw the type No. of which is 99829 shall not be used in case of new design.

4. Mechanical Properties and Test Method

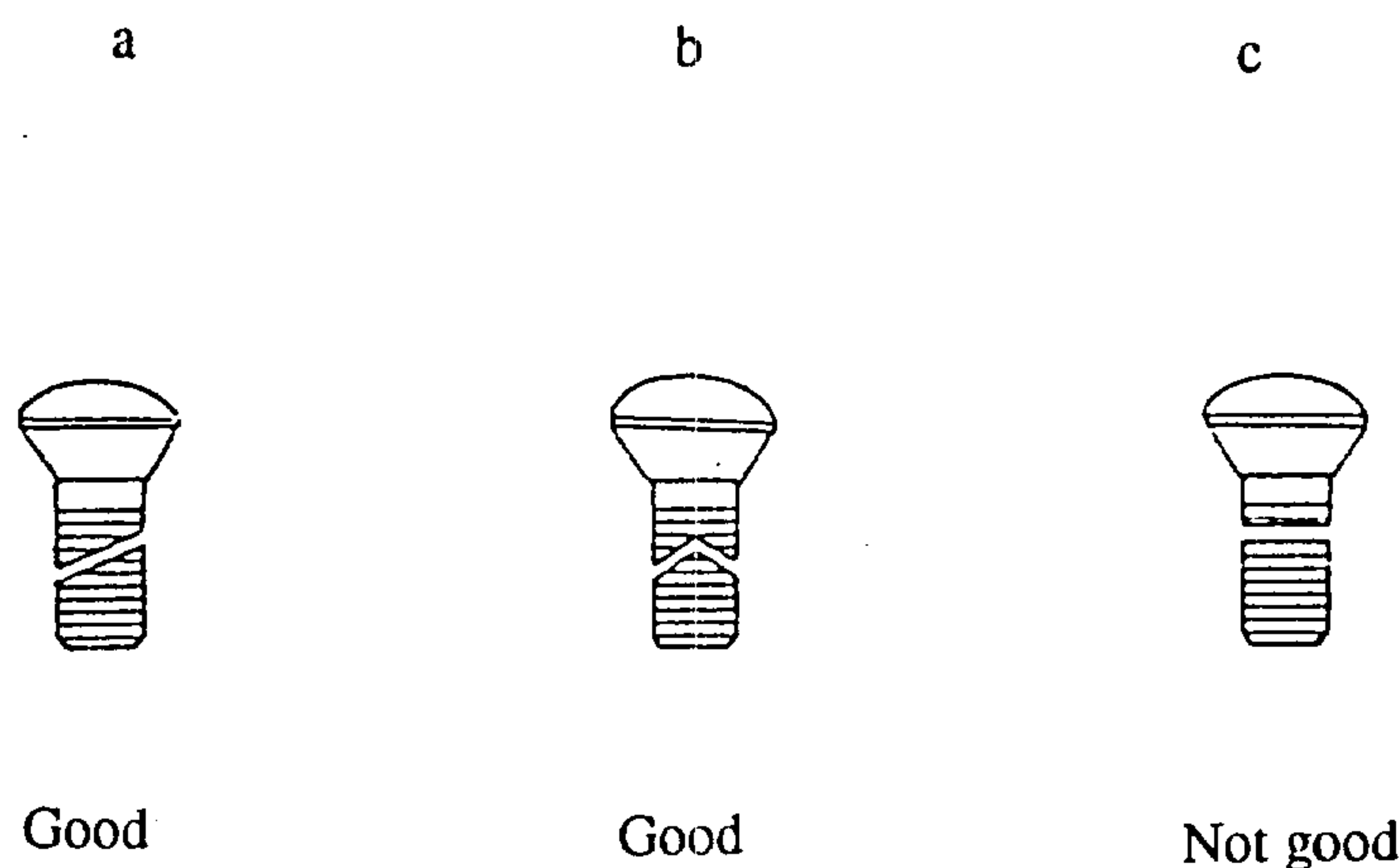
4.1 Steel Machine Screw : The mechanical properties and the Test method of steel machine screw shall conform to Table 2.

Table 2

Item		Test Method for Strength Division			4.8	8.8	Test Method	
Tensile strength *1	Wedge tensile strength		kg f /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			kg f /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	kg f /mm ² {N/mm ² }	—	29.1{285}	58.2{571}	KES C-C001	
Hard- ness	Core hard- ness	Brinell hardness	HB	min.	116	—	KES C-C001	
				max.	229	—	KES C-C001	
		Rockwell hardness	HRB	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		kg f · 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. *7		KES C-C001	
Decarbonization of threaded portion *8		Height of non-decarbonized portion E		min.	—	H ₁	KES C-C001	
		Depth of ferritic decarbonized layer G _{mm}		mzs.	—	0.015	KES C-C001	

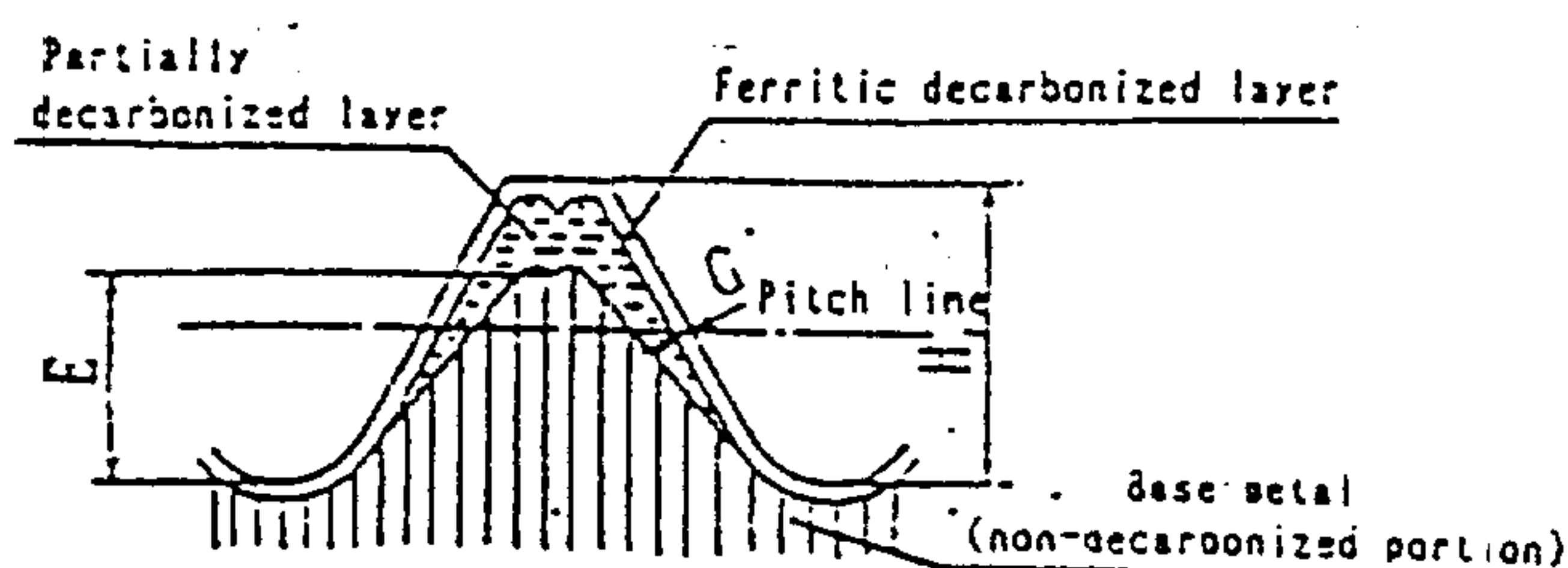
- *1 The rupture shall occur in the threaded portion or in the body, and shall not occur at the joint of the head and the body.
- *2 The shape of rupture shall be of a or b in Fig. 2.

Fig. 2 Shape of rupture



- *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 μm or less.
- *6 Except for doubts, the surface hardness may be measured by converting into HR 30-N according to SAE J 417.
- *7 For a 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. 3. Heat treatment in the carburizing atmosphere shall not be performed since it causes the lag rupture.

Fig. 3 Decarbonization of threaded portion



H₁: Height of the thread in the maximum body of the external thread.

[As for H₁ and E(minimum), refer to Table 3.]

Table 3 Values of H1 and E (minimum)

(Unit:mm)

Pitch of Tread		1	1.25
H1		0.613	0.767
E minimum	Strength division 8.8	0.307	0.384

4.2 Stainless Steel Machine Screw : The mechanical properties and the test method of stainless steel machine screw shall conform to Table 4.

Table 4.

Test Method for Strength Division		50	Test Method
Item			
Tensile-strength	Minimum value kg f /mm ² {N/mm ² }	51 {500}	JIS B 1054
Torsional-strength	Minimum value kg f · cm {N · cm}	M4	JIS B 1054
		M5	JIS B 1054
Proof stress	kg f /mm ² {N/mm ² }	21.4 {210}	JIS B 1054
Elongation	mm	0.6 d	JIS B 1054
Hardness	Brinell	HB	187 or less
	Rockwell	HRB	90 or less
	Vickers	HV	200 or less

Remark : The stainless steel materials in this standard are austenitic stainless steels and are excellent in corrosion resistance and strength.

5. Material

The material for the machine screw shall conform to Table 5.

Table 5.

Material Division	Strength Division	Material	Material Standard
Carbon steel	4.8	SWCH8 to 17R SWCH8 to 20A SWCH10 to 20K	*1 KS D 3697 (Carbon Steel Wires for Cold Heading and Cold Forging)
	8.8	SWCH38 to 45K	
Stainless steel	50	SUS 304 SUS 305 SUS X M7	JIS G 4303 (Stainless Steel Bars)
		SUS 305 J1	*2 KS D 3702 (Stainless Steel Wire Rods)

*1 JIS G 3539 *2 JIS G 4308

6. Shape and Dimension

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

However, the length M of the cross recess and the gauge sinking depth Q shall conform to Attached Tables 1 to 20.

*1 JIS B 1012

6.2 Shapes and dimensions except for cross recess : The shapes and dimensions except for the cross recess of machine screws shall conform to Attached Tables 1 to 20.

7. Surface Treatment

The surface treatment of machine screws 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 steel machine screw having 8.8 of strength division shall be treated to remove brittleness before chromate finishing.

7.1 Standard treatment : The standard treatment is applied to machine screws according to the base type number. The standard treatment shall conform to Table 6.

Table 6

Machine screw	Standard treatment		Example of part Number	Pertinent standard
Steel machine screw	Znic plating	Color chromate	Part number of 9 figures (example 99831 0310)	KES C-F002 (Plating)
		Other chromate	Part number of 10 figures (example 99831 0310B)	
Stainless steel machine screw	Non-treatment		Part number of 9 figures (example 99774 0410)	None
	Blackening *1		Part number of 10 figures (99774 0410B)	

*1 Colored by EBONOR SS-48(trade name)

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

8. Quality Rank

The quality rank of the machine screw shall conform to Table 7.

Table 7

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
Appearance	Crack, flaw, burr, surface roughness except for the end, etc.	B

9. Thread

Machine screws 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

There shall be no crack, remarkable flaw, burr, etc. The surface roughness except for the end shall conform to 6.3a specified in *KES A-C005(Definitions and Designation of Surface Roughness).

11. Inspection

The inspection of the machine screw shall be conform to requirement mentioned in 4 to 10.

12. Presentation of Test and Inspection Results

The test and inspection results sheet of the machine screw shall be presented to the Kia inspection department in charge of it according to KES C-C001(The mechanical properties of the bolt and the machine screw).

13. Alteration of Specification

The alteration of specification shall be performed through the revision of this standard. This standard is revised following the specified proceedings and according to the KMS proposal system.

14. Designation of Part

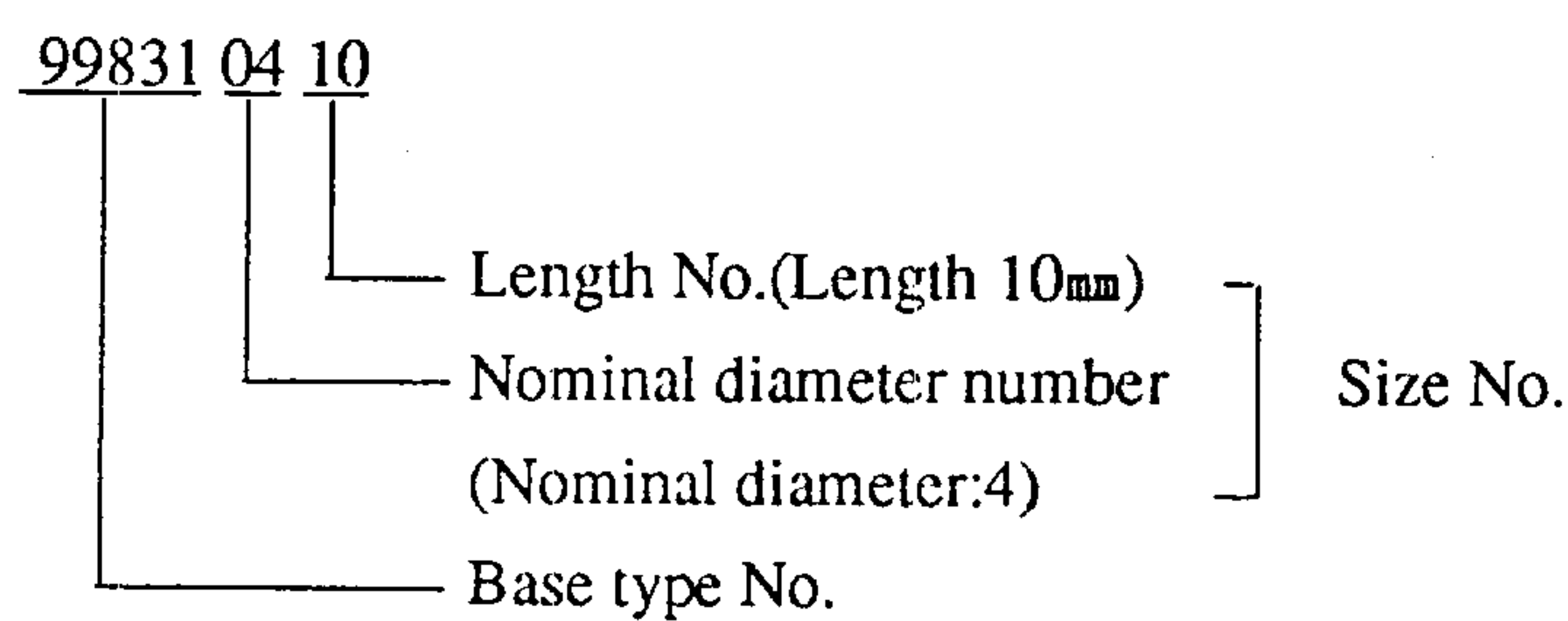
The designation of the machine screw shall be "SCREW".

15. Structure of Part Number

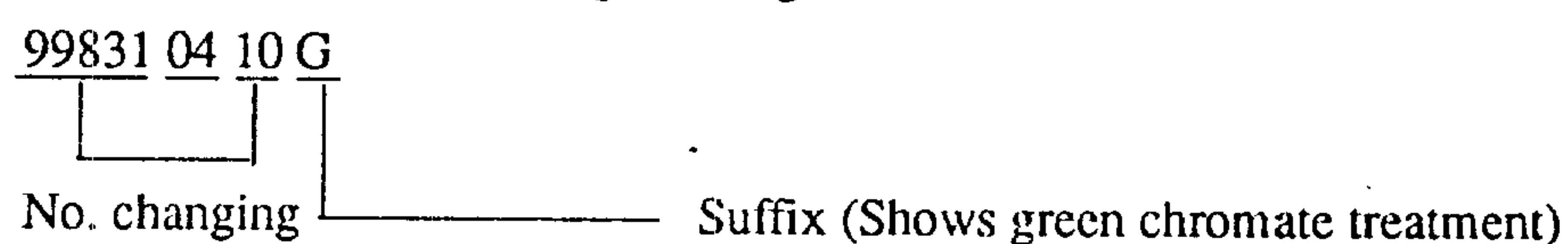
The structure of part number of the machine screw shall conform to the following examples.

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

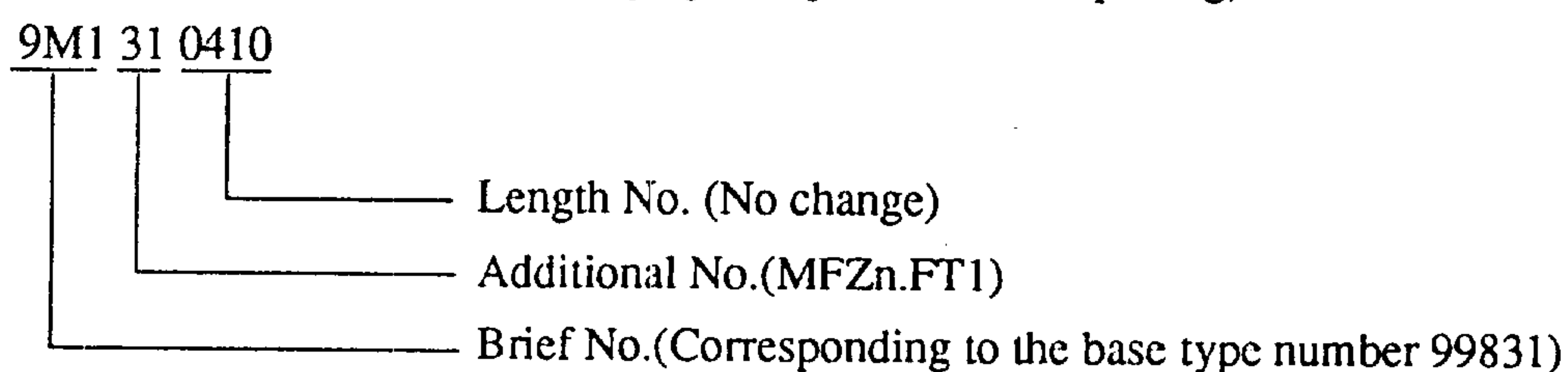
Example 1. For standard treatment (MFZnT₁-C)



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



Example 3. For derivative treatment (Changing the specification of plating)



16. Report of Effective Date.

No item to be reported.

17. Quoted Standards and Regulations

Refer to the latest editions.

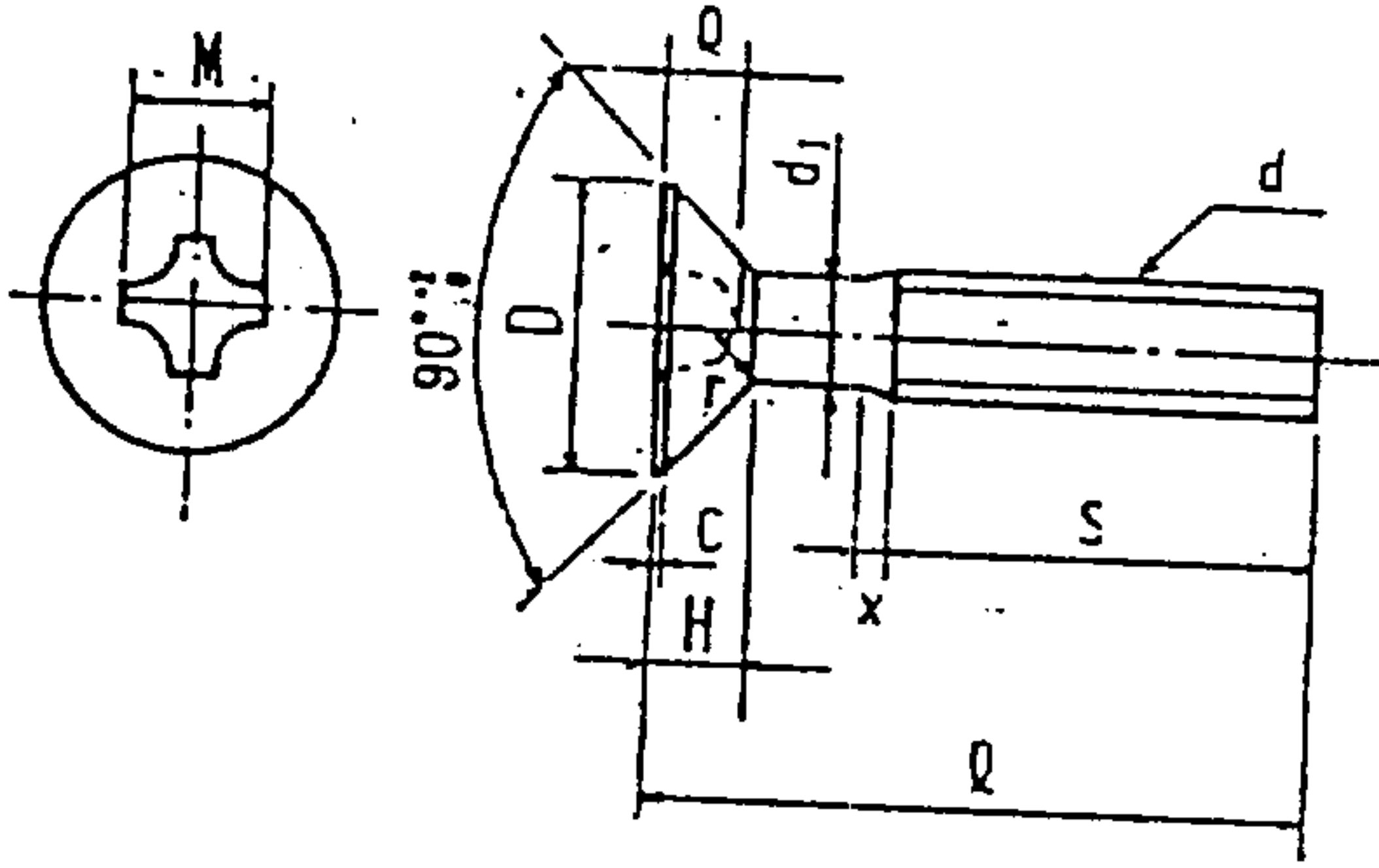
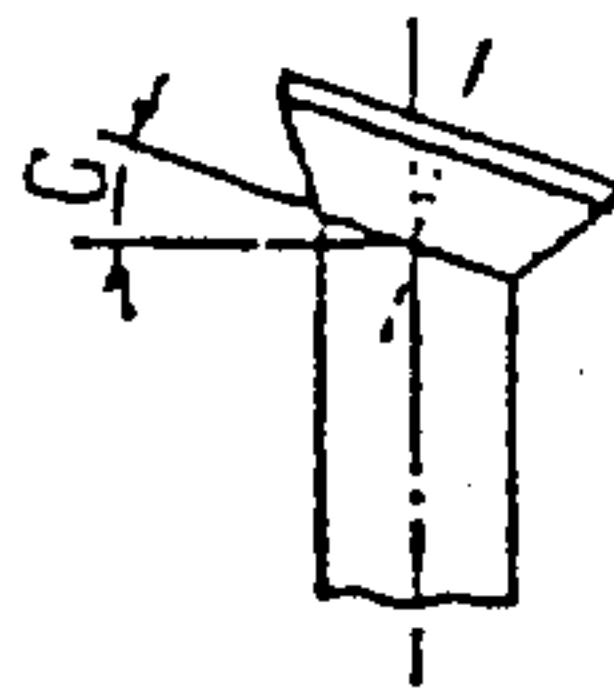
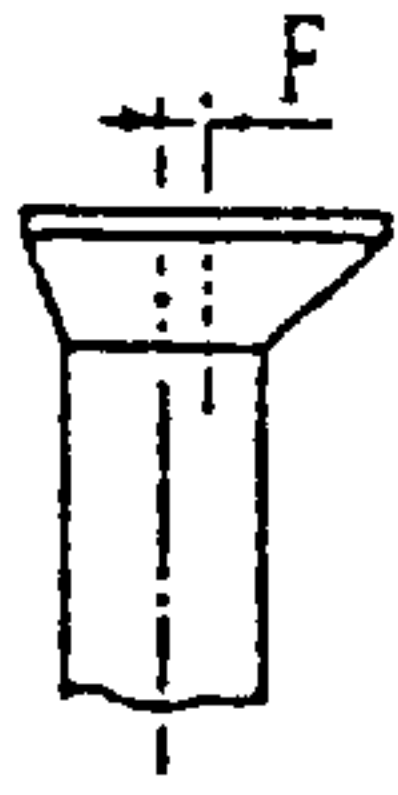
SAE J 417	Hardness Tests and Hardness Number Conversions
JIS B 0205	Metric Coarse Screw Threads
JIS B 0209	Limits of Sizes and Tolerances for Metric Coarse Screw Threads
JIS B 1012	Cross-Recesses for Screw

JIS B 1054	Specification for Corrosion-Resistant Stainless Steel Fasteners
JIS G 3539	Carbon Steel Wires for Cold Heading and Cold Forging
JIS G 4303	Stainless Steel Bars
JIS G 4308	Stainless Steel Wire Rods
KES A-C005	Definitions and Designation of Surface Roughness
KES A-A006	Structure and Application of Standard Part Number
KES C-C001	Mechanical Properties of Bolts and Screws
KES C-F002	Plating

Attached Table 1. Shape and demension of steel machine screws

Unit: mm

99831 (9M1)

Eccentricity of
cross - recessEccentricity
of headInclination
of bearing
surface

Nominal diameter number		03	04	05	06	08
Nominal diameter d		3	4	5	6	8
Pitch		0.5	0.7	0.8	1	1.25
No.of cross-recess		2			3	
D	Basic size	6	8	10	12	16
	Tolerance	0 -0.5		0 -0.6	0 -0.7	0 -0.8
*1	Basic size	1.75	2.3	2.8	3.4	4.4
H	Tolerance	0 -0.3			0 -0.4	
C	About.	0.25	0.3		0.4	
M	Max.	3.5	4.4	5	6.6	8.3
*2	Max.	1.43	2.33	2.93	3.26	4.96
Q	Min.	0.91	1.79	2.38	2.7	4.36
r	Max.	0.8	1	1.2	1.4	1.6
S		12	16	20	25	30
E	Max.	0.25	0.3	0.35	0.4	0.5
F	Max.	0.2	0.2	0.25	0.3	0.4
G	Max.	2°				

*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.

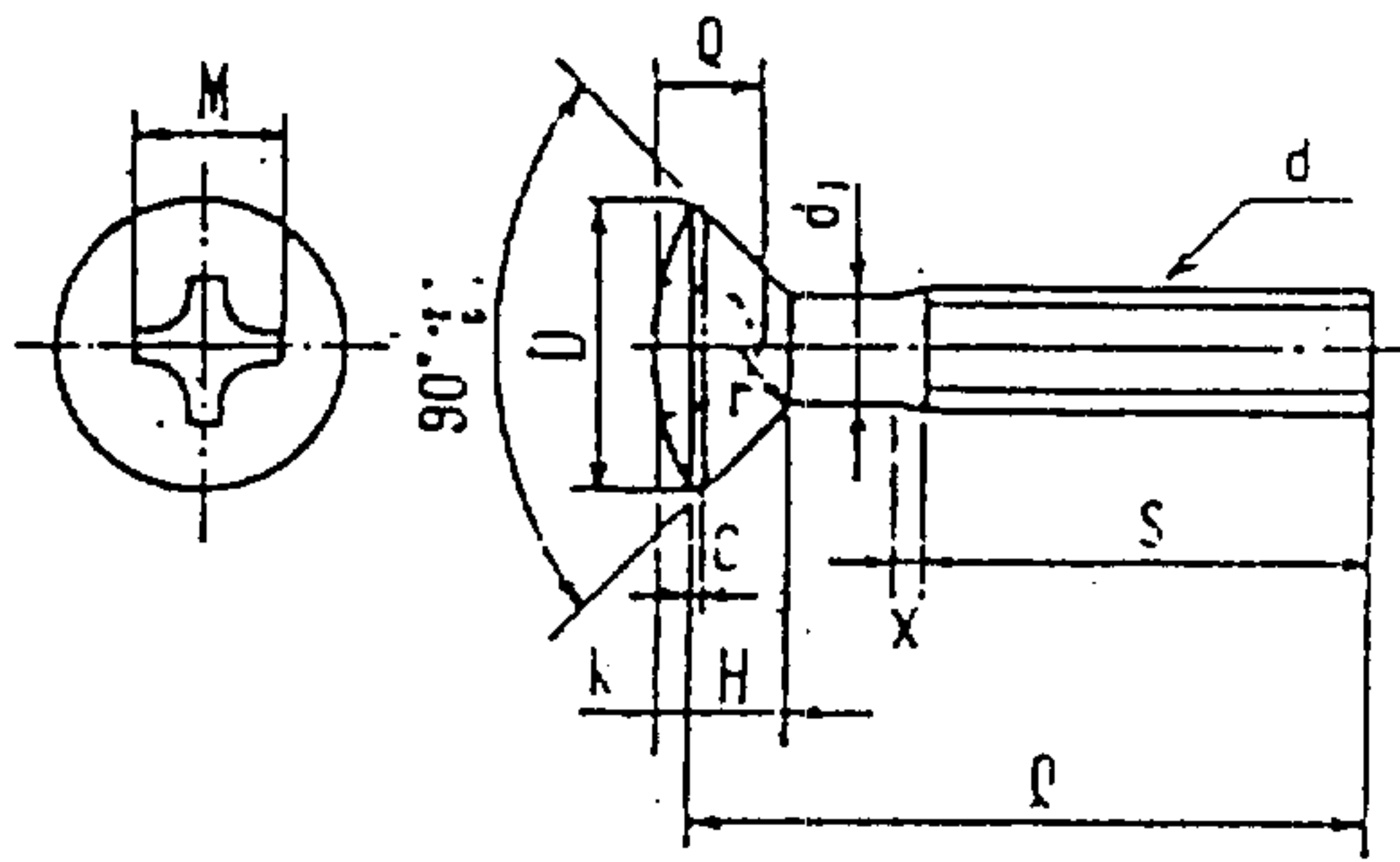
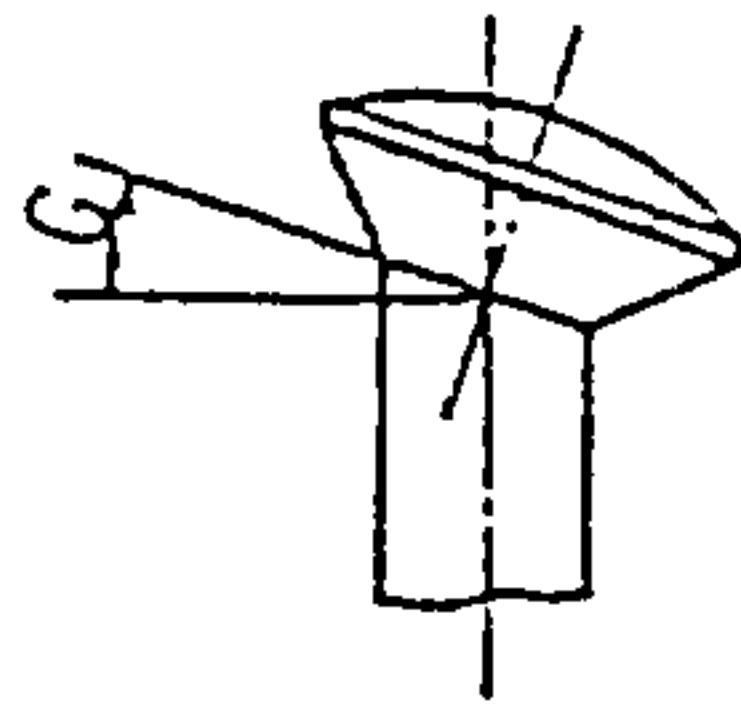
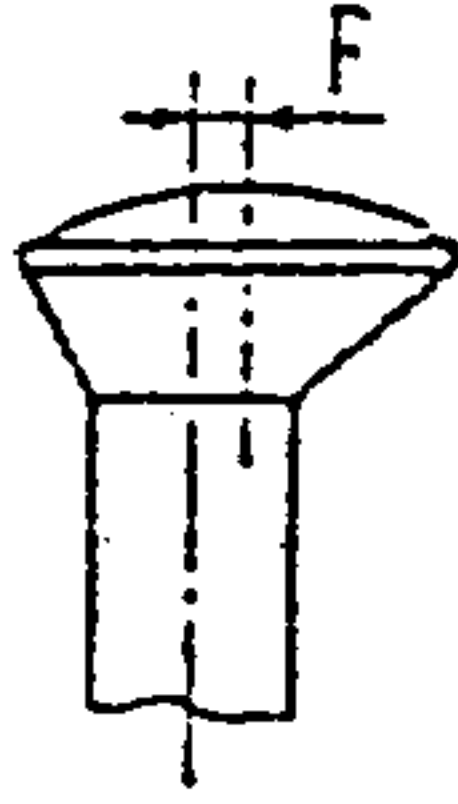
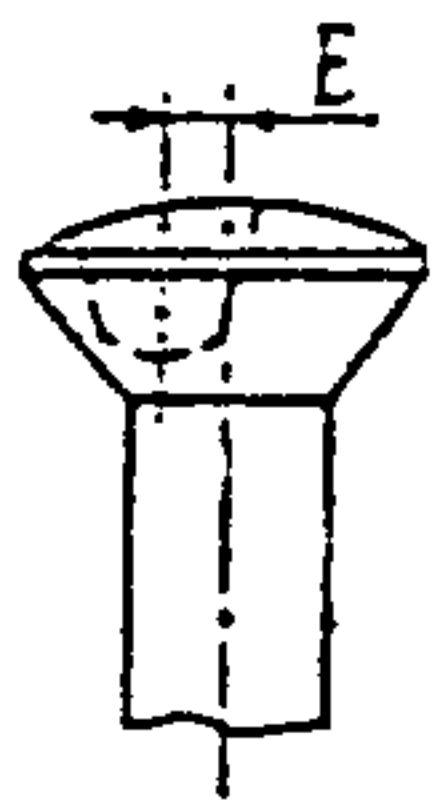
- Remarks 1. As a rule, the diameter d_1 of the unthreaded portion shall be approximately equivalent to the pitch diameter of the thread. In this case, d_1 shall be more than the minimum pitch diameter of the thread
2. "X" is the length of the incomplete thread and shall be approximately 2 ridges. When 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 $^{+3P}_0$ However, P shall be the pitch of the thread.

Length number	<i>l</i>	Weight: g * 3				
08	8					
10	10		1.0	1.7		
12	12		1.1	1.9	2.9	
16	16		1.4	2.4	3.6	7.0
20	20		1.7	2.9	4.3	8.3
25	25		2.1	3.5	5.1	9.8
30	30				6.0	11.3
35	35				6.8	12.9
40	40				7.7	13.2
45	45					
50	50					17.5
Over 50		At 5 intervals (special use)				
Toler- ance of <i>l</i>	10 and under	0 -0.6		0 -0.8		
	Over10 to 20 incl			0 -1		
	Over 20 to 40 incl	0 -0.8				
	Over 40	0 -1				

Attached Table 2. Shape and demension of steel machine screws

Unit: mm

99832 (9M2)

Eccentricity of
cross - recessEccentricity
of headInclination
of bearing
surface

- *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.
- *4 Screws of this length for special use shall not be used for new model.

Nominal diameter number		04	05	06
Nominal diameter d.		4	5	6
Pitch		0.7	0.8	1
No of cross-recess		2		3
D	Basic size	8	10	12
	Tolerance	$\begin{smallmatrix} 0 \\ -0.5 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.6 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.7 \end{smallmatrix}$
*1	Basic size	3.2	4	4.8
	Tolerance	$\begin{smallmatrix} 0 \\ -0.5 \end{smallmatrix}$		$\begin{smallmatrix} 0 \\ -0.6 \end{smallmatrix}$
C	About.	0.3		0.4
K	About	0.9	1.2	1.4
M	Max.	4.6	5.2	6.8
*2	Max.	2.53	3.13	3.46
	Min.	1.99	2.58	2.9
Q	Min.	1.99	2.58	2.9
r	Max.	1	1.2	1.4
S		16	20	25
E	Max.	0.3	0.35	0.4
F	Max.	0.2	0.25	0.3
G	Max.	2°		

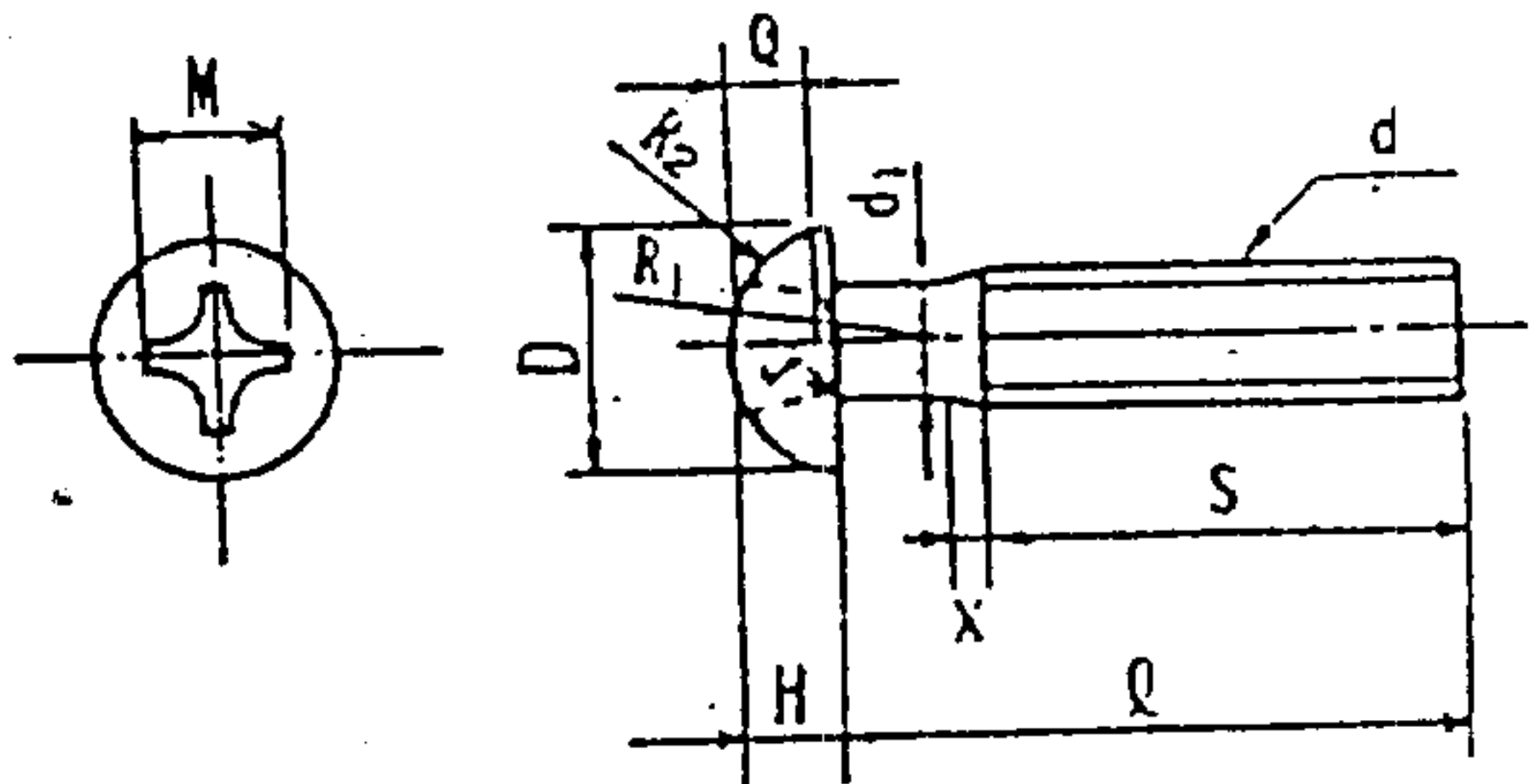
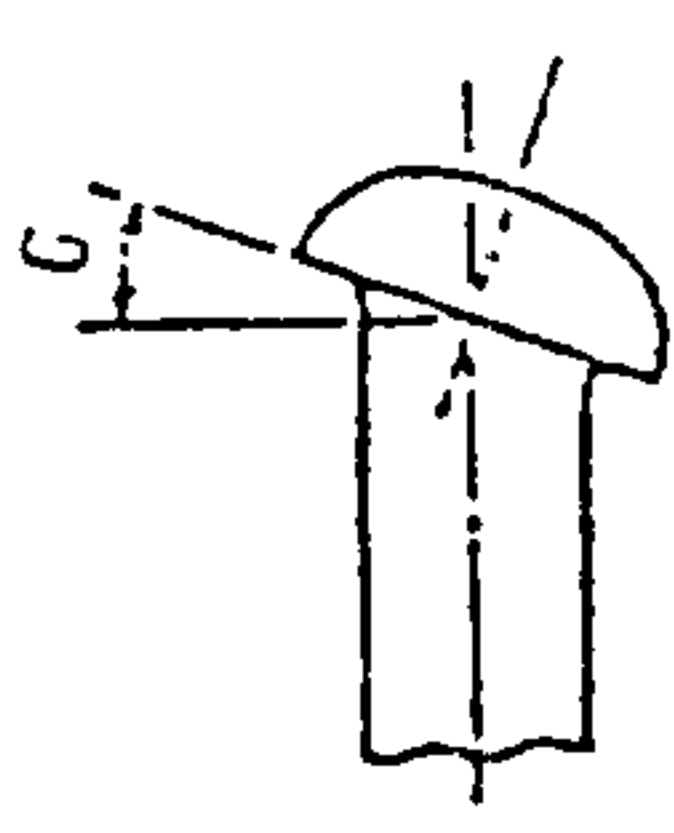
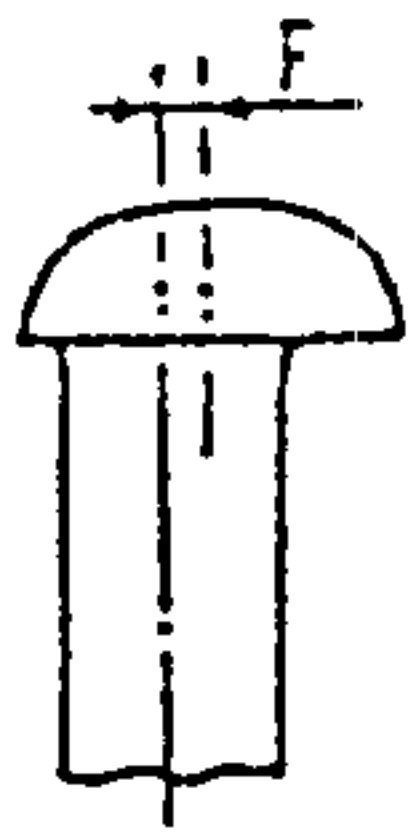
- Remarks 1. As a rule, the diameter d_1 of the unthreaded portion shall be approximately equivalent to the pitch diameter of the thread. In this case, d_1 shall be more than the minimum pitch diameter of the thread.
2. "X" is the length of the incomplete thread and shall be approximately 2 ridges. When 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 $\begin{smallmatrix} +3P \\ 0 \end{smallmatrix}$ However, P shall be the pitch of the thread.

Length number		<i>l</i>	Weight : g * 3		
08		8	*4		
10		10	1.2	2.0	
12		12	1.3	2.3	3.5
16		16	1.6	2.8	4.3
20		20	1.9	3.2	4.9
25		25		3.8	5.8
30		30			6.6
35		35		5.1	7.5
40		40			
45		45			
50		50			
Over 50			At 5 intervals (special use)		
Toler- ance of <i>l</i>	10 and under		0 -0.6	0 -0.8	
	Over 10 to 20 incl			0 -1	
	Over 20 to 40 incl		0 -0.8		
	Over 40		0 -1		

Attached Table 3. Shape and demension of steel machine screws

unit: mm

99833 (9M3)

Eccentricity of
cross - recessEccentricity
of headInclination of
bearing
surface

Nominal diameter number		*1 (03)	04	05	06	08
Nominal diameter d		3	4	5	6	8
Pitch		0.5	0.7	0.8	1	1.25
No.of cross-recess		2			3	
D	Basic size	5.5	7	9	10.5	14
	Tolerance	0 -0.5		0 -0.6	0 -0.7	0 -0.8
H	Basic size	2	2.6	3.4	4	5.4
	Tolerance	±0.15			± 0.2	
R1	About.	3.3	4.3	5.4	6.3	8.4
R2	About	1.8	2.3	3	3.5	4.6
M	Max.	3.4	4	4.7	6.1	7.6
*2	Max.	1.33	1.93	2.63	2.76	4.26
Q	Min.	0.76	1.35	2.04	2.16	3.63
r	Max.	0.4	0.5	0.6	0.7	0.9
S		12	16	20	25	30
E	Min.	0.25	0.3	0.35	0.4	0.5
F	Max.	0.2	0.2	0.25	0.3	0.4
G	Max.	2°				

*1. Screws of M3 in nominal diameter are rarely used. (Limited used)

*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.

*4 Screws of 0306 in size for special use shall not be used for new model.