Chapter 9

Fasteners

SUMMARY

Rationalization — The change to the metric system opens up a tremendous opportunity for USA industry to rationalize on fewer metric fastener sizes used in new products. For preferred metric thread sizes, see Table 8-1 and Table 9-1 for fastener length. Apply the preferred metric sizes shown in Table 4-1 to the fastener length to the extent practical. (Except for the length 250 mm where either 240 or 260 mm should be specified.) Rationalization on fewer standard parts released for production could save your company large sums of money. Each unique standard part creates additional cost in documentation, spare parts, handling, purchasing, quality assurance, inventory, etc., and for many large companies the cost runs into several thousand dollars and more.

INTRODUCTION

The national standards[1] for fasteners are shown in a World Metric Fastener Standards Index, which follows, and the comparison of standards on metric screw threads around the world can be found in Table 8-2. A comprehensive description of the existing ISO fasteners will be given later in this chapter.

The following index provides an illustration of each type of fastener with its name in English (E), German (G), French (F), and Italian (I). The applicable national standard number is shown with references as to where to find specific information.

[1] For information about the term “standard” as used in this book, please see p. 12.

GENERAL SPECIFICATIONS FOR FASTENERS

HOW TO ORDER METRIC HARDWARE

An Order Check List. The proper designation of metric bolts, screws, and nuts should include the following information:

1. General product description such as: bolts, hex cap screws, tapping screws, machine screws, nuts, slotted nuts, rivets, etc., and material if other than steel. Refer to the world index for the fastener name in the required language.
2. The letter M is used for a product with ISO metric screw threads followed by the thread pitch. The designations are as follows:

   ANSI: M10 X 1.5 10 mm nominal diameter ISO metric screw thread with standard 1.5 mm coarse thread pitch.

   ISO: M10 10 mm nominal diameter ISO metric screw thread with standard 1.5 mm coarse thread pitch.
   M10 X 1.25 10 mm nominal diameter ISO metric screw thread with standard 1.25 mm fine thread pitch.
3. Thread fit designation. Refer to Chapter 8, p. 141 for thread fit details.

   ANSI: M12 X 1.75 - Designates standard thread fit 6H/6g approximately equal to SAE class 2 fit.
   6H/6g
   M12 x 1.75 - Designates close thread fit — 6H/4g6g approximately equal to SAE class 3 fit.
   6H/4g6g

   The medium thread fit is customary in most countries, and need not be specified when ordering fasteners to a specific standard.
4. The length designation is shown in millimeters. Refer to Table 9-1 for the preferred fastener lengths.
5. The standard thread length conforms to ISO recommendations worldwide, and no special call-out for thread length is required (Table 9-3).
6. National standards reference. The threaded fasteners details are defined in industry or national the standards, and a reference to the desired standards must be made when ordering fasteners outside of USA.
7. The strength grade which applies to steel products only, must be specified. See p. 187 for details on strength properties.
8. The surface protection (if required) should be in accordance with company practice or other standards.

WORLD METRIC FASTENER STANDARDS INDEX

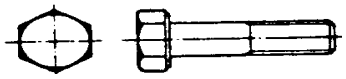
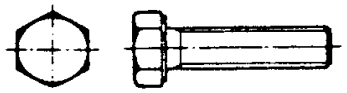
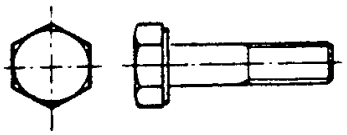
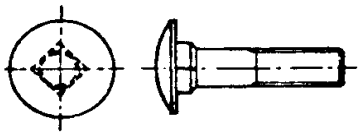
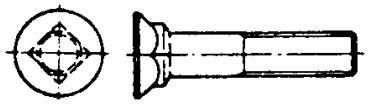
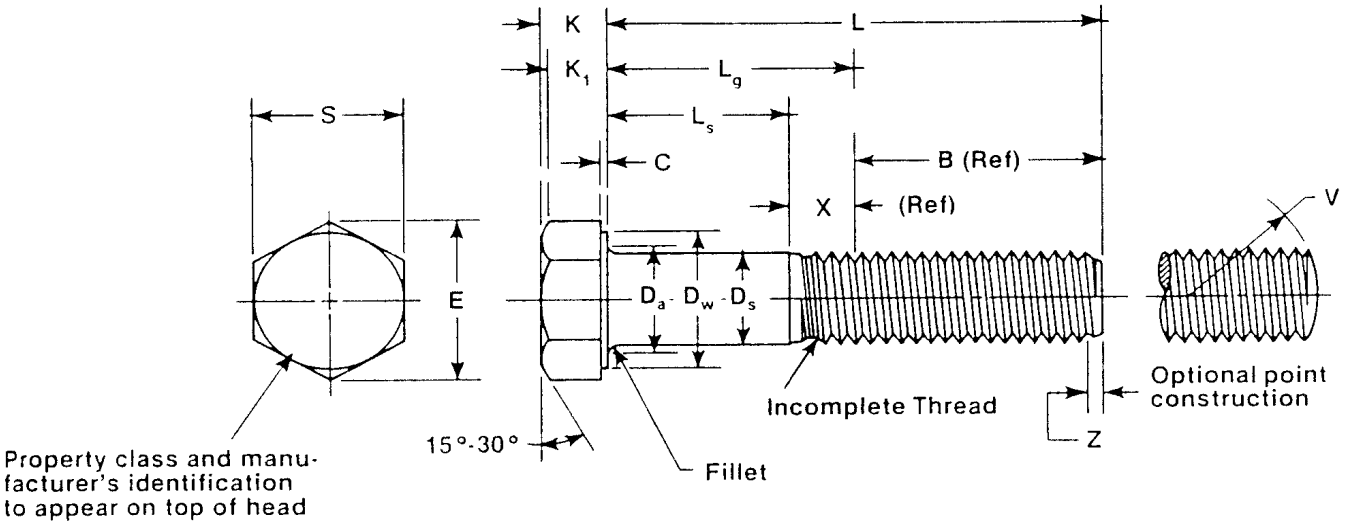
STANDARD	FIGURE	NAME	REFERENCE
N0. 1 ISO 4014-4016		(E) HEX HEAD CAP SCREW	FOR DETAILS SEE
USA ANSI B18.2.3.1M			TABLE 9-31 (CAP SCREW)
JAPAN JIS B1180		(G) SECHSKANTSCHRAUBE	TABLE 9-32 (FORMED SCR)
GERMANY DIN 931, 960		MIT SHAFT	TABLE 9-34 (BOLT)
FRANCE NF E27-311		(F) VIS A TETE	NOTE: THE ISO
UK BS 3692		HEXAGONALE	DESIGNATES PRODUCTS
ITALY UNI 5737, 5738		(I) VITE A TESTA	PARTIALLY THREADED
AUSTRAL AS 1110		ESAGONALE	AS BOLTS.
N0. 2 ISO 4017, 4018		(E) HEX HEAD CAP SCREW	FOR DETAILS SEE
USA ANSI B18.2.3.1M		THREADED TO HEAD	TABLE 9-31
JAPAN JIS		(G) SECHSKANTSCHRAUBE	NOTE: THE ISO DESIGNATES
GERMANY DIN 933, 961		MIT GEWINDE BIS KOPF	PRODUCTS THREADED TO
FRANCE NF E27-310		(F) VIS A TETE HEXAGONALE FILETEE	HEAD AS SCREWS
UK BS 4190 (BOLTS)		JUSQU'A PROXIMITE DE LA TETE	
ITALY UNI 5739, 5740		(I) VITE A TESTA	
AUSTRAL AS 1111 (BOLTS)		ESAGONALE	
NO. 3 ISO 272.0000		(E) HEX HEAD BOLT WITH LARGE	FOR DETAILS SEE
USA ANSI B18.2.3.1M		HEAD (HIGH STRENGTH STRUCTURAL)	TABLE 9-33 (HEAVY SCREW)
JAPAN JIS B1186		(G) SECHSKANTSCHRAUBE	
GERMANY DIN 6914		MIT GROSSER SCHLUSSELWEITE	TABLE 9-35 (HEAVY BOLT)
FRANCE NF E27-711		(F) VIS A TETE HEXAGONALE	
UK BS 4395		LARGE, A COLERETTE	TABLE 9-36
ITALY UNI 5712		(I) VITE A TESTA	(HEAVY STRUCTURAL BOLT)
AUSTRAL AS 1252		ESAGONALE LARGO	
NO. 4 ISO 8677		(E) ROUND HEAD SQUARE NECK	FOR DETAILS SEE
USA ANSI B18.5.2.1M		BOLT (CARRIAGE BOLT)	TABLE 9-39 (SHORT NECK)
JAPAN JIS B1171		(G) FLACHRUNDSCHRAUBE	
GERMANY DIN 603		MIT VIERKANTANSATZ	TABLE 9-40 (LONG NECK)
FRANCE NF E27-350		(F) VIS A TETE BOMBEE	
UK BS 4933		A COLLET CARRE	TABLE 9-41 (LARGE HEAD)
ITALY UNI 5731. 5732		(I) VITE A TESTA TONDO	
AUSTRAL AS 1390		LARGO CON QUARDRA SOTTOTESTA	
NO. 5 ISO 5713		(E) ROUND HEAD COUNTERSUNK	FOR DETAILS SEE
USA ANSI B18.5.1		SQUARE NECK BOLT (PLOW BOLT)	TABLE 9-43
JAPAN JIS B1179		(G) SENKSCHRAUBE MIT	
GERMANY DIN 608		VIERKANTANSATZ	
FRANCE NF E27-354		(F) VIS A TETE FRAISEE	
UK BS 4933		COLLET CARRE	
ITALY UNI 5735, 6104		(I) VITE A TESTA SVASATA	
AUSTRAL AS		CON QUADRA SOTTOTESTA	

TABLE 9-31 HEX CAP SCREWS (ANSI B18.2.3.1M) SAMPLE TABLE



D	D_s		S		E		K		K_W	C		D_W
Nominal Screw Dia and Thread Pitch	Body Diameter		Width Across Flats		Width Across Corners		Head Height		Wrenching Height	Washer Face Thickness		Washer Face Dia
	Max	Min	Max	Min	Max	Min	Max	Min	Min	Max	Min	Min
M5 x 0.8	5	4.82	8	7.78	9.24	8.79	3.65	3.35	2.4	0.5	0.2	7
M6 x 1	6	5.82	10	9.78	11.55	11.05	4.15	3.85	2.8	0.5	0.2	8.9
M8 x 1.125	8	7.78	13	12.73	15.01	14.38	5.5	5.1	3.7	0.6	0.3	11.6
M10 x 1.5	10	9.78	15	14.73	17.32	16.64	6.63	6.17	4.5	0.6	0.3	13.6
M10 x 1.5			16*	15.73	18.48	17.77						14.6
M12 x 1.75	12	11.73	18	17.73	20.78	20.03	7.76	7.24	5.2	0.6	0.3	16.6
M 14 x 2	14	13.73	21	20.67	24.25	23.35	9.09	8.51	6.2	0.6	0.3	19.6
M 16 x 2	16	15.73	24	23.67	27.71	26.75	10.32	9.68	7	0.8	0.4	22.49
M20 x 2.5	20	19.67	30	29.16	34.64	32.95	12.88	12.12	8.8	0.8	0.4	27.7
M24 x 3	24	23.67	36	35	41.57	39.55	15.44	14.56	10.5	0.8	0.4	33.2
M30 x 3.5	30	29.67	46	45	53.12	50.85	19.48	17.92	13.1	0.8	0.4	42.7
M36 x 4	36	35.61	55	53.8	63.51	60.79	23.38	21.62	15.8	0.8	0.4	51.1
M42 x 4.5	42	41.38	65	62.9	75.06	71.71	26.97	25.03	18.2	1	0.5	59.8
M48 x 5	48	47.38	75	72.6	86.6	82.76	31.07	28.93	21	1	0.5	69
M56 x 5.5	56	55.26	85	82.2	98.15	93.71	36.2	33.8	24.5	1	0.5	78.1
M64 x 6	64	63.26	95	91.8	109.7	104.65	41.32	38.68	28	1	0.5	87.2
M72 x 6	72	71.26	105	101.4	121.24	115.6	46.45	43.55	31.5	1.2	0.6	96.3
M80 x 6	80	79.26	115	111	132.72	126.54	51.58	48.42	35	1.2	0.6	105.4
M90 x 6	90	89.13	130	125.5	150.11	143.07	57.74	54.26	39.2	1.2	0.6	119.2
M100 x 6	100	99.13	145	140	167.43	159.6	63.9	60.1	43.4	1.2	0.6	133

*M10 x 1.5 with 16 mm WAF will be supplied unless the ISO 15 mm WAF is specified.

NOTES:

1. Parts made to this standard are interchangeable with parts made to ISO 4014, product grade A.
2. Standard strength property classes are: 5.8, 9.8, and 10.9 (see Table 9-4).
3. Designation example: Hex cap screw, M6 x 1 x 40, class 9.8, zinc plated.
4. See general data on p. 230 or referenced standard.