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AN AMERICAN NATIONAL STANDARD

Socket Head Cap Screws (Metric Series)

ASME/ANSI B18.3.1M-1986

(REVISION OF ANSI/ASME B18.3.1M-1982)

Government Key Words:
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FOREWORD

(This Foreword is not part of ASME/ANSI B18.3.1M-1986.)

American National Standards Committee B18 for the standardization of bolts, screws, nuts, rivets, and similar fasteners was organized in March 1922 as Sectional Committee B18 under the aegis of the American Engineering Standards Committee (later the American Standards Association, then the United States of America Standards Institute and, as of October 6, 1969, the American National Standards Institute) with the Society of Automotive Engineers and the American Society of Mechanical Engineers as joint sponsors.

Subcommittee No. 9 was established in April 1929 to undertake development and oversee maintenance of standards covering socket head cap screws and set screws. In line with a general realignment of the Subcommittee structure on April 1, 1966, Subcommittee 9 was redesignated Subcommittee 3. Over the intervening years this activity has produced several versions of American National Standards covering inch series socket cap, shoulder, and set screws bearing the B18.3 designation.

At the December 4, 1974 meeting of American National Standards Committee B18, Subcommittee 3 was assigned the task of preparing standards for metric series socket screw products paralleling that contained in the latest ANSI B18.3 document. The Subcommittee was also instructed to continue coordinating that activity with the International Standards Organization, ISO Technical Committee 2, and Working Group 3, and to the extent possible, keep the proposals for metric standards under development in conformance with agreements reached therein.

At the February 19, 1975 meeting of Subcommittee 3, it was agreed that the following basic principles be considered in developing the metric version of the standard.

(*a*) To assure consumers continuity of performance integrity consistent with inch socket screw products, the metric standards should maintain the same quality levels as their inch counterparts.

(*b*) To facilitate and expedite the processing, acceptance, and adoption of the metric versions, proposals for the various product categories should be prepared as separate and complete product standards.

(*c*) To promote understanding and assimilation during the transition to metric, the dimensional symbols, designations, terminology, and basic formats of the metric standards should be kept similar to those used in the ANSI B18.3 document.

In line with the foregoing, it was also agreed that a proposal covering metric series socket head cap screws based on the socket screw industry document, recognizing only alloy steel screws conforming to ISO property class 12.9 and containing data paralleling that under development by ISO/TC2/WG3 for updating the ISO R861 standard, be circulated for Subcommittee consideration. It was noted that due to diverse methods of tolerancing, several noncritical dimensions such as head diameter, head height, key engagement, and wall thickness reflected minor differences from the ISO values at their extremes. Consequently, a draft standard documenting these dimensional differences in an appendix and denoting that screws would be considered both functional and acceptable to these dimensions during the transition period was prepared and adopted by Subcommittee 3. Letter ballot of the initial proposal to Committee B18 resulted in extensive comments. A redraft incorporating

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resolutions of these comments, changes appearing in ISO 4762-1977, plus contemplated revisions thereto, and addition of government procurement data, was accepted by the B18 Committee in September 1977. After approval by the sponsor organizations, the proposed standard was submitted to the American National Standards Institute and granted recognition as an American National Standard on April 5, 1978.

Updating of the standard was initiated at the May 1979 meeting of Subcommittee 3, and discussions held over two ensuing meetings resulted in agreement that the document should be revised to incorporate changes to the tolerance on length, the grip, body lengths, and thread documentation; add dimensions for drilled head screws as an appendix; and eliminate the extensive data pertaining to nondimensional and performance requirements in favor of referencing the ASTM A 574M specification which had been released in the interim. A proposal embodying these changes along with extensive editorial refinements was prepared. Subsequent to Subcommittee acceptance, the proposal was approved by letter ballot to American National Standards Committee B18 and duly submitted for approval by the sponsor organizations and the American National Standards Institute. The revision was officially designated an American National Standard on February 18, 1982.

A periodic review of the standard, undertaken by the Subcommittee in 1985, resulted in agreement that the standard be revised to reflect interchangeability with screws made to ISO documents and to incorporate by reference the new ASTM documents for the appropriate mechanical, chemical, and testing requirements of metric socket head cap screws. A proposal containing these changes, as well as editorial corrections, was prepared for and balloted by letter ballot to ASME Committee B18. Following approval by ASME, the proposal was submitted to the American National Standards Institute and designated an American National Standard on August 29, 1986.

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SOCKET HEAD CAP SCREWS (METRIC SERIES)

1 GENERAL

1.1 Scope

1.1.1 This Standard contains complete general and dimensional data for metric series hexagon socket head cap screws in sizes from 1.6 mm to 48 mm and for metric series spline socket head cap screws in sizes from 1.6 mm to 8 mm recognized as American National Standard. Also included are appendices covering drill and counterbore sizes (Appendix I), drilled head dimensions (Appendix II), formulas for dimensions (Appendix III), ISO dimensional variations (Appendix IV), part numbering system and preferred sizes for government use (Appendix V), and thread dimensions (Appendix VI).

1.1.2 The inclusion of dimensional data in this Standard is not intended to imply that all of the products described are stock production sizes. Consumers should consult with manufacturers concerning lists of stock production sizes.

1.2 Interchangeability With Screws Made to ISO Documents[1]

Screws made to this Standard are functionally interchangeable with screws that conform to International Standard ISO 4762-1977. Minor variations in dimensions due to diverse tolerancing practices are documented in Appendix IV.

1.3 Dimensions

All dimensions in this Standard are given in millimeters (mm) and apply before plating unless stated otherwise.

[1]ISO documents are available for purchase from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

1.4 Options

Options, where specified, shall be at the discretion of the manufacturer unless agreed upon otherwise by manufacturer and purchaser.

1.5 Responsibility for Modification

The manufacturer shall not be held responsible for malfunctions of product due to plating or other modifications, when such plating or modification is not accomplished under his control or direction.

1.6 Terminology

For definitions of terms relating to fasteners or to component features thereof used in this Standard, refer to ANSI B18.12, Glossary of Terms for Mechanical Fasteners.

1.7 Designation

Metric socket head cap screws conforming to this Standard shall be designated by the following data in the sequence shown:

(*a*) Specification (ASME/ANSI document) number followed by a dash;

(*b*) Nominal size of screw;

(*c*) Thread pitch, preceded by ×;

(*d*) Nominal screw length, preceded by ×;

(*e*) Product name. If desired, the product name may be abbreviated SHCS.

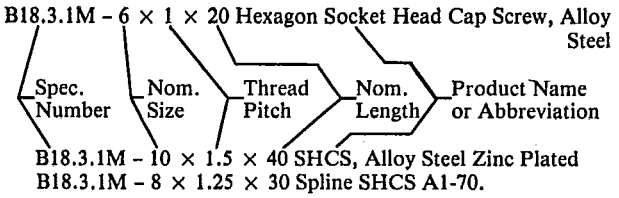
(*f*) Material and property class. Alloy steel screws shall be supplied to property class 12.9 as specified in ASTM A 574M. For corrosion-resistant steel screws, the property class and material requirements shall be as specified in ASTM F 837M (see para. 3.1).

(*g*) Drive. Unless specified otherwise, the socket shall be hexagon.

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(*h*) Protective finish, if required (see para. 3.3).

Examples:



1.8 Part Numbering System

For users who need a definitive part numbering system, one is suggested in Appendix V.

2 DIMENSIONAL CHARACTERISTICS

The following requirements supplement the dimensional data presented in Tables 1, 2, and 3 and shall apply to the respective features of screws.

2.1 Heads

2.1.1 Head Diameter. Heads may be plain or knurled at the option of the manufacturer unless specified otherwise by the customer. For knurled screws the maximum head diameter shall be measured across the tops of the knurl and the minimum head diameter shall be the diameter of the unknurled portion. The minimum head diameter should be measured just above the radius or chamfer at the bottom edge of the head. For nominal screw sizes 5 mm and larger, the heads shall be marked as specifed in para. 3.2.

2.1.2 Top of Head. The top of head, excluding socket, shall be flat and chamfered or radiused at the periphery. The length of the chamfer or rounding measured on the side of the head shall not exceed the tabulated value for *S* given in Table 1.

2.1.3 Edge of Head. The edge between the bearing surface and the side of the head may be broken (rounded or chamfered). If broken, the radius or chamfer measured along the bearing surface shall not exceed the values listed for *K* in Table 1.

2.1.4 Bearing Surface. The plane of the bearing surface shall be perpendicular to the axis of the screw within a maximum deviation of 1 deg.

2.1.5 Head Concentricity. The head shall be concentric with the axis of the screw shank within an amount equal to 2% of the basic screw diameter or 0.15 mm, whichever is greater, FIM (Full Indicator Movement). Concentricity shall be measured with the screw being held within a distance equal to one screw diameter from the underside of head but beyond the underhead fillet.

2.1.6 Underhead Fillet. For all lengths of screws the form of the fillet at junction of head and shank shall be optional within the following provisions. The fillet shall be a smooth and continuous concave curve fairing into the bearing surface within the limits for diameter *B*, with a juncture radius of not less than *F*, and blending into the shank at a distance from the head not exceeding *E*, as determined at the basic screw diameter *D*.

2.2 Sockets

2.2.1 Socket Type. Hexagon sockets shall be supplied, unless spline sockets are specified by the customer for screw sizes in which they are available.

2.2.2 Socket Size. Sockets shall be nominal size *J* for hexagon sockets and *M* for spline sockets specified in Table 1 for the corresponding screw size, and shall conform to the dimensions given in Tables 2 and 3, respectively, as determined by gaging or measurement in accordance with para. 2.2.4.

2.2.3 Key Engagement. The key engagement depth shall conform to the minimum values specified for *T* in Table 1, as determined by gaging or measurement in accordance with para. 2.2.4.

2.2.4 Socket Gaging. Acceptability of hexagon sockets of nominal socket sizes up to and including 24 mm and all spline sockets shall be ascertained by the use of the socket gages specified in Tables 4 and 5, respectively. The sockets shall allow the GO member of the gage to enter freely to the minimum key engagement depth. The NOT GO gage member shall be permitted to enter only to a depth equivalent to 10% of the nominal socket size for the 1.5 nominal size and 7.5% of the nominal socket size for larger sockets. Suitability of hexagon sockets of nominal sizes larger than 24 mm shall be determined by direct measurement.

To determine the acceptability of sockets in plated products after plating, a GO gage identical in design and tolerances to that shown in Tables 4 and 5 for hexagon or spline sockets, respectively, except having minimum dimensions equal to the nominal size, shall be employed.

2.2.5 Edge of Socket. The edge at the junction of the socket with the top of the head may be broken (rounded or chamfered) as depicted in Fig. 1 provided

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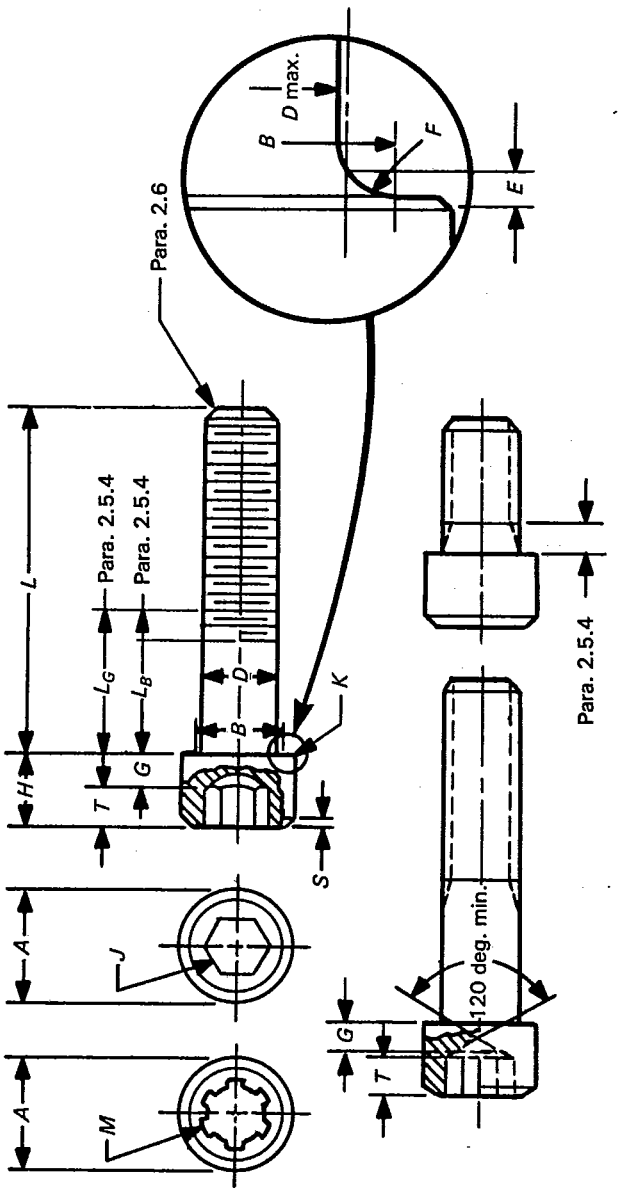


TABLE 1 DIMENSIONS OF METRIC SOCKET HEAD CAP SCREWS

Nominal Size and Thread Pitch	D		A		H		S	J	M	T	G	B		E	F	K
	Body Diameter		Head Diameter		Head Height		Chamfer or Radius	Hexagon Socket Size	Spline Socket Size	Key Engagement	Wall Thickness	Underhead Fillet				Chamfer or Radius
												Transition Diam.		Transition Length	Juncture Radius	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Nom.	Nom.	Min.	Min.	Max.	Min.	Max.	Min.	Max.
M1.6 × 0.35	1.60	1.46	3.00	2.87	1.60	1.52	0.16	1.5	1.829	0.80	0.54	2.0	1.8	0.34	0.10	0.08
M2 × 0.4	2.00	1.86	3.80	3.65	2.00	1.91	0.20	1.5	1.829	1.00	0.68	2.6	2.2	0.51	0.10	0.08
M2.5 × 0.45	2.50	2.36	4.50	4.33	2.50	2.40	0.25	2.0	2.438	1.25	0.85	3.1	2.7	0.51	0.10	0.08
M3 × 0.5	3.00	2.86	5.50	5.32	3.00	2.89	0.30	2.5	2.819	1.50	1.02	3.6	3.2	0.51	0.10	0.13
M4 × 0.7	4.00	3.82	7.00	6.80	4.00	3.88	0.40	3.0	3.378	2.00	1.52	4.7	4.4	0.60	0.20	0.13
M5 × 0.8	5.00	4.82	8.50	8.27	5.00	4.86	0.50	4.0	4.648	2.50	1.90	5.7	5.4	0.60	0.20	0.13
M6 × 1	6.00	5.82	10.00	9.74	6.00	5.85	0.60	5.0	5.486	3.00	2.28	6.8	6.5	0.68	0.25	0.20
M8 × 1.25	8.00	7.78	13.00	12.70	8.00	7.83	0.80	6.0	7.391	4.00	3.20	9.2	8.8	1.02	0.40	0.20
M10 × 1.5	10.00	9.78	16.00	15.67	10.00	9.81	1.00	8.0	. . .	5.00	4.00	11.2	10.8	1.02	0.40	0.20

(Table 1 continues on next page)

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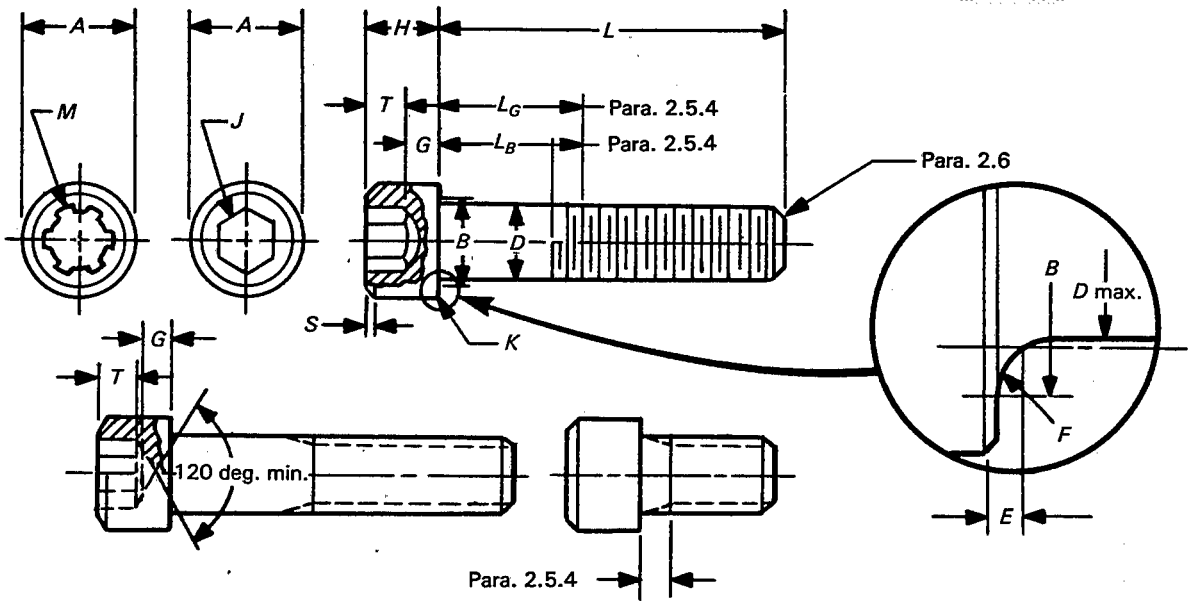
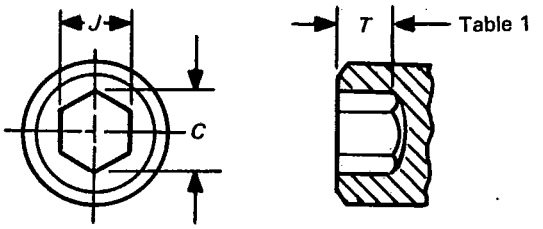


TABLE 1 DIMENSIONS OF METRIC SOCKET HEAD CAP SCREWS (CONT'D)

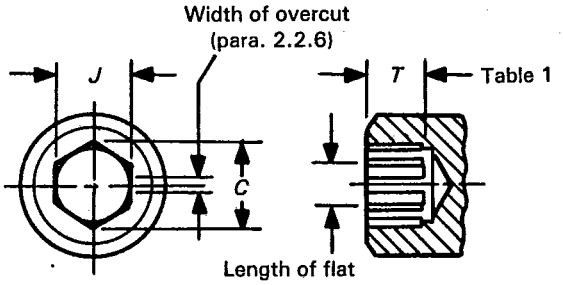
Nominal Size and Thread Pitch	D		A		H		S	J	M	T	G	B		E	F	K
	Body Diameter		Head Diameter		Head Height		Chamfer or Radius	Hexagon Socket Size	Spline Socket Size	Key Engagement	Wall Thickness	Underhead Fillet				
												Transition Diam.		Transition Length	Juncture Radius	Chamfer or Radius
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Nom.	Nom.	Min.	Min.	Max.	Min.	Max.	Min.	Max.
M12 × 1.75	12.00	11.73	18.00	17.63	12.00	11.79	1.20	10.0	...	6.00	4.80	14.2	13.2	1.87	0.60	0.25
M14 × 2 (1)	14.00	13.73	21.00	20.60	14.00	13.77	1.40	12.0	...	7.00	5.60	16.2	15.2	1.87	0.60	0.25
M16 × 2	16.00	15.73	24.00	23.58	16.00	15.76	1.60	14.0	...	8.00	6.40	18.2	17.2	1.87	0.60	0.25
M20 × 2.5	20.00	19.67	30.00	29.53	20.00	19.73	2.00	17.0	...	10.00	8.00	22.4	21.6	2.04	0.80	0.40
M24 × 3	24.00	23.67	36.00	35.48	24.00	23.70	2.40	19.0	...	12.00	9.60	26.4	25.6	2.04	0.80	0.40
M30 × 3.5	30.00	29.67	45.00	44.42	30.00	29.67	3.00	22.0	...	15.00	12.00	33.4	32.0	2.89	1.00	0.40
M36 × 4	36.00	35.61	54.00	53.37	36.00	35.64	3.60	27.0	...	18.00	14.40	39.4	38.0	2.89	1.00	0.40
M42 × 4.5	42.00	41.61	63.00	62.31	42.00	41.61	4.20	32.0	...	21.00	16.80	45.6	44.4	3.06	1.20	0.40
M48 × 5	48.00	47.61	72.00	71.27	48.00	47.58	4.80	36.0	...	24.00	19.20	52.6	51.2	3.91	1.60	0.40
See Para.	2.4.2		2.1.1				2.1.2	2.2.2	2.2.2	2.2.3		2.1.6				2.1.3

NOTE:
(1) The 14 × 2 mm size is not recommended for use in new designs.

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(a) Forged Socket



(b) Broached Socket

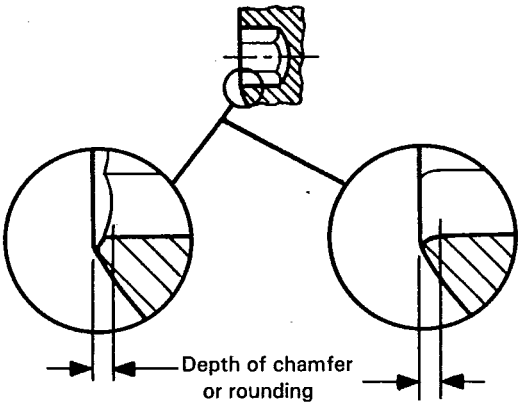


FIG. 1 SOCKET EDGE DETAIL

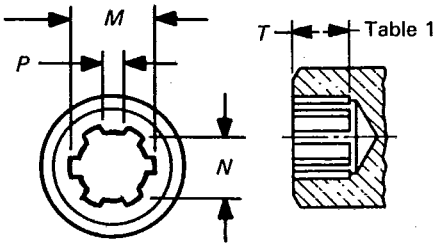


TABLE 2 DIMENSIONS OF METRIC HEXAGON SOCKETS

Nominal Hexagon Socket Size	J		C
	Socket Width Across Flats		Socket Width Across Corners
	Max.	Min.	Min.
1.5	1.545	1.520	1.73
2	2.045	2.020	2.30
2.5	2.560	2.520	2.87
3	3.071	3.020	3.44
4	4.084	4.020	4.58
5	5.084	5.020	5.72
6	6.095	6.020	6.86
8	8.115	8.025	9.15
10	10.127	10.025	11.50
12	12.146	12.032	13.80
14	14.159	14.032	16.09
17	17.216	17.050	19.56
19	19.243	19.065	21.87
22	22.319	22.065	25.31
24	24.319	24.065	27.60
27	27.319	27.065	31.04
32	32.461	32.080	36.80
36	36.461	36.080	41.38

TABLE 3 DIMENSIONS OF METRIC SPLINE SOCKETS

Nominal Spline Socket Size	M		N		P	
	Socket Major Diameter		Socket Minor Diameter		Width of Tooth	
	Max.	Min.	Max.	Min.	Max.	Min.
1.829	1.8796	1.8542	1.6256	1.6002	0.4064	0.3810
2.438	2.4892	2.4638	2.0828	2.0320	0.5588	0.5334
2.819	2.9210	2.8702	2.4892	2.4384	0.6350	0.5842
3.378	3.4798	3.4290	2.9972	2.9464	0.7620	0.7112
4.648	4.7752	4.7244	4.1402	4.0894	0.9906	0.9398
5.486	5.6134	5.5626	4.8260	4.7752	1.2700	1.2192
7.391	7.5692	7.5184	6.4516	6.4008	1.7272	2.6764

GENERAL NOTE:
The tabulated dimensions represent direct metric conversions of the equivalent inch size spline sockets shown in ASME/ANSI B18.3, Socket Cap, Shoulder, and Set Screws (Inch Series). Therefore, the spline keys and bits shown therein are applicable for wrenching the corresponding size metric spline sockets.

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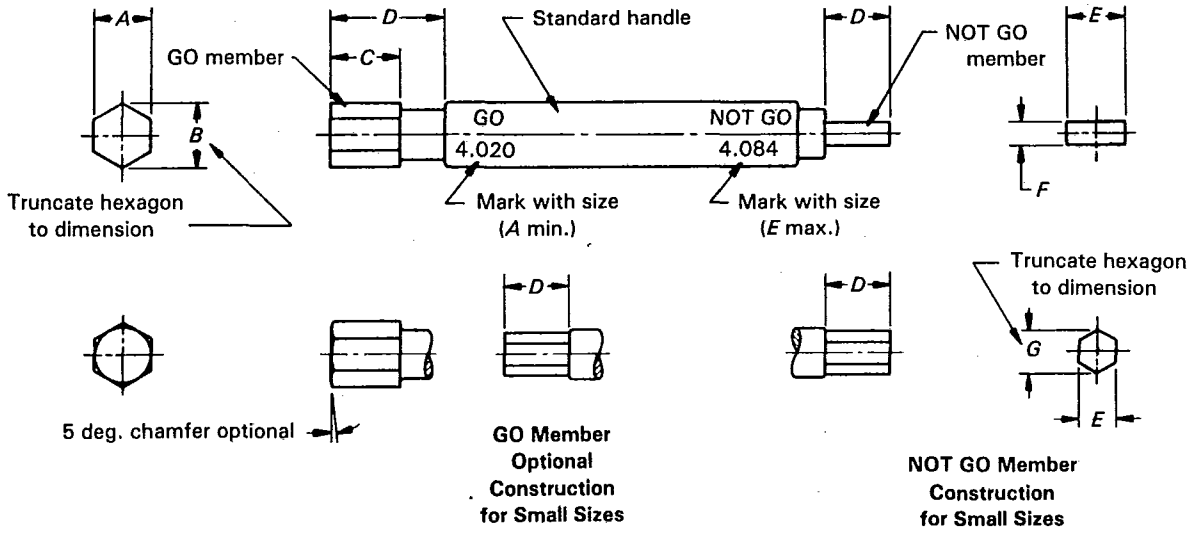


TABLE 4 DIMENSIONS OF METRIC HEXAGON SOCKET GAGES

Nominal Hexagon Socket Size	A		B		C	D	E		F		G	
	GO Gage Width Across Flats		GO Gage Width Across Corners		GO Gage Length	Usable Gage Length	NOT GO Gage Width		NOT GO Gage Thickness		NOT GO Gage Width Across Corners	
	Max.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1.5	1.523	1.520	1.730	1.725	5.0	5.0	1.545	1.543	...	...	1.68	1.66
2.0	2.023	2.020	2.300	2.295	5.0	5.0	2.045	2.043	...	...	2.23	2.21
2.5	2.525	2.520	2.870	2.865	7.0	7.0	2.560	2.554	...	...	2.79	2.77
3.0	3.025	3.020	3.440	3.435	7.0	7.0	3.071	3.066	...	...	3.35	3.33
4.0	4.025	4.020	4.580	4.575	7.0	7.0	4.084	4.079	1.80	1.75	...	...
5.0	5.025	5.020	5.720	5.715	7.0	7.0	5.084	5.079	2.30	2.25	...	...
6.0	6.025	6.020	6.860	6.855	8.0	12.0	6.095	6.091	2.80	2.75	...	...
8.0	8.030	8.025	9.150	9.145	8.0	16.0	8.115	8.109	3.80	3.75	...	...
10.0	10.030	10.025	11.500	11.495	12.0	20.0	10.127	10.122	4.80	4.75	...	...
12.0	12.037	12.032	13.800	13.795	12.0	24.0	12.146	12.141	5.75	5.70	...	...
14.0	14.037	14.032	16.090	16.085	12.0	28.0	14.159	14.154	6.75	6.70	...	...
17.0	17.055	17.050	19.560	19.555	19.0	34.0	17.216	17.211	8.10	8.05	...	...
19.0	19.070	19.065	21.870	21.865	19.0	38.0	19.243	19.238	9.10	9.05	...	...
22.0	22.070	22.065	25.310	25.305	22.0	44.0	22.319	22.314	10.50	10.45	...	...
24.0	24.070	24.065	27.600	27.595	25.0	48.0	24.319	24.314	11.50	11.45	...	...

GENERAL NOTES:

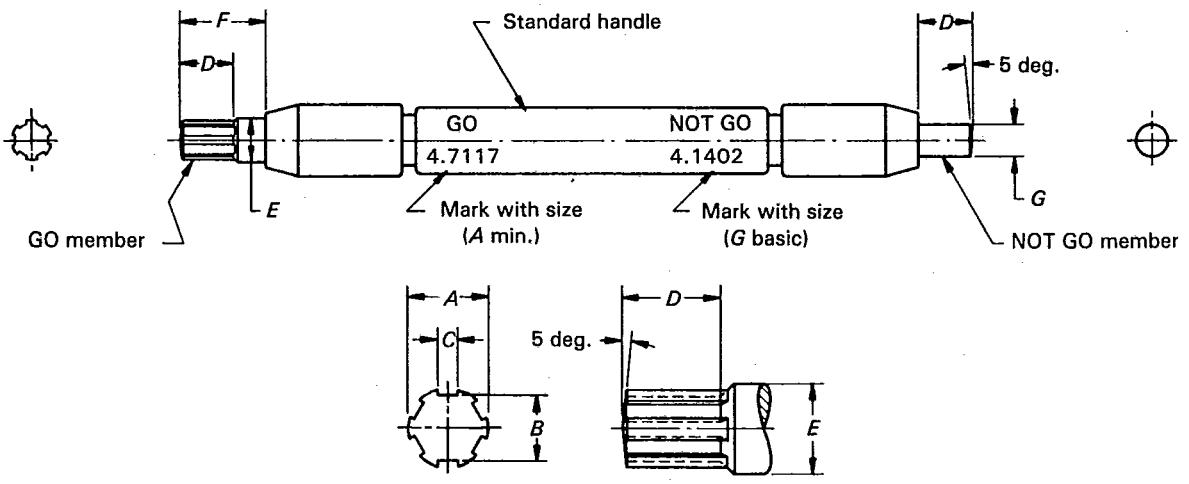
(a) Gages shall be made from steel, hardened and tempered to a hardness of HRC 60 minimum. They shall be thermally stabilized and given suitable surface treatment to obtain maximum abrasion resistance.

(b) The form of hexagonal gage members shall be within the tolerance zone specified. See ANSI Y14.5M, Engineering Drawing and Related Documentation Practices, Dimensioning and Tolerancing.

(c) The surface roughness on hexagonal flats shall be 0.2 μm (arithmetical average) maximum. See ANSI/ASME B46.1, Surface Texture.

(d) The gage handles shall conform to ANSI B47.1, Gage Blanks.

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Detail of GO Gage Member

TABLE 5 DIMENSIONS OF METRIC SPLINE SOCKET GAGES[1]

Nominal Spline Socket Size	Number of Teeth	A		B		C		D	E	F	G
		GO Gage Major Diameter		GO Gage Minor Diameter		GO Gage Space Width		GO Gage Length	GO Gage Shoulder Diameter	Length	NOT GO Gage Diameter
		Max.	Min.	Max.	Min.	Max.	Min.	Min.	±0.0508	Min.	Basic
1.829	6	1.8466	1.8415	1.5926	1.5875	0.4191	0.4140	1.5875	1.8542	4.7498	1.6256
2.438	6	2.4562	2.4511	2.0244	2.3825	0.5715	0.5664	2.0193	2.4892	6.3500	2.0828
2.819	6	2.8626	2.8575	2.4308	2.3825	0.6477	0.6426	2.4257	2.8702	6.3500	2.4892
3.378	6	2.4214	2.4163	2.9388	2.3825	0.7747	0.7696	2.9337	3.4544	6.3500	2.9972
4.648	6	4.7168	4.7117	4.0818	4.7625	1.0033	0.9982	4.0767	4.7625	9.5250	4.1402
5.486	6	5.5550	5.5499	4.7676	4.7625	1.2827	1.2776	4.7625	5.5550	11.0998	4.8260
7.391	6	7.5103	7.5057	6.3932	6.3500	1.7399	1.7348	6.3881	7.5387	15.8750	6.4516

GENERAL NOTES:

(a) Gages shall be made from steel, hardened and tempered to a hardness of HRC 60 minimum. They shall be thermally stabilized and given suitable surface treatment to obtain maximum abrasion resistance.

(b) The form of hexagonal gage members shall be within the tolerance zone specified. See ANSI Y14.5M, Engineering Drawing and Related Documentation Practices, Dimensioning and Tolerancing.

(c) The surface roughness on spline surfaces shall be 0.2 μm (arithmetical average) maximum. See ANSI/ASME B46.1, Surface Texture.

(d) The gage handles shall conform to ANSI B47.1, Gage Blanks.

NOTE:

(1) The tabulated dimensions represent direct metric conversions of the equivalent inch size spline socket gages shown in ASME/ANSI B18.3, Socket Cap, Shoulder, and Set Screws (Inch Series). Therefore, the spline socket gages shown therein are applicable to gaging of the corresponding size metric spline sockets.

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the depth of chamfer or rounding does not violate the NOT GO gage penetration limit specified in para. 2.2.4.

2.2.6 Broached Sockets. For hexagon broached sockets at or near the maximum size limit, the overcut resulting from drilling shall not exceed 20% of the length of any flat of the socket on nominal socket sizes up to and including 24 mm and 30% on larger sockets. See Table 2, sketch (b).

2.2.7 Socket True Position. The axis of the socket shall be located at true position relative to the axis of the screw within a tolerance zone having a diameter equal to 3% of the basic screw diameter or 0.26 mm, whichever is greater, for nominal screw sizes up to and including 12 mm; and equal to 6% of the basic screw diameter for sizes larger than 12 mm — regardless of feature size.

2.3 Length

2.3.1 Measurement. The length of the screw shall be measured, parallel to the axis of the screw, from the plane of the bearing surface under the head to the extreme end of the shank.

2.3.2 Tolerance on Length. The tolerance on length shall be bilateral as tabulated below:

Nominal Screw Size	M1.6 Through M10	M12 Through M20	Over M20
Nominal Screw Length	Tolerance on Length, mm		
Up to 16 mm, incl.	±0.3	±0.3	...
Over 16 mm to 50 mm, incl.	±0.4	±0.4	±0.7
Over 50 mm to 120 mm, incl.	±0.7	±1.0	±1.5
Over 120 mm to 200 mm, incl.	±1.0	±1.5	±2.0
Over 200 mm	±2.0	±2.5	±3.0

2.3.3 Standard Lengths. The standard lengths for socket head cap screws shall be as follows: 2.5, 3, 4, 5, 6, 8, 10, 12, 16, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 180, 200, 220, 240, 260, and 300.

2.4 Body

2.4.1 Body Length. The body length (unthreaded portion of shank) shall be as specified in para. 2.5.4.2.

2.4.2 Body Diameter. The diameter of body throughout the body length shall be within the limits for D specified in Table 1. For screws that are threaded full length, the diameter of the unthreaded portion of shank shall be within D maximum and the specified minimum pitch diameter of the thread.

2.5 Threads

2.5.1 Thread Series and Form. Unless specified otherwise, threads shall be the metric coarse series in accordance with ANSI/ASME B1.13M, Metric Screw Threads — M Profile.

2.5.2 Thread Tolerance Class. Threads shall be tolerance class 4g6g. For plated screws, the allowance g may be consumed by the thickness of plating so that the maximum size limit after plating shall be that of tolerance class 4h6h. Thread limits shall be in accordance with ANSI/ASME B1.13M. See Appendix VI wherein the allowance g shown for sizes up to and including 4 mm has been increased over that specified for corresponding sizes in the ISO documents to better accommodate plating requirements. However, because the minimum limits are unchanged, the screws will be totally interchangeable.

2.5.3 Thread Gaging. Acceptability of screw threads shall be determined based upon System 22 of ANSI/ASME B1.3M.

2.5.4 Thread Length. The length of complete thread L_T shall be controlled by the grip length L_G as described in para. 2.5.4.1, and the length of total thread L_{TT} shall be controlled by the body length L_B as set forth in para. 2.5.4.2. The L_T minimum and L_{TT} maximum values shown in Table 6B are reference dimensions intended for calculation purposes only in accordance with para. 2.5.4.4. See sketch Table 6B.

2.5.4.1 Grip Length. The grip length L_G shall be maximum and represents the minimum design grip length of the screw. It shall be measured, parallel to the axis of screw, from the bearing surface of the head to the face of a GO thread ring gage, having the countersink and/or counterbore removed, which has been assembled by hand as far as the thread will permit. The L_G maximum length is a criterion for acceptance and shall conform to the values given in Table 6 or, for diameter/length combinations not shown therein, shall be as calculated per para. 2.5.4.4.

2.5.4.2 Body Length. The body length L_B shall be minimum and represents the minimum full body length of the screw. It shall be measured, parallel to the axis of the screw, from the bearing surface of the head to the top of the extrusion angle or to the last scratch of the thread. The L_B minimum length is a criterion for acceptance and shall conform to the values

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TABLE 6A BODY AND GRIP LENGTH DIMENSIONS FOR METRIC SOCKET HEAD CAP SCREWS

Nominal Size	M1.6		M2		M2.5		M3		M4		M5		M6		M8		M10		M12		M14		M16		M20		M24	
Nominal Length	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B	L_G	L_B
20	4.8	3.0	4.0	2.0																								
25	9.8	8.0	9.0	7.0	8.0	5.7	7.0	4.5																				
30	14.8	13.0	14.0	12.0	13.0	10.7	12.0	9.5	10.0	6.5																		
35	...	...	19.0	17.0	18.0	15.7	17.0	14.5	15.0	11.5	13.0	9.0	11.0	6.0														
40	...	...	24.0	22.0	23.0	20.7	22.0	19.5	20.0	16.5	18.0	14.0	16.0	11.0														
45	...	...	...	...	28.0	25.7	27.0	24.5	25.0	21.5	23.0	19.0	21.0	16.0	17.0	10.7												
50	...	...	...	...	33.0	30.7	32.0	29.5	30.0	26.5	28.0	24.0	26.0	21.0	22.0	15.7	18.0	10.5										
55	...	...	...	...	...	...	37.0	34.5	35.0	31.5	33.0	29.0	31.0	26.0	27.0	20.7	23.0	15.5										
60	...	...	...	...	...	...	42.0	39.5	40.0	36.5	38.0	34.0	36.0	31.0	32.0	25.7	28.0	20.5	24.0	15.2								
65	...	...	...	...	...	...	47.0	44.5	45.0	41.5	43.0	39.0	41.0	36.0	37.0	30.7	33.0	25.5	29.0	20.2	25.0	15.0						
70	...	...	...	...	...	...	...	...	50.0	46.5	48.0	44.0	46.0	41.0	42.0	35.7	38.0	30.5	34.0	25.2	30.0	20.0	26.0	16.0				
80	...	...	...	...	...	...	...	...	60.0	56.5	58.0	54.0	56.0	51.0	52.0	45.7	48.0	40.5	44.0	35.2	40.0	30.0	36.0	26.0				
90	...	...	...	...	...	...	...	...	...	...	68.0	64.0	66.0	61.0	62.0	55.7	58.0	50.5	54.0	45.2	50.0	40.0	46.0	36.0	38.0	25.5		
100	...	...	...	...	...	...	...	...	...	...	78.0	74.0	76.0	71.0	72.0	65.7	68.0	60.5	64.0	55.2	60.0	50.0	56.0	46.0	48.0	35.5	40.0	25.0
110	...	...	...	...	...	...	...	...	...	...	...	...	86.0	81.0	82.0	75.7	78.0	70.5	74.0	65.2	70.0	60.0	66.0	56.0	58.0	45.5	50.0	35.0
120	...	...	...	...	...	...	...	...	...	...	...	...	96.0	91.0	92.0	85.7	88.0	80.5	84.0	75.2	80.0	70.0	76.0	66.0	68.0	55.5	60.0	45.0
130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	102.0	95.7	98.0	90.5	94.0	85.2	90.0	80.0	86.0	76.0	78.0	65.5	70.0	55.0
140	...	...	...	...	...	...	...	...	...	...	...	...	...	...	112.0	105.7	108.0	100.5	104.0	95.2	100.0	90.0	96.0	86.0	88.0	75.5	80.0	65.0
150	...	...	...	...	...	...	...	...	...	...	...	...	...	...	122.0	115.7	118.0	110.5	114.0	105.2	110.0	100.0	106.0	96.0	98.0	85.5	90.0	75.0
160	...	...	...	...	...	...	...	...	...	...	...	...	...	...	132.0	125.7	128.0	120.5	124.0	115.2	120.0	110.0	116.0	106.0	108.0	95.5	100.0	85.0
180	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	148.0	140.5	144.0	135.2	140.0	130.0	136.0	126.0	128.0	115.5	120.0	105.0
200	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	168.0	160.5	164.0	155.2	160.0	150.0	156.0	146.0	148.0	135.5	140.0	125.0
220	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	184.0	175.2	180.0	170.0	176.0	166.0	168.0	155.5	160.0	145.0
240	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	204.0	195.2	200.0	190.0	196.0	186.0	188.0	175.5	180.0	165.0
260	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	220.0	210.0	216.0	206.0	208.0	195.5	200.0	185.0
300	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	256.0	246.0	248.0	235.5	240.0	225.0

GENERAL NOTES:
(a) Screws of diameter/length combinations above heavy line shall be threaded full length. See para. 2.5.4.3.
(b) For screw sizes and/or lengths not tabulated, see para. 2.5.4.4.

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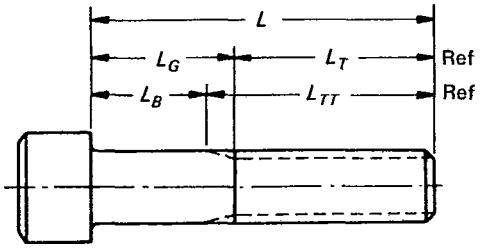


TABLE 6B THREAD LENGTHS FOR DETERMINING BODY AND GRIP LENGTHS ON SCREWS BEYOND DIAMETERS AND LENGTHS TABULATED IN TABLE 6A

Nominal Size or Basic Screw Diameter	L_T Thread Length Min.	L_{TT} Total Thread Length [Note (1)] Max.
M1.6	15.2	17.0
M2	16.0	18.0
M2.5	17.0	19.3
M3	18.0	20.5
M4	20.0	23.5
M5	22.0	26.0
M6	24.0	29.0
M8	28.0	34.3
M10	32.0	39.5
M12	36.0	44.8
M14	40.0	50.0
M16	44.0	54.0
M20	52.0	64.5
M24	60.0	75.0
M30	72.0	89.5
M36	84.0	104.0
M42	96.0	118.5
M48	108.0	133.0

NOTE:
(1) Tabulated values are equal to L_T plus 5 times the pitch of the coarse thread for the respective screw sizes.

given in Table 6A or, for diameter/length combinations not shown therein, shall be as calculated in accordance with para. 2.5.4.4.

2.5.4.3 Threaded Full Length Screws. Screws of nominal lengths above the heavy horizontal line in Table 6A or, for nominal sizes larger than 24 mm, lengths that are equal to or shorter than L_{TT} shall be threaded for full length. On these screws for nominal sizes from 1.6 mm through 16 mm, the complete (full form) threads—as determined by a GO thread ring gage, having the countersink and/or counterbore removed, assembled by hand as far as the thread will permit—shall extend to within 2 pitches (threads) of the underside of head. For sizes larger than 16 mm, the complete threads shall extend as close to the head as practicable.

2.5.4.4 Nontabulated Sizes and Lengths. For screws of nominal lengths not listed in Table 6A and for nominal sizes larger than 24 mm, the maximum grip length L_G and minimum body length L_B shall be determined from the following formulas:

$$L_G = L - L_T$$
$$L_B = L - L_{TT}$$

where:

L = nominal screw length
L_T = minimum thread length from Table 6B
L_{TT} = maximum total thread length from Table 6B

Screws having nominal lengths falling between those for which L_G and L_B values are tabulated in Table 6A shall have L_G and L_B dimensions conforming to those of the next shorter tabulated nominal length for the respective screw size.

2.6 Point

The end on screws of 5 mm nominal size and larger and of nominal lengths equivalent to 0.75 times the basic screw diameter or longer shall be chamfered. The chamfer shall extend slightly below the root of the thread, and the edge between the flat and chamfer may be slightly rounded. The included angle of the point shall be approximately 90 deg. Chamfering on screw sizes up to and including 4 mm and of larger sizes having lengths shorter than 0.75 times the basic screw diameter shall be optional.

2.7 Total Runout

The total runout between the thread, body, and head on socket head cap screws shall be such that screws will assemble into a compound hole (see Fig. 2) that is threaded at one end to the basic thread size (tolerance class 6H minimum), for a depth equivalent to 1.5 times the basic screw diameter, and counterbored

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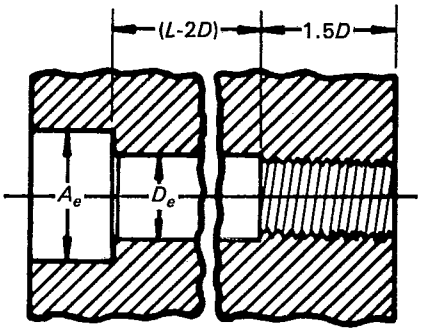


FIG. 2 COMPOUND HOLE FOR CHECKING RUNOUT BETWEEN THREAD, BODY, AND HEAD

at the other end to diameter A_e and through the center portion to diameter D_e as specified in Table 7. Diameters D_e and A_e shall be concentric with the axis of the thread within the equivalent of 10% of the thread pitch diameter tolerance. The length of the center portion shall be equal to the nominal screw length minus two times the basic screw diameter. The starting thread shall be chamfered, and the corner at juncture of diameters A_e and D_e shall be chamfered or rounded to a diameter equal to B maximum as given in Table 1.

2.8 Surface Roughness

For alloy steel screws of nominal sizes up to and including 16 mm and nominal lengths equal to or less than 8 times the basic screw diameter, the surface roughness on the screws before plating shall not exceed 1.6 μm AA on the fillet and head bearing surfaces, nor exceed 0.8 μm AA on the threads.

For longer lengths, larger sizes, and corrosion-resistant steel screws, the surface roughness of the screws prior to plating shall not exceed 3.2 μm AA on the body, fillet, and head bearing surfaces.

Normally, it shall be sufficient to ascertain that these surfaces on screws have the equivalent of a smooth machined finish by visual comparison with known surface standards. However, where it is practical and deemed necessary to measure those surfaces with commercially available equipment, roughness measurements shall be taken axially on the body and fillet surfaces, and circumferentially on the bearing surface.

3 MATERIALS, PROCESSING, AND MECHANICAL PROPERTIES

Socket head cap screws shall conform to the following requirements pertaining to materials, processing, and mechanical and physical properties.

3.1 Material and Heat Treatment

3.1.1 Alloy Steel. Alloy steel metric socket head cap screws shall conform to property class 12.9.[2] They shall be fabricated from alloy steel, and all nondimensional, mechanical, and physical properties of screws, fabrication processes, and testing requirements shall conform to ASTM Specification A 574M, Alloy Steel Socket Head Cap Screws (Metric).[3]

3.1.2 Corrosion-Resistant Steel. Corrosion-resistant steel metric socket head cap screws shall be fabricated from a corrosion-resistant steel, and all nondimensional, mechanical, and physical properties of screws, fabrication processes, and testing requirements shall conform to ASTM specification F 837M, Stainless Steel Metric Socket Head Cap Screws. Unless specified otherwise, the standard corrosion-resistant steel SHCS property class shall be A1-70.

3.2 Marking Practice

All socket head cap screws of 5 mm size and larger shall be permanently marked to identify the property class. In addition, screws shall be marked with the manufacturer's identification symbol. Markings may be placed on the side of the head or on the top of the head.

3.3 Finish

The finish on alloy steel screws shall be an oiled black oxide coating (thermal or chemical) unless a protective plating or coating is specified by the purchaser.

The surface finish for corrosion-resistant steel screws shall be passivated in accordance with ASTM F 837M, unless specified otherwise.

[2]The property class 12.9 designation is consistent with ISO practices wherein the numeral 12 symbolizes approximately 1/100 of the minimum tensile stress in MPa, and the decimal .9 symbolizes the approximate ratio of the minimum yield stress to the minimum tensile stress.

[3]Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

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TABLE 7 FUNCTIONAL LIMITS FOR RUNOUT OF HEAD, BODY, AND THREAD ON METRIC SOCKET HEAD CAP SCREWS

Nominal Size		M1.6		M2		M2.5		M3		M4		M5		M6		M8		M10		M12	
Nominal Length		Hole Diameters for Shank D_e and for Head A_e																			
Over	To, Incl.	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e
0	6	1.66	3.21	2.05	4.00	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	12	1.72	3.27	2.11	4.06	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	20	1.80	3.35	2.18	4.13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	25	1.85	3.40	2.22	4.17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
25	35	...	...	2.31	4.26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0	12	...	...	...	...	2.60	4.75	3.09	5.74	...	...	...	...	...	...	...	...	...	...	...	...
12	25	...	...	...	...	2.70	4.85	3.18	5.83	...	...	...	...	...	...	...	...	...	...	...	...
25	35	...	...	...	...	2.78	4.93	3.25	5.90	...	...	...	...	...	...	...	...	...	...	...	...
35	50	...	...	...	...	2.90	5.05	3.36	6.01	...	...	...	...	...	...	...	...	...	...	...	...
50	60	...	...	...	...	...	...	3.44	6.09	...	...	...	...	...	...	...	...	...	...	...	...
0	20	...	...	...	...	...	...	...	...	4.13	7.28	5.12	8.77	...	...	...	...	...	...	...	...
20	35	...	...	...	...	...	...	...	...	4.22	7.37	5.20	8.85	...	...	...	...	...	...	...	...
35	60	...	...	...	...	...	...	...	...	4.38	7.53	5.34	8.99	...	...	...	...	...	...	...	...
60	70	...	...	...	...	...	...	...	...	4.44	7.59	5.39	9.04	...	...	...	...	...	...	...	...
70	100	...	...	...	...	...	...	...	...	4.63	7.78	5.56	9.21	...	...	...	...	...	...	...	...
0	25	...	...	...	...	...	...	...	...	...	...	...	...	6.13	10.18	8.11	13.27	10.10	16.30	12.09	18.33
25	50	...	...	...	...	...	...	...	...	...	...	...	...	6.26	10.41	8.22	13.38	10.20	16.40	12.18	18.42
50	70	...	...	...	...	...	...	...	...	...	...	...	...	6.36	10.51	8.31	13.47	10.28	16.48	12.25	18.49
70	100	...	...	...	...	...	...	...	...	...	...	...	...	6.51	10.66	8.44	13.60	10.40	16.60	12.36	18.60
100	150	...	...	...	...	...	...	...	...	...	...	...	...	6.64	10.79	8.64	13.80	10.60	16.80	12.54	18.78

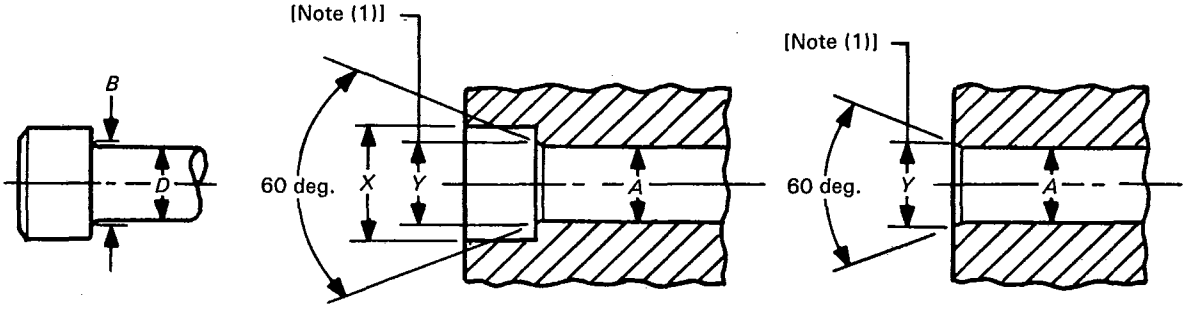
Nominal Size		M14		M16		M20		M24		M30		M36		M42		M48	
Nominal Length		Hole Diameters for Shank D_e and for Head A_e															
Over	To, Incl.	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e	D_e	A_e
0	50	14.17	21.45	16.16	24.48	20.14	30.54	24.13	36.61	...	...	...	...	...	...	...	...
50	100	14.34	21.62	16.32	24.64	20.28	30.68	24.26	36.74	...	...	...	...	...	...	...	...
100	150	14.50	21.78	16.47	24.79	20.42	30.82	24.38	36.86	...	...	...	...	...	...	...	...
150	200	14.64	21.92	16.63	24.95	20.56	30.96	24.51	36.99	...	...	...	...	...	...	...	...
200	250	14.64	21.92	16.64	24.96	20.64	31.04	24.64	37.12	...	...	...	...	...	...	...	...
0	150	...	...	...	...	...	...	...	...	30.38	45.98	36.38	55.10	42.38	64.22	48.38	73.34
150	300	...	...	...	...	...	...	...	...	30.75	46.35	36.75	55.47	42.75	64.59	48.75	73.71
300	450	...	...	...	...	...	...	...	...	31.12	46.72	37.12	55.84	43.12	64.96	49.12	74.08
450	600	...	...	...	...	...	...	...	...	31.50	47.10	37.50	56.22	43.50	65.34	49.50	74.46

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APPENDIX I

DRILL AND COUNTERBORE SIZES FOR METRIC SOCKET HEAD CAP SCREWS

(This Appendix is not part of ASME/ANSI B18.3.1M-1986, and is included here for information purposes only.)



Nominal Size or Basic Screw Diameter	A		X	Y
	Nominal Drill Size			
	Close Fit [Note (2)]	Normal Fit [Note (3)]	Counterbore Diameter	Countersink Diameter [Note (1)]
M1.6	1.80	1.95	3.50	2.0
M2	2.20	2.40	4.40	2.6
M2.5	2.70	3.00	5.40	3.1
M3	3.40	3.70	6.50	3.6
M4	4.40	4.80	8.25	4.7
M5	5.40	5.80	9.75	5.7
M6	6.40	6.80	11.25	6.8
M8	8.40	8.80	14.25	9.2
M10	10.50	10.80	17.25	11.2
M12	12.50	12.80	19.25	14.2
M14	14.50	14.75	22.25	16.2
M16	16.50	16.75	25.50	18.2
M20	20.50	20.75	31.50	22.4
M24	24.50	24.75	37.50	26.4
M30	30.75	31.75	47.50	33.4
M36	37.00	37.50	56.50	39.4
M42	43.00	44.00	66.00	45.6
M48	49.00	50.00	75.00	52.6

(See notes on p. 14.)

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NOTES:

(1) Countersink. It is considered good practice to countersink or break the edges of holes that are smaller than *B* maximum (see Table 1) in parts having a hardness that approaches, equals, or exceeds the screw hardness. If such holes are not countersunk, the heads of screws may not seat properly or the sharp edges on the hole may deform the fillets on screws, thereby making them susceptible to fatigue in applications involving dynamic loading. The countersink or corner relief, however, should not be larger than is necessary to insure that the fillet on the screw is cleared. Normally, the diameter of countersink does not have to exceed *B* maximum. Countersinks or corner reliefs in excess of this diameter reduce the effective bearing area and introduce the possibility of imbedment where the parts to be fastened are softer than the screws, or of brinnelling or flaring the heads of the screws where the parts to be fastened are harder than the screws.

(2) Close Fit. The close fit is normally limited to holes for those lengths of screws that are threaded to the head (see Table 6A) in assemblies where only one screw is to be used or where two or more screws are to be used and the mating holes are to be produced either at assembly or by matched and coordinated tooling.

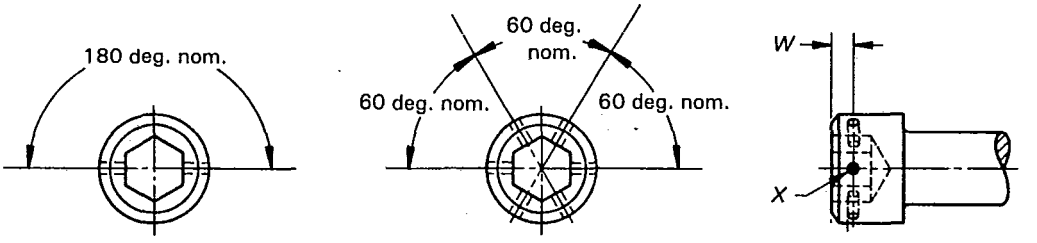
(3) Normal Fit. The normal fit is intended for screws of relatively long length or for assemblies involving two or more screws where the mating holes are to be produced by conventional tolerancing methods. It provides for the maximum allowable eccentricity of the longest standard screws and for certain variations in the parts to be fastened, such as: deviations in hole straightness, angularity between the axis of the tapped hole and that of the hole for shank, differences in center distances of the mating holes, etc.

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APPENDIX II

DIMENSIONS OF DRILLED HEAD METRIC HEXAGON SOCKET HEAD CAP SCREWS

(This Appendix is not part of ASME/ANSI B18.3.1M-1986, and is included here for information purposes only.)



Two holes Six holes

Nominal Size or Basic Screw Diameter	W Hole Center Location		X Drilled Hole Diameter		Hole Alignment Check Plug Diameter
	Max.	Min.	Max.	Min.	Basic
M3	1.20	0.80	0.95	0.80	0.75
M4	1.60	1.20	1.35	1.20	0.90
M5	2.00	1.50	1.35	1.20	0.90
M6	2.30	1.80	1.35	1.20	0.90
M8	2.70	2.20	1.35	1.20	0.90
M10	3.30	2.80	1.65	1.50	1.40
M12	4.00	3.50	1.65	1.50	1.40
M16	5.00	4.50	1.65	1.50	1.40
M20	6.30	5.80	2.15	2.00	1.80
M24	7.30	6.80	2.15	2.00	1.80
M30	9.00	8.50	2.15	2.00	1.80
M36	10.50	10.00	2.15	2.00	1.80

GENERAL NOTES:

(a) Screws. Drilled head metric hexagon socket head cap screws normally are not available in screw sizes smaller than M3 or larger than M36. The M3 and M4 nominal screw sizes shall have two drilled holes spaced 180 deg. apart. Nominal screw sizes M5 and larger shall have six drilled holes spaced 60 deg. apart, unless the purchaser specifies two drilled holes. Drilled head screws, except for the holes, shall conform in all respects with the dimensions and requirements documented in this Standard for metric hexagon socket head cap screws.

(b) Holes. The drilled hole size and the location from the top of the head shall be in conformance with the tabulated dimensions above. The holes shall lie within the flats of the hexagon socket and shall not break through the corners of the socket. The positioning of holes on opposite sides of the socket shall be such that the hole alignment check plug will pass completely through the head without any deflection.

When specified by the purchaser, the edge of holes on the outside surface of the head shall be chamfered 45 deg. to a depth of 0.30 mm to 0.50 mm. The edge of holes within the socket may contain burrs to the extent that the socket will accept a key having standard minimum width across flats per ANSI B18.3.2M, Metric Series Hexagon Keys and Bits.

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APPENDIX III
FORMULAS FOR DIMENSIONS

(This Appendix is not part of ASME/ANSI B18.3.1M-1986, and is included here for information purposes only.)

Body Diameter D, Table 1

D (max.) = Basic or nominal size — see Table 1 for values
D (min.) = D (max.) — IT13 tolerance[1]

Head Diameter A, Table 1

A (max.) = See Table 1 for sizes 1.6 mm through 2.5 mm
= $1.5D$ + 1 mm for sizes 3 mm through 8 mm
= $1.5D$ for sizes 10 mm and larger
A (min.) = A (max.) − $0.1058\sqrt{D\text{ (max.)}}$

Head Height H, Table 1

H (max.) = D (max.)
H (min.) = H (max.) − $0.0604\sqrt{D\text{ (max.)}}$

Top of Head Chamfer or Radius S, Table 1

S (max.) = $0.10H$ (max.)

Key Engagement T, Table 1

T (min.) = $0.50H$ (max.)

Wall Thickness G, Table 1

G (min.) = $0.34H$ (max.) for sizes 1.6 mm through 3 mm
= $0.38H$ (max.) for sizes 4 mm through 6 mm
= $0.40H$ (max.) for sizes 8 mm through 12 mm
= $0.43H$ (max.) for sizes 14 mm through 48 mm

Functional Limits for Runout of Head, Body, and Thread, Table 7

Limits are based on:
$D_e = D + 0.0126\,L \div \sqrt{D}$ for sizes up to and including 24 mm with a maximum of 0.64 mm
$D_e = D + 0.0025\,L$ for sizes over 25 mm with a maximum of 1.52 mm

[1]Tolerances from International Standard, System of Limits and Fits, Part 1: General, Tolerances and Deviations, ISO R286-1962.

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APPENDIX IV
ISO DIMENSIONAL VARIATIONS DUE TO TOLERANCE DEVIATIONS

(This Appendix is not part of ASME/ANSI B18.3.1M-1986, and is included here for information purposes only.)

Nominal Size or Basic Screw Diameter	*A* Head Diameter Min.	*H* Head Height Min.	*T* Key Engagement Min.	*G* Wall Thickness Min.
M1.6	2.86	1.46	0.70	0.55
M2	3.62	1.86	...	0.55
M2.5	4.32	2.36	1.10	...
M3	...	2.86	1.30	1.15
M4	6.78	3.82	...	1.4
M5	8.28	4.82	...	...
M6	9.78	5.70	...	2.3
M8	12.73	7.64	...	3.3
M10	15.73	9.64	...	...
M12	17.73	11.57	...	...
M14	20.67	13.57	...	5.8
M16	23.67	15.57	...	6.8
M20	29.67	19.48	...	...
M24	35.61	23.48	...	10.4
M30	44.61	29.48	15.50	13.1
M36	53.54	35.38	19.00	15.8
M42	62.54	41.38	...	...
M48	71.54	47.38	...	...

GENERAL NOTES:

(a) Threads. The thread tolerance class of 5g6g specified in ISO standards is not as close as the tolerance class of 4g6g specified herein.

(b) Body and Grip Length. The body and grip lengths on some size/length combinations of screws may not agree due to differences in North American thread length practice. However, the thread length on screws specified herein is equal to or longer than that on corresponding screws conforming to the ISO standard practice.

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APPENDIX V
GOVERNMENT STANDARD ITEMS AND PART NUMBERING SYSTEM

(This Appendix is not part of ASME/ANSI B18.3.1M-1986, and is included here for information purposes only.)

NOTE: The government encourages the general use of this Appendix to achieve maximum parts standardization.

This Appendix establishes standard items for Government application, selected from the possible variations of items within the scope of the Standard, and provides a part numbering system for identification and application in engineering documents.

The following variations are standard:

(*a*) Diameter/Thread Pitch and Length Combinations — as specified in Table V-1

(*b*) Material (Alloy Steel, Property Class 12.9, or Corrosion-Resistant Steel, Property Class A1-70 — as coded in Part Numbering System

(*c*) Finish (Cadmium Plating, Zinc Coating, or Black Oxide Coating for Alloy Steel; Cleaning, Descaling, and Passivation for Corrosion-Resistant Steel) — as coded in Part Numbering System

(*d*) Socket Type — hexagon

(*e*) Special Features — drilled head with each hole chamfered on outside edge in accordance with Appendix II, or self-locking if specified

The part number shall consist of the following element codes in the order shown:

(*a*) Document identifier — ASME/ANSI Standard Number less decimal points

(*b*) Material and finish

(*c*) Socket type

(*d*) Nominal diameter

(*e*) Nominal length

(*f*) Special features

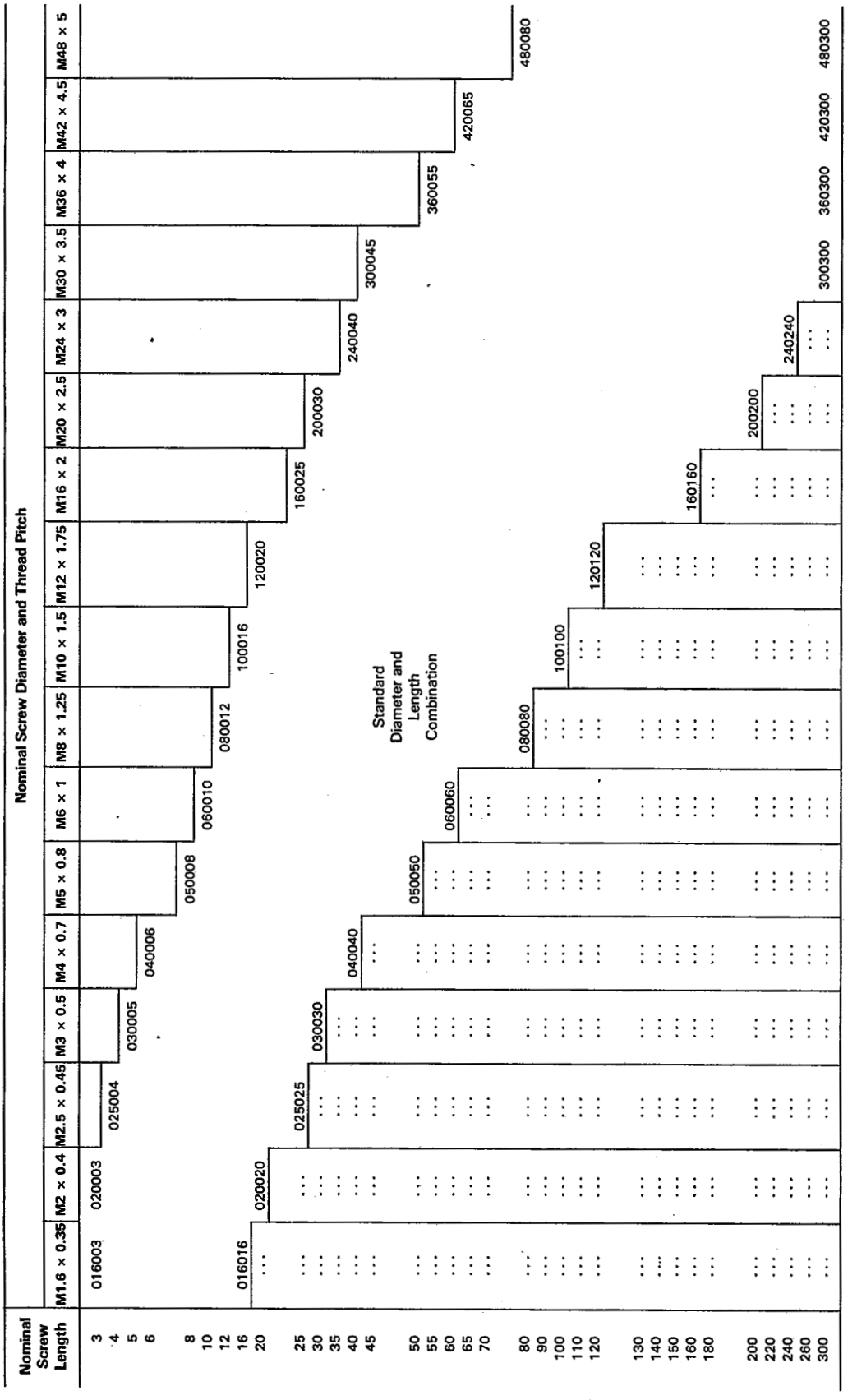
NOTE: The Part Numbering System may also be used for nonstandard diameter and length combinations.

Quality Assurance Provisions. Quality assurance provisions shall be in accordance with ANSI B18.18.1M. Inspection level B shall apply for thread acceptability.

Packaging. Packaging shall be in accordance with ASTM D 3951.

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TABLE V-1 METRIC HEXAGON SOCKET HEAD CAP SCREWS — STANDARD SIZES FOR GOVERNMENT USE



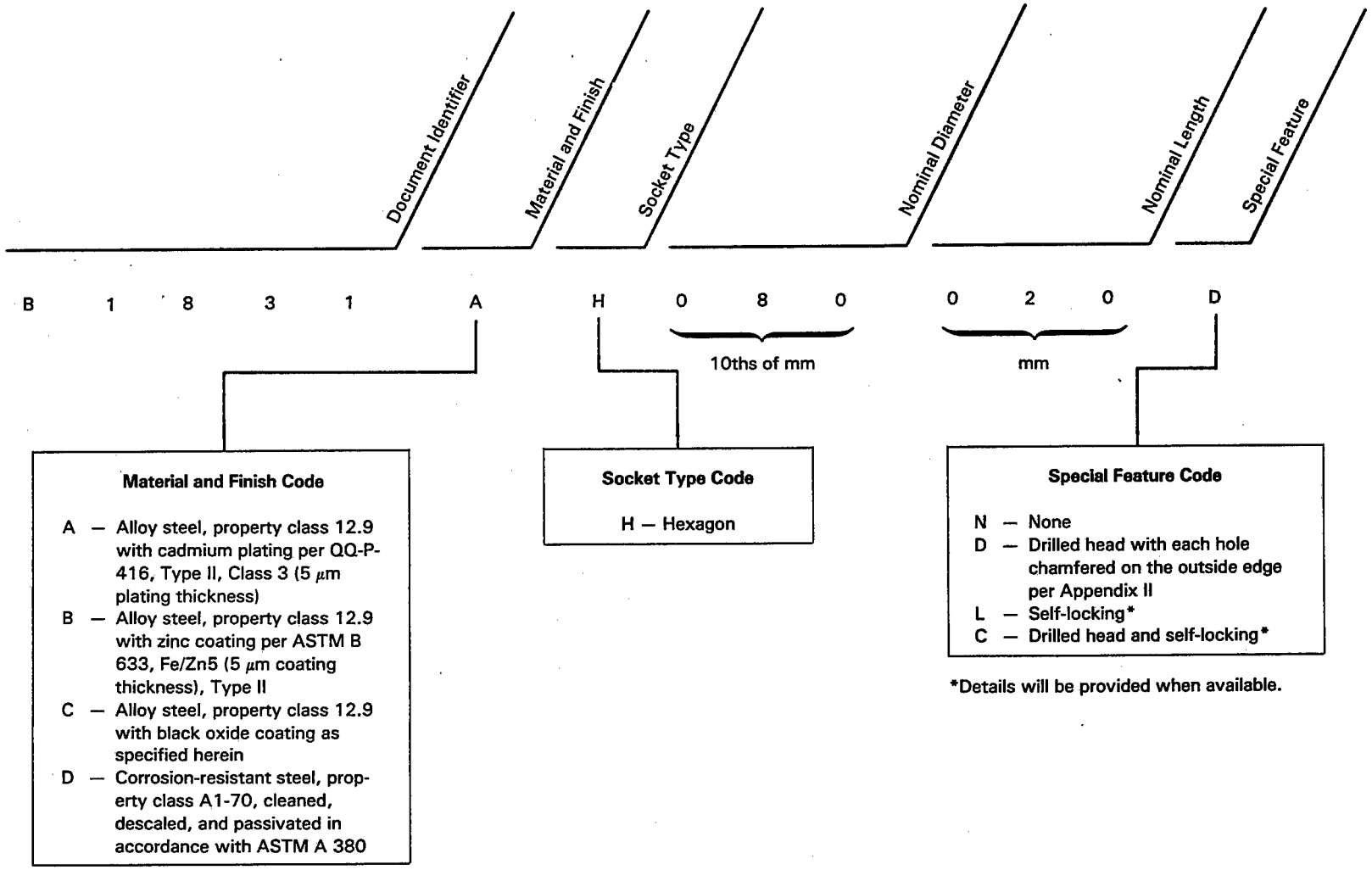
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PART NUMBERING SYSTEM COVERING STANDARD ITEMS FOR GOVERNMENT USE

NOTE: THE GOVERNMENT ENCOURAGES THE GENERAL USE OF THIS SYSTEM TO ACHIEVE MAXIMUM PARTS STANDARDIZATION.



*Details will be provided when available.

EXAMPLE: B1831AH080020D indicates a screw, cap, hexagon socket head (metric) made of cadmium plated alloy steel, property class 12.9, 8 mm in diameter, 20 mm in length with drilled head — each hole chamfered on the outside edge.

APPENDIX VI

DIMENSIONS OF METRIC THREADS FOR SMALL SIZES OF SOCKET SCREW PRODUCTS

(This Appendix is not part of ASME/ANSI B18.3.1M-1986, and is included here for information purposes only.)

Nominal Size or Basic Thread Diameter	Pitch	Tolerance Class 4g6g [Note (1)]					Tolerance Class 4h6h [Note (2)]			
		Major Diameter 6g		Pitch Diameter 4g		Allowance *g* [Note (3)]	Root Radius 0.125P	Major Diameter 6h	Pitch Diameter 4h	GO Gage Minor Diameter
		Max.	Min.	Max.	Min.		Min.	Max.	Max.	
M1.6	0.35	1.576	1.496	1.349	1.314	0.024	0.04	1.600	1.373	1.221
M2	0.4	1.976	1.886	1.716	1.679	0.024	0.05	2.000	1.740	1.567
M2.5	0.45	2.476	2.380	2.184	2.143	0.024	0.06	2.500	2.208	2.013
M3	0.5	2.976	2.874	2.651	2.607	0.024	0.06	3.000	2.675	2.459
M4	0.7	3.976	3.838	3.521	3.467	0.024	0.08	4.000	3.545	3.242

NOTES:
(1) Applies to unplated or uncoated screws and plated or coated screws before plating or coating.
(2) Applies to plated or coated screws after plating or coating.
(3) This allowance is uniform to provide for normal plating buildup and is greater than the standard ISO *g* graded allowance.

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AMERICAN NATIONAL STANDARDS FOR BOLTS, NUTS, RIVETS, SCREWS, WASHERS, AND SIMILAR FASTENERS

Small Solid Rivets B18.1.1-1972 (R1983)
Large Rivets B18.1.2-1972 (R1983)
Metric Small Solid Rivets B18.1.3M-1983
Square and Hex Bolts and Screws — Inch Series B18.2.1-1981
Square and Hex Nuts B18.2.2-1972 (R1983)
Metric Hex Cap Screws B18.2.3.1M-1979
Metric Formed Hex Screws B18.2.3.2M-1979
Metric Heavy Hex Screws B18.2.3.3M-1979
Metric Hex Flange Screws B18.2.3.4M-1984
Metric Hex Bolts B18.2.3.5M-1979
Metric Heavy Hex Bolts B18.2.3.6M-1979
Metric Heavy Hex Structural Bolts B18.2.3.7M-1979
Metric Hex Lag Screws B18.2.3.8M-1981
Metric Heavy Hex Flange Screws B18.2.3.9M-1984
Metric Hex Nuts, Style 1 . . . . . B18.2.4.1M-1979
Metric Hex Nuts, Style 2 . . . . . B18.2.4.2M-1979
Metric Slotted Hex Nuts B18.2.4.3M-1979
Metric Hex Flange Nuts B18.2.4.4M-1982
Metric Hex Jam Nuts B18.2.4.5M-1979
Metric Heavy Hex Nuts B18.2.4.6M-1979
Socket Cap, Shoulder and Set Screws (Inch Series) B18.3-1982
Socket Head Cap Screws (Metric Series) B18.3.1M-1986
Metric Series Hexagon Keys and Bits B18.3.2M-1979 (R1986)
Hexagon Socket Head Shoulder Screws (Metric Series) B18.3.3M-1986
Hexagon Socket Button Head Cap Screws (Metric Series) B18.3.4M-1986
Hexagon Socket Flat Countersunk Head Cap Screws (Metric Series) B18.3.5M-1986
Metric Series Socket Set Screws B18.3.6M-1986
Round Head Bolts (Inch Series) B18.5-1978
Metric Round Head Short Square Neck Bolts B18.5.2.1M-1981
Metric Round Head Square Neck Bolts B18.5.2.2M-1982
Wood Screws B18.6.1-1981
Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws B18.6.2-1972 (R1983)
Machine Screws and Machine Screw Nuts B18.6.3-1972 (R1983)
Metric Thread Forming and Thread Cutting Tapping Screws B18.6.5M-1986
Metric Machine Screws B18.6.7M-1985
Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) B18.6.4-1981
General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps B18.7-1972 (R1980)
Metric General Purpose Semi-Tubular Rivets B18.7.1M-1984
Clevis Pins and Cotter Pins B18.8.1-1972 (R1983)
Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) B18.8.2-1978
Plow Bolts B18.9-1958 (R1977)
Track Bolts and Nuts B18.10-1982
Miniature Screws B18.11-1961 (R1983)
Glossary of Terms for Mechanical Fasteners B18.12-1962 (R1981)
Screw and Washer Assemblies — Sems B18.13-1965 (R1983)
Forged Eyebolts B18.15-1985
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