## Hexagon Socket Flat Countersunk Head Cap Screws (Metric Series)

ASME/ANSI B18.3.5M-1986

**REAFFIRMED 1993** 

FOR CURRENT COMMITTEE PERSONNEL PLEASE SEE ASME MANUAL AS-11 Government Key Words: Screw, Cap, Hexagon Socket, Flat Countersunk Head – Metric

SPONSORED AND PUBLISHED BY

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERSUnited Engineering Center345 East 47th StreetNew York, N. Y. 10017

Date of Issuance: February 28, 1987

This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda or written interpretations of the requirements of this Standard issued to this Edition.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Consensus Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment which provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable Letters Patent, nor assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations issued in accordance with governing ASME procedures and policies which preclude the issuance of interpretations by individual volunteers.

> No part of this document may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

> Copyright © 1987 by THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS All Rights Reserved Printed in U.S.A.

### FOREWORD

(This Foreword is not part of ASME/ANSI B18.3.5M-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 9 was established in April of 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 coordination with the International Standards Organization, ISO Technical Committee 2, and Working Group 3 under that activity and, to the extent possible, keep the proposals for metric standards under development in conformance with agreements reached therein. Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled w

Subsequent meetings of Subcommittee 3 held in February 1975 and January 1976 resulted in general agreement on the following basic principles to 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.

There is no present or proposed ISO document for hexagon socket flat countersunk head cap screws, and the work in ISO/TC2/WG3 is proceeding slowly. Three different proposals have been submitted to WG3 for consideration and a draft document combining the best features of these proposals was circulated to the industry and many users. At the Subcommittee meeting of May 1982, it was voted to submit this draft, as modified, as a proposed standard. It is noted that these screws are functionally interchangeable with those recently adopted by the United Kingdom as BSI 4168-1982, with the exception of the class of thread fit, with the U.S. document specifying class 4g6g in line with past practice.

The document was modified to suit the ASME/ANSI format and was submitted for letter ballot vote to ASME Committee B18 and for public review. It was granted recognition as an American National Standard on April 8, 1983.

Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled w

A periodic review of the standard, undertaken by the Subcommittee in 1985, resulted in agreement that the document should be revised to add corrosion-resistant steel and to incorporate by reference ASTM documents for the appropriate mechanical, chemical, and testing requirements for the hexagon socket flat countersunk head cap screw products. A proposal containing these changes, as well as editorial corrections, was prepared 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 September 25, 1986.

\$

### ASME STANDARDS COMMITTEE B18 Standardization of Bolts, Nuts, Rivets, Screws, Washers, and Similar Fasteners

(The following is the roster of the Committee at the time of approval of this Standard.)

### **OFFICERS**

J. B. Levy, Chairman H. W. Ellison, Vice Chairman E. Schwartz, Vice Chairman R. W. McGinnis, Secretary

### COMMITTEE PERSONNEL

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS E. R. Friesth, Don E. Williams Co., Rock Island, Illinois

AMERICAN SOCIETY OF MECHANICAL ENGINEERS A. R. Machell, Webster, New York K. E. McCullough, SPS Technologies Inc., Jenkintown, Pennsylvania

ENGINE MANUFACTURERS ASSOCIATION G. A. Russ, Cummins Engine Co., Columbus, Indiana

FARM & INDUSTRIAL EQUIPMENT INSTITUTE D. A. Clever, Deere & Co., Moline, Illinois

HAND TOOL INSTITUTE **R. B. Wright**, Wright Tool Co., Barberton, Ohio

INDUSTRIAL FASTENERS INSTITUTE

- D. J. Broomfield, Illinois Tool Works Inc., Elgin, Illinois
- D. A. Garrison, Russell, Burdsall & Ward Corp., Rock Falls, Illinois
- R. M. Harris, Bethlehem Steel Corp., Lebanon, Pennsylvania
- D. Littel, Greensburg, Pennsylvania
- J. C. McMurray, Alternate, Russell, Burdsall & Ward Inc., Cleveland, Ohio
- J. S. Orlando, Chicago, Illinois
- E. Sterling, Emhart Corp., Cambellsville, Kentucky
- J. A. Trilling, Holo-Krome Co., West Hartford, Connecticut
- S. Vass, Lake Erie Screw Corp., Cleveland, Ohio
- C. J. Wilson, Industrial Fasteners Institute, Cleveland, Ohio

METAL CUTTING TOOL INSTITUTE

D. Emanuelli, TRW-Greenfield Tap & Die, Greenfield, Massachusetts

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

J. B. Levy, Scotia, New York

F. F. Weingruber, Westinghouse Electric Corp., Pittsburgh, Pennsylvania

NATIONAL FASTENERS DISTRIBUTORS ASSOCIATION J. F. Sullivan, Accurate Fasteners, Inc., South Boston, Massachusetts

SOCIETY OF AUTOMOTIVE ENGINEERS

H. W. Ellison, General Motors Corp., Warren, Michigan

R. S. Piotrowski, Mack Trucks Inc., Allentown, Pennsylvania

# Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled

### **TUBULAR & MACHINE INSTITUTE**

R. M. Byrne, Trade Association Management Inc., Tarrytown, New York

J. G. Zeratsky, National Rivet & Manufacturer Co., Waupun, Wisconsin

### U. S. DEPARTMENT OF THE ARMY

M. E. Taylor, U. S. Army Armament, Munitions & Chemical Command, Dover, New Jersey

J. E. Long, Alternate, U. S. Tank Command, Warren, Michigan

A. Herskovitz, Alternate, U. S. Army Armament, Munitions & Chemical Command, Dover, New Jersey

### U. S. DEPARTMENT OF DEFENSE

E. Schwartz, Defense Industrial Supply Center, Philadelphia, Pennsylvania

L. Pieninck, Alternate, Defense Industrial Supply Center, Philadelphia, Pennsylvania

INDIVIDUAL MEMBERS

- A. R. Breed, Lakewood, Ohio
- R. A. Flor, Chrysler Corp., Detroit, Michigan
- G. A. Gobb, Ford Motor Co., Dearborn, Michigan
- F. E. Graves, F. E. Graves Associates, Fairfield, Connecticut
- J. J. Naesset, Clark Equipment Co., Battle Creek, Michigan

### PERSONNEL OF SUBCOMMITTEE 3 - SOCKET HEAD CAP AND SET SCREWS (B18)

J. Trilling, Chairman, Holo-Krome Co., West Hartford, Connecticut

- R. M. Byrne, Tubular Rivet & Machine Institute, Westchester, New York
- A. Herskovitz, U. S. Army Armament R & D Command, Dover, New Jersey
- K. E. McCullough, SPS Technologies, Jenkintown, Pennsylvania
- L. Pieninck, Defense Industrial Supply Center, Philadelphia, Pennsylvania
- F. F. Weingruber, Westinghouse Electric Corp., R & D Center, Pittsburgh, Pennsylvania
- C. J. Wilson, Industrial Fasteners Institute, Cleveland, Ohio

### CONTENTS

For	eword	iii
Star	Idards Committee Roster	v
1 2 3	General Dimensional Characteristics Material, Processing, and Mechanical Properties	1 2 7
Figu	ires	
1 2 3	Forged Hexagon Socket Broached Hexagon Socket Socket Edge Detail.	6 6 6
Tab	les	
1A 1B 2 3A 3B	Dimensions of Metric Countersunk Socket Head Cap Screws Body and Grip Lengths Dimensions of Metric Hexagon Sockets Dimensions of Hexagon Socket Gages Thread Lengths for Lengths Not Tabulated in Table 1B	3 4 4 5 7
Арр	endices	
I II III	Formulas for Dimensions Government Standard Items and Part Numbering System Dimensions of Metric Threads for Socket Screw Products	9 10 13
1 V	wall Inickness Gage	14

.

.

### HEXAGON SOCKET FLAT COUNTERSUNK HEAD CAP SCREWS (METRIC SERIES)

### 1 GENERAL

### 1.1 Scope

**1.1.1** This Standard contains complete general and dimensional requirements for Metric Series Hexagon Socket Flat Countersunk Head Cap Screws of nominal sizes from 3 mm to 20 mm recognized as American National Standard. Also included are appendices covering formulas for dimensions, part numbering system and preferred sizes for government use, and thread dimensions. The application of these screws is limited by their design as noted below.

This product is designed and recommended for applications where a flush seating socket head screw is desired. Wrenchability is limited by the socket size and key engagement. Because of the head configuration, this product is not recommended where maximum fatigue resistance is required.

**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.

**1.1.3** Screws purchased for government use shall conform to this Standard and to the requirements of Appendix II.

### 1.2 Interchangeability

Hexagon socket flat countersunk head cap screws manufactured to this Standard are intended for structural use. There is no ISO standard in existence for the product at this time, and this design differs from and is not interchangeable with many similar metric parts. It is, however, functionally interchangeable with BS 4168-1982, and may be substituted for those parts.

### 1.3 Dimensions

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

### 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

Hexagon socket flat countersunk 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  $\times$ ;

(d) Nominal screw length, preceded by  $\times$ ;

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

(f) Material and property class. Alloy steel screws shall be supplied to property class 12.9 as specified in ASTM F 835M. For corrosion-resistant steel screws, the property class and material requirements shall be as specified in ASTM F 879M (see para. 3.1).

(g) Protective finish, if required.

Examples:



### 1.8 Part Numbering System

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

### **2 DIMENSIONAL CHARACTERISTICS**

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

### 2.1 Heads

**2.1.1 Head Diameters.** The maximum sharp values listed under A in Table 1A are theoretical values, as it is not practical to make the edges of the head sharp. The maximum sharp value represents the exact diameter of a hole countersunk to exactly 90 deg., in which a screw having maximum head size will fit flush.

**2.1.2 Head Height.** The tabulated values for head height are given for reference only and are calculated to the maximum formulation.

**2.1.3 Flushness Tolerance.** The flushness tolerance is the distance the top surface of a screw having the minimum head size will be below the flush condition in a hole countersunk exactly 90 deg. to the maximum sharp dimension listed under A in Table 1A.

**2.1.4 Fillet.** A fillet between the conical bearing surface of the head and the shank (body) of the screw is allowable above the maximum tabulated value for D within the value listed for F.

### 2.2 Sockets

**2.2.1 Socket Size.** Sockets shall be nominal size J specified in Table 1A for the respective screw sizes and shall conform to the dimensions given in Table 2, as determined by gaging in accordance with para. 2.2.3.

HEXAGON SOCKET FLAT COUNTERSUNK HEAD CAP SCREWS (METRIC SERIES)

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

2.2.3 Socket Gaging. Acceptability of sockets shall be determined by the use of the hexagon socket gages specified in Table 3A. The hexagon 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 7.5% of the nominal socket size.

To determine the acceptability of sockets in plated products after plating, a GO gage identical in design and tolerances to that shown in Table 3A, except having a maximum width across flats dimension equal to the nominal socket size, shall be used.

**2.2.4 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. 3, providing the depth of chamfer or rounding does not violate the NOT GO gage penetration limit specified in para. 2.2.3.

2.2.5 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 (see Fig. 2).

**2.2.6 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.

**2.2.7 Wall Thickness.** Wall thickness G may be controlled by using gaging shown in Appendix IV, Fig. IV-1.

### 2.3 Length

**2.3.1 Measurement.** The length of hexagon socket flat countersunk head cap screws shall be measured parallel to the axis of the screw from the plane of the top of the head to the extreme end of the shank.

Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled w



TABLE 1A DIMENSIONS OF METRIC COUNTERSUNK SOCKET HEAD CAP SCREWS

		L 1	0		A	ŀ	1	J	Т	G	F	м
				Head [	Diameter	Head I	Height					
Nominal Size or Basic Scrow	Thread	Body D	iameter	Theo- retical Sharp	Absolute	Befer-	Flush- ness Toler-	Hexagon Socket Size	Key Engage- ment	Socket Wall	Fillet Extension Above D	Drill Allow.
Diameter	Pitch	Max.	Min.	Max.	Min.	ence	ance	Nom.	Min.	Min.	Max.	Max.
3	0.5	3.0	2.86	6.72	5.35	1.86	0.30	2.0	1.1	0.25	0.25	0.3
4	0.7	4.0	3.82	8.96	7.80	2.48	0.30	2.5	1.5	0.45	0.35	0.4
5	0.8	5.0	4.82	11.20	9.75	3.10	0.35	3.0	1.9	0.66	0.40	0.5
6	1	6.0	5.82	13.44	11.70	3.72	0.35	4.0	2.2	0.70	0.50	0.6
8	1.25	8.0	7.78	17.92	15.60	4.96	0.40	5.0	3.0	1.16	0.60	0.8
10	1.5	10.0	9.78	22.40	19.50	6.20	0.50	6.0	3.6	1.62	0.80	0.9
12	1.75	12.0	11.73	26.88	23.40	7.44	0.60	8.0	4.3	1.80	0.90	1.2
14 (1)	2	14.0	13.73	30.24	26.18	8.12	0.70	10.0	4.7	1.62	1.00	1.5
16	2	16.0	15.73	33.60	28.96	8.80	0.80	10.0	4.8	2.20	1.00	1.5
20	2.5	20.0	19.67	40.32	34.60	10.16	1.00	12.0	5.6	2.20	1.20	1.8

NOTE:

(1) Not recommended for new design.

### ASME/ANSI B18.3.5M-1986

Nominal Diameter	N	<b>/</b> 3	N	/14	м	15	м	16	M	18	м	10	M	12	M	14	М1	6	м	20
Nominal Length	L <sub>GH</sub>	L <sub>BH</sub>																		
35	17	14.5	15	11.5																
40	22	19.5	20	16.5	18	14														
45	27	24.5	25	21.5	23	19	21	16												
50	32	29.5	30	26.5	28	24	26	21	22	15.7										
55	37	34.5	35	31.5	33	29	31	26	27	20.7										
60			40	36.5	38	34	36	31	32	25.7	28	20.5								
65			45	41.5	43	39	41	36	37	30.7	33	25.5	29	20.2						
70			50	46.5	48	44	46	41	42	35.7	38	30.5	34	25.2	30	20				
80			60	56.5	58	54	56	51	52	45.7	48	40.5	44	35.2	40	30	36	26		
90					68	64	66	61	62	55.7	58	50.5	54	45.2	50	40	46	36		
100	•				78	74	76	71	72	65.7	68	60.5	64	55.2	60	50	56	46		
110							86	81	82	75.7	78	70.5	74	65.2	70	60	66	56	58	45.5
120							96	91	92	85.7	88	80.5	84	75.2	80	70	76	66	68	55.5
130									102	95.7	98	90.5	94	85.2	90	80	86	76	78	65.5
140									112	105.7	108	100.5	104	95.2	100	90	96	86	88	75.5
150									122	115.7	118	110.5	114	105.2	110	100	106	96	98	85.5
	1	1	1	1	1		1							L						

TABLE 1B BODY AND GRIP LENGTHS

		,	с	
Nominal Socket	Socket Acros	Width s Flats	Socket Width Across Corners	
Size	Max.	Min.	Min.	
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	

### TABLE 2 DIMENSIONS OF METRIC HEXAGON SOCKETS

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

Nominal Screw Length, mm	Tolerance on Length, mm
Up to 16, incl. Over 16 to 60, incl. Over 60 to 150, incl.	$\pm 0.3 \\ \pm 0.5 \\ \pm 0.8$

**2.3.3 Standard Lengths**. The standard lengths for cap screws shall be as follows: 6, 8, 10, 12, 16, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 80, 90, 100, 110, 120, 130, 140, 150 mm.

**2.3.4 Body Length**,  $L_{BH}$ . The body length is the length, measured parallel to axis of screw, of the unthreaded portion of the shank and the head height (see Tables 1B and 3B).

### 2.4 Threads

**2.4.1 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.

2.4.2 Thread Tolerance Class. Threads shall be ISO 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 III, wherein the limiting dimensions applicable to thread sizes through M4 before and after plating are given for reference purposes. The allowable g shown therein for those sizes has been increased over that specified in ANSI/ASME B1.13M. However, because the minimum limits are unchanged, the screws will be totally interchangeable.

ASME/ANSI B18.3.5M-1986



### TABLE 3A DIMENSIONS OF HEXAGON SOCKET GAGES

		4		9	с	D		E		F		<u> </u>
Nominal	GO ( Width Fla	Gage Across ats	GO ( Width Cor	Gage Across ners	GO Usable Gage Gage Length Length		NOT GO Gage Width		NOT GO Gage Thickness		NOT GO Gage Width Across Corners	
Size	Max.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
2.0	2.023	2.020	2.300	2.295	5.0	5.0	2.045	2.042			2.23	2.21
2.5	2.525	2.520	2.870	2.865	7.0	7.0	2.560	2.555			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	6.090	2.80	2.75		
8.0	8.030	8.025	9.150	9.145	8.0	16.0	8.115	8.110	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		

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 hexagon 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.



FIG. 1 FORGED HEXAGON SOCKET



FIG. 2 BROACHED HEXAGON SOCKET



FIG. 3 SOCKET EDGE DETAIL

**2.4.3 Thread Gaging.** Acceptability of screw threads shall be determined based on System 22 of ANSI/ASME B1.3M.

**2.4.4 Thread Length**,  $L_{T}$ . The length of thread is controlled by the grip length  $L_{GH}$  specified in Table 1B.

**2.4.4.1 Grip Length**,  $L_{GH}$ . The tabulated  $L_{GH}$  values are maximum and represent the minimum design grip length, including the reference head height of the screw. They shall be measured from the top of the head to the face of a GO thread ring gage, having the thread countersink and/or counterbore removed, which has been assembled by hand as far as the thread will permit. The tabulated  $L_{BH}$  values are minimum and represent the minimum body length, including the reference head height of the screw. They are equal to  $L_{GH}$  minus 5 times the pitch of the thread for the respective screw size.

Screws having nominal lengths falling between those for which  $L_{GH}$  and  $L_{BH}$  values are tabulated in Table 1B shall have  $L_{GH}$  and  $L_{BH}$  dimensions conforming with those of the next shorter tabulated nominal length for the respective screw size.

**2.4.4.2 Thread to Head.** For screws of nominal lengths above the heavy line in Table 1B, the thread length shall govern the grip and body lengths. On these screws, the complete full-form threads, measured with a thread ring gage, having the thread chamfer and/or counterbore removed, shall extend to within 2 pitches (threads) of the intersection of the conical portion of the head with the body diameter.

**2.4.4.3 Nontabulated Sizes.** For screws of nominal lengths longer than those for which  $L_{GH}$  and  $L_{BH}$  values are tabulated in Table 1B, the grip gaging length of the screws shall be determined as follows:

$$L_{GH} = L - L_T$$
$$L_{BH} = L - L_T$$

where

L = nominal length

 $L_T$  = minimum thread length from Table 3B  $L_{TT}$  = maximum total thread length from Table 3B

### 2.5 Point

The end on screws of 5 mm nominal size and larger and of nominal lengths equivalent to 1.5 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 the chamfer HEXAGON SOCKET FLAT COUNTERSUNK HEAD CAP SCREWS (METRIC SERIES)



### TABLE 3B THREAD LENGTHS FOR LENGTHS NOT TABULATED IN TABLE 1B

<i>D</i> Nominal Screw Diameter	L <sub>7</sub> Minimum Thread Length	L <sub>77</sub> Maximum Total Thread Length
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

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 1.5 times the basic screw diameter shall be optional.

### 2.6 Concentricity

The body shall be concentric to the thread within a total runout of 0.13 mm per mm of body length (but not to exceed 0.64 mm) when the screw is held by the full threads closest to the head of the screw.

### 2.7 Surface Finish

**2.7.1 Surface Roughness.** For alloy steel screws of nominal lengths equal to or less than 8 times the basic screw diameter, the surface roughness of the screws before plating shall not exceed  $1.6 \,\mu$ m AA on the fillet and head bearing surfaces, nor exceed  $0.8 \,\mu$ m AA on the threads.

For longer lengths and corrosion-resistant steel screws, the surface roughness of the screws prior to . plating shall not exceed  $3.2 \,\mu m$  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 these surfaces with commercially available equipment, roughness measurements shall be taken axially on the body and fillet surfaces, and circumferentially on the bearing surface.

### 3 MATERIAL, PROCESSING, AND MECHANICAL PROPERTIES

Hexagon socket flat countersunk head cap screws shall conform to the following requirements pertaining to materials, processing, mechanical and physical properties, and testing and sampling procedures.

### 3.1 Materials

**3.1.1 Alloy Steel.** Alloy steel metric flat countersunk head cap screws shall be fabricated from an alloy steel, and physical properties of screws, fabrication processes, and testing requirements shall conform to ASTM Specification F 835M, Alloy Metric Socket Button and Flat Countersunk Head Cap Screws.

**3.1.2 Corrosion-Resistant Steel.** Corrosion-resistant steel metric flát countersunk head cap screws shall be fabricated from austenitic corrosion-resistant steel and physical properties of screws, fabrication processes, and testing requirements shall conform to ASTM Specification F 879M, Stainless Steel Metric Button and Flat Countersunk Head Cap Screws. Unless otherwise specified, the property class shall be A1-70.

### **APPENDIX I**

### FORMULAS FOR DIMENSIONS

(This Appendix is not part of ASME/ANSI B18.3.5M-1986, and is included here for information purposes only.)

Body Diameter D, Table 1A

D (max.) = Basic or nominal size — see table for values D (min.) = D (max.) — IT13 tolerance from ISO system of limits and fits (ANSI B4.2)

Head Diameter A, Table 1A

A (max.) A (min.)

Head Height H, Table 1A

H (ref.) Flushness Tolerance

Key Engagement, Table 1A

T (min.) G (min.)



FIG. I-1 HOLE AND COUNTERSINK SIZES FOR FLAT COUNTERSUNK HEAD CAP SCREWS

D	A	x	Ŷ
Nominal Screw Size	Nominal Hole Diam.	Countersink Depth (Ref.)	Countersink Diameter Min.
M3	3.5	1.61	6.72
M4	4.6	2.18	8.96
M5	6.0	2.60	11.20
мí6	7.0	3.22	13.44
M8	9.0	4.46	17.92
M10	11.5	5.45	22.40
M12	13.5	6.69	26.88
M14	16.0	7.12	30.24
M16	18.0	7.80	33.60
M20	22.4	8.96	40.32

**TABLE I-1** 

Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled w

# Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled

≶

### APPENDIX II

### **GOVERNMENT STANDARD ITEMS AND PART NUMBERING SYSTEM**

(This Appendix is not part of ASME/ANSI B18.3.5M-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 II-1

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

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

(d) Special Features - 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) Nominal diameter
- (d) Nominal length
- (e) 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.



Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled w

## TABLE II-1 METRIC HEXAGON SOCKET FLAT COUNTERSUNK HEAD CAP SCREWS – GOVERNMENT STANDARD ITEMS AND PART NUMBERING SYSTEM







EXAMPLE: B1835A06020N indicates a screw, cap, hexagon socket, flat countersunk head (metric) made of cadmium plated alloy steel, with M6X1 thread, 20 mm in length, with no special feature. copyrighted material licensed to standid University by Thomson Scientific (www.techsiteet.com), downloaded on Oct-03-2010 by standid University Ost. No further reproduction of distinguishing or controlled

### **APPENDIX III**

### DIMENSIONS OF METRIC THREADS FOR SOCKET SCREW PRODUCTS

(This Appendix is not part of ASME/ANSI B18.3.5M-1986, and is included here for information purposes only.)

			Dime	nsions Be	fore Platin	g [Note (1)]		Toleranc	e Class 4h6h	[Note (2)]
Nominal Size or Basic Thread		Major D	liameter	Pitch D	liameter		Root Radius	Major Diameter 6h	Pitch Diameter 4h	GO Gage Minor
Diameter	Pitch	Max.	Min.	Max.	Min.	Allowance	Min.	Max.	Max.	Diameter
M3 M4	0.5 0.7	2.976 3.976	2.874 3.838	2.651 3.521	2.607 3.467	0.024 0.024	0.06 0.08	3.000 4.000	2.675 3.545	2.459 3.242

NOTES:

Applies to unplated or uncoated screws and plated or coated screws before plating or coating.
 Applies to plated or coated screws after plating or coating.

### APPENDIX IV

### WALL THICKNESS GAGE

(This Appendix is not part of ASME/ANSI B18.3.5M-1986, and is included here for information purposes only.)



GENERAL NOTE: With gage assembled as shown, set dial indicator to read *G* dimension (dial indicator will now read hex wall directly.)

### FIG. IV-1 SUGGESTED GAGE FOR FLAT COUNTERSUNK HEAD CAP SCREW TO CHECK MINIMUM WALL THICKNESS G





Flushness Gage

Setting Plug

Copyrighted material licensed to Stanford University by Thomson Scientific (www.techstreet.com), downloaded on Oct-05-2010 by Stanford University User. No further reproduction or distribution is permitted. Uncontrolled v

TABLE IV-1

D	A	G	С	E	L (Ref.)	Q (Ref.)	B (Ref.)	R	x	Y
M3	6.72	0.25	2.4	0.30	20	24	6	2	2.0	0.1
M4	8.96	0.45	2.9	0.30	20	24	10	2	2.5	0.1
M5	11.20	0.66	3.5	0.35	24	24	12	3	3.0	0.2
M6	13.44	0.70	4.7	0.35	24	30	12	3	4.0	0.2
M8	17.92	1.16	5.8	0.40	36	30	16	3	5.0	0.2
					5					ļ
M10	22.40	1.62	7.0	0.50	36	35	16	3	6.0	0.2
M12	26.88	1.80	9.3	0.60	36	40	20	4	8.0	0.2
M14	30.24	1.62	11.6	0.70	36	45	22	4	10.0	0.2
M16	33.60	2.2	11.6	0.80	36	50	24	4	10.0	0.2
M30	40.32	2.2	13.8	1.0	36	60	25	4	12.0	0.2
		1						L		

GENERAL NOTE: All dimensions are maximum, with the exception of gage markers' tolerance, as noted.

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

	DIO 1 1 1070 (D1000)
Small Solid Rivets	. BI8.1.1-1972 (R1983)
Large Rivets	. B18.1.2-1972 (R1983)
Matric Small Solid Rivets	B18.1.3M-1983
	B18 2 1-1981
Square and Hex Bolts and Screws – Inch Series	
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
Matrie Hanny Hay Corowa	B18 2 3 3M-1979
Metric Heavy Hex Sciews.	D10.2.2.4M 1094
Metric Hex Flange Screws	B10.2.3.4W-1904
Metric Hex Bolts	B18.2.3.5M-1979
Metric Heavy Hex Bolts	B18.2.3.6M-1979
Motio Honory Hox Structural Bolts	B18.2.3.7M-1979
Metic Heavy Hex Structural Boits	D10 2 2 0M 1001
Metric Hex Lag Screws.	
Metric Heavy Hex Flange Screws	B18.2.3.9M-1984
Metric Hex Nuts. Style 1	B18.2.4.1M-1979
Motrie Hox Nute, Style 2	B18.2.4.2M-1979
	B18 2 / 3M-1979
Metric Slotted Hex Nuts	D10.2.4.3W-1979
Metric Hex Flange Nuts	B18.2.4.4W-1982
Metric Hex Jam Nuts	B18.2.4.5M-1979
Matric Heavy Hex Nuts	B18.2.4.6M-1979
Method Heavy Heavilian Content (Lash Content)	B18 3-1082
Socket Cap, Shoulder and Set Screws (Inch Series)	
Socket Head Cap Screws (Metric Series)	B18.3.1M-1986
Metric Series Hexagon Keys and Bits	B18.3.2M-1979 (R1986)
Havagen Socket Head Shoulder Screws (Metric Series)	B18.3.3M-1986
The agent Socket Read Should Society (Motion Society)	B18 3 4M-1986
Hexagon Socket Button Head Cap Screws (Metric Series)	D10.0.4M 1000
Hexagon Socket Flat Countersunk Head Cap Screws (Metric Series)	B18.3.5W-1960
Metric Series Socket Set Screws	B18.3.6M-1986
Bound Head Bolts (Inch Series)	B18.5-1978
Matria Round Hoad Short Square Neck Bolts	B18 5 2 1M-1981
	D10 5 2 2M 1092
Metric Round Head Square Neck Bolts	DI0.5.2.2W-1902
Wood Screws	B18.6.1-1981
Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless	
	B18.6.2-1972 (B1983)
Marking Consult and Marking Sorow Nuto	B18 6 3-1972 (B1983)
Machine Screws and Machine Screw Nuts	. B18.6.3-1972 (R1983)
Machine Screws and Machine Screw Nuts	
Machine Screws and Machine Screw Nuts	B18.6.3-1972 (R1983) B18.6.5M-1986 B18.6.7M-1985
Machine Screws and Machine Screw Nuts	B18.6.3-1972 (R1983) B18.6.5M-1986 B18.6.7M-1985
Machine Screws and Machine Screw Nuts	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series)	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets Clevis Pins and Cotter Pins.	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins         Clevis Pins and Cotter Pins.	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets Clevis Pins and Cotter Pins. Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) Plow Bolts Track Bolts and Nuts Miniature Screws Glossary of Terms for Mechanical Fasteners.	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets Clevis Pins and Cotter Pins. Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) Plow Bolts Track Bolts and Nuts Miniature Screws Glossary of Terms for Mechanical Fasteners. Screws and Washer Assemblies — Same	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies – Sems.         Forged Eyebolts.	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts         Mechanical and Performance Requirements for Prevailing-Torque Type	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies – Sems.         Forged Eyebolts         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque Tapesion Test Bequirements for Prevailing-Torque Type	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies – Sems.         Forged Eyebolts         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts         Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         E Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts         and Hex Flange Nuts.	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts         Ming Nuts, Thumb Screws, and Wing Screws	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies – Sems.         Forged Eyebolts.         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts         and Hex Flange Nuts.         Bimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts         and Hex Flange Nuts.         Wing Nuts, Thumb Screws, and Wing Screws         Ins	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies – Sems.         Forged Eyebolts.         Metric Hex Nuts and Hex Flange Nuts         Machine Screws         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         E Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Ming Nuts, Thumb Screws, and Wing Screws         Inspection and Quality Assurance for General Purpose Metric Fasteners         Inspection and Quality Assurance for General Purpose Metric Fasteners	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts         Ming Nuts, Thumb Screws, and Wing Screws         Inspection and Quality Assurance for General Purpose Metric Fasteners         Inspection and Quality Assurance for High-Volume Machine Assembly	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Poimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Ming Nuts, Thumb Screws, and Wing Screws         Inspection and Quality Assurance for General Purpose Metric Fasteners         Inspection and Quality Assurance for High-Volume Machine Assembly </td <td></td>	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Ming Nuts, Thumb Screws, and Wing Screws         Inspection and Quality Assurance for General Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Metric Fasteners	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Ming Nuts, Thumb Screws, and Wing Screws         Inspection and Quality Assurance for General Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Metric Fastenered	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets Clevis Pins and Cotter Pins. Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) Plow Bolts Track Bolts and Nuts Miniature Screws Glossary of Terms for Mechanical Fasteners. Screw and Washer Assemblies — Sems. Forged Eyebolts. Mechanical and Performance Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Torque-Tension Test Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts. Wing Nuts, Thumb Screws, and Wing Screws Inspection and Quality Assurance for General Purpose Metric Fasteners Inspection and Quality Assurance for High-Volume Machine Assembly Metric Fasteners. Inspection and Quality Assurance for Special Purpose Metric Fasteners Inspection and Quality Assurance for Highly Specialized Engineered Annli retions — Metric Fasteners	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies – Sems.         Forged Eyebolts.         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies         Screw and Washer Assemblies         Screw and Washer Assemblies         Mechanical and Performance Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Torque-Tension Test Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Ming Nuts, Thumb Screws, and Wing Screws         Inspection and Quality Assurance for General Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Met	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets Clevis Pins and Cotter Pins. Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) Plow Bolts Track Bolts and Nuts Miniature Screws Glossary of Terms for Mechanical Fasteners. Screw and Washer Assemblies — Sems. Forged Eyebolts. Mechanical and Performance Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts. Wing Nuts, Thumb Screws, and Wing Screws Inspection and Quality Assurance for General Purpose Metric Fasteners Inspection and Quality Assurance for Special Purpose Metric Fasteners Inspection and Quality Assurance for Special Purpose Metric Fasteners Inspection and Quality Assurance for Highly Specialized Engineered Applications — Metric Fasteners Lock Washers Metric Plain Washers	
Machine Screws and Machine Screw Nuts         Metric Thread Forming and Thread Cutting Tapping Screws         Metric Machine Screws         Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws         (Inch Series)         General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps         Metric General Purpose Semi-Tubular Rivets         Clevis Pins and Cotter Pins.         Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)         Plow Bolts         Track Bolts and Nuts         Miniature Screws         Glossary of Terms for Mechanical Fasteners.         Screw and Washer Assemblies — Sems.         Forged Eyebolts.         Metric Hex Nuts and Hex Flange Nuts         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Dimensional Requirements for Prevailing-Torque Type         Steel Metric Hex Nuts and Hex Flange Nuts         Ming Nuts, Thumb Screws, and Wing Screws         Inspection and Quality Assurance for General Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Metric Fasteners         Inspection and Quality Assurance for Special Purpose Met	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) Plow Bolts Track Bolts and Nuts Miniature Screws Glossary of Terms for Mechanical Fasteners. Screw and Washer Assemblies — Sems. Forged Eyebolts. Mechanical and Performance Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Torque-Tension Test Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Ming Nuts, Thumb Screws, and Wing Screws Inspection and Quality Assurance for General Purpose Metric Fasteners Inspection and Quality Assurance for Special Purpose Metric Fasteners Inspection and Quality Assurance for Special Purpose Metric Fasteners Inspection and Quality Assurance for Highly Specialized Engineered Applications — Metric Fasteners Lock Washers Metric Plain Washers Plain Washers Plain Washers Plain Washers	
Machine Screws and Machine Screw Nuts Metric Thread Forming and Thread Cutting Tapping Screws Metric Machine Screws Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps Metric General Purpose Semi-Tubular Rivets Clevis Pins and Cotter Pins. Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) Plow Bolts Track Bolts and Nuts Miniature Screws Glossary of Terms for Mechanical Fasteners. Screw and Washer Assemblies — Sems. Forged Eyebolts. Mechanical and Performance Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts Inspection and Quality Assurance for General Purpose Metric Fasteners Inspection and Quality Assurance for Special Purpose Metric Fasteners Inspection and Quality Assurance for Special Purpose Metric Fasteners Inspection and Quality Assurance for Highly Specialized Engineered Applications — Metric Fasteners Lock Washers Hetric Plain Washers Plain Washers Beveled Washers.	