AN AMERICAN NATIONAL STANDARD

Hexagon Socket Head Shoulder Screws (Metric Series)

ASME/ANSI B18.3.3M-1986

REAFFIRMED 1993

FOR CURRENT COMMITTEE PERSONNEL
PLEASE SEE ASME MANUAL AS-11

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FOREWORD

(This Foreword is not part of ASME/ANSI B18.3.3M-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.

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.

At the November 10, 1976 meeting of Subcommitte 3, it was agreed that the socket screw industry document covering metric hexagon socket head shoulder screws should be circulated for subcommittee consideration as a proposed standard. It was noted that the dimensional characteristics were similar to proposals prepared by Working Group 3 of ISO TC2, the major difference being in the thread fit. The ISO proposal specifies tolerance class 5g6g, whereas the socket screw industry document calls for tolerance class 4g6g in line with past practice. Subcommittee acceptance of the content ensued and the document, modified to suit the ANSI format, was approved by letter ballot to American National Standards Committee B18. Following its approval by the sponsor organizations, the proposal was submitted to the American National Standards Institute and granted recognition as an American National Standard on July 18, 1979.

A periodic review of the standard, undertaken by the Subcommittee in 1985, resulted in agreement that the document should be revised to include values of the shoulder neck fillet radius for metric hexagon socket head shoulder screws, and to incorporate by reference the ASME standards for screw thread acceptability and the ASTM standard for hardness testing. 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 19, 1986.

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HEXAGON SOCKET HEAD SHOULDER SCREWS (METRIC SERIES)

1 GENERAL

1.1 Scope

1.1.1 This Standard contains complete dimensional, mechanical, and performance requirements for Metric Series Hexagon Socket Head Shoulder Screws with nominal shoulder diameters from 6.5 mm to 25 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.

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 Dimensions

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

1.3 Options

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

1.4 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.

1.5 Terminology

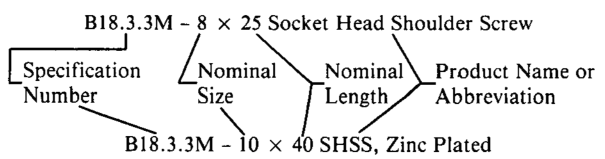
For definitions of terms relating to fasteners or to component features thereof used in this Standard, refer to ANSI B18.12, Glossary of Terms for Mechanical Fasteners.

1.6 Designation

Metric hexagon socket head shoulder 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 (shoulder diameter) of screw;
(*c*) Nominal screw (shoulder) length, preceded by ×;
(*d*) Product name. If desired, the product name may be abbreviated SHSS.
(*e*) Material and property class. For alloy steel screws the material and property class shall be omitted.
(*f*) Protective finish, if required.

Examples:



1.7 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 1 and 2 and shall apply to the respective features of screws.

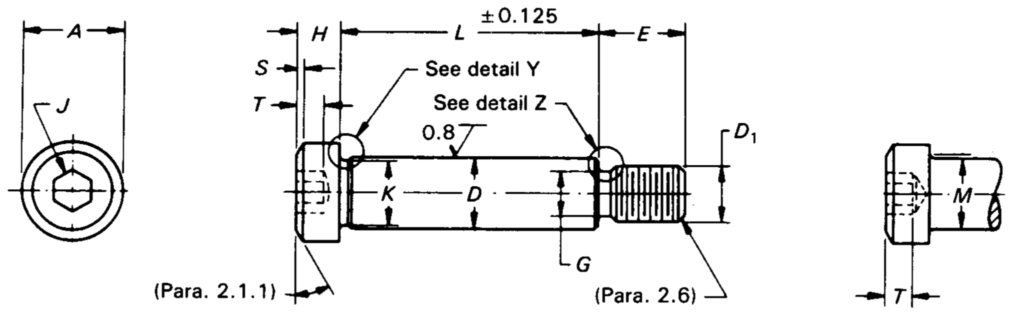


TABLE 1 DIMENSIONS OF METRIC HEXAGON SOCKET HEAD SHOULDER SCREWS

Nominal Screw Size or Basic Shoulder Diameter	D		A		H		S	J	T	M	R
	Shoulder Diameter		Head Diameter		Head Height		Chamfer or Radius	Hexagon Socket Size	Key Engagement	Head Fillet Extension Diameter	Shoulder Neck Fillet Radius
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Nom.	Min.	Max.	Min.
6.5	6.487	6.451	10.00	9.78	4.50	4.32	0.6	3	2.4	7.5	.2
8.0	7.987	7.951	13.00	12.73	5.50	5.32	0.8	4	3.3	9.2	.4
10.0	9.987	9.951	16.00	15.73	7.00	6.78	1.0	5	4.2	11.2	.4
13.0	12.984	12.941	18.00	17.73	9.00	8.78	1.2	6	4.9	15.2	.6
16.0	15.984	15.941	24.00	23.67	11.00	10.73	1.6	8	6.6	18.2	.6
20.0	19.980	19.928	30.00	29.67	14.00	13.73	2.0	10	8.8	22.4	.8
25.0	24.980	24.928	36.00	35.61	16.00	15.73	2.4	12	10.0	27.4	.8
See Para.	2.3.1		2.1.2				2.1.1	2.2.1	2.2.2	2.1.5	2.1.5

GENERAL NOTE: For additional requirements refer to Sections 2 and 3.

2.1 Heads

2.1.1 Top of Head. The top of head, excluding socket, shall be flat and chamfered or rounded at the periphery. The length of the chamfer or the corner radius shall not exceed the values for *S* listed in Table 1.

2.1.2 Head Diameter. The sides of head may be plain or knurled at the option of the manufacturer, unless specified otherwise by the purchaser.

2.1.3 Head Concentricity. The head shall be concentric with the screw shoulder within 2% of the nominal screw diameter or 0.15 mm full indicator movement (FIM), whichever is greater.

2.1.4 Bearing Surface. The plane of the bearing surface of the head shall be perpendicular to the axis of the shoulder within a maximum deviation of 2 deg.

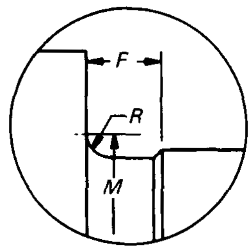
2.1.5 Underhead Fillet. At the option of the manufacturer, screws may be necked under the head as depicted in Detail Y within the limits of the *F*, *R*, and *K* dimensions given in Table 1. The transition diameter over fillet at the intersection of the bearing surface of the head with the neck or shoulder shall be within the tabulated value for *M*.

2.2 Sockets

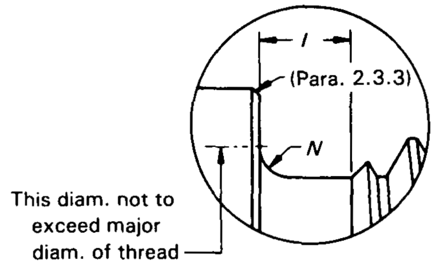
2.2.1 Socket Size. Sockets shall be nominal size *J* specified in Table 1 for the respective screw sizes and shall conform to the dimensions given in Table 2, as determined by gaging in accordance with para. 2.2.3.

2.2.2 Key Engagement. The key engagement depth shall conform to the minimum values specified for *T* in Table 1, 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 3. The hexagon sockets shall



Enlarged
Detail Y
(Para. 2.1.5)



Enlarged
Detail Z
(Para. 2.4)

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

Nominal Screw Size or Basic Shoulder Diameter	*K* Shoulder Neck Diameter	*F* Shoulder Neck Width	*D*$_1$ Nominal Thread Size or Basic Thread Diameter		*G* Thread Neck Diameter		*I* Thread Neck Width	*N* Thread Neck Fillet Radius		*E* Thread Length
	Min.	Max.		Thread Pitch	Max.	Min.	Max.	Max.	Min.	Max.
6.5	5.92	2.5	5	0.8	3.86	3.68	2.4	0.66	0.50	9.75
8.0	7.42	2.5	6	1	4.58	4.40	2.6	0.69	0.53	11.25
10.0	9.42	2.5	8	1.25	6.25	6.03	2.8	0.80	0.64	13.25
13.0	12.42	2.5	10	1.5	7.91	7.69	3.0	0.93	0.77	16.40
16.0	15.42	2.5	12	1.75	9.57	9.35	4.0	1.03	0.87	18.40
20.0	19.42	2.5	16	2	13.23	12.96	4.8	1.30	1.14	22.40
25.0	24.42	3.0	20	2.5	16.57	16.30	5.6	1.46	1.30	27.40
See Para.	2.1.5		2.5		2.4			2.4		2.5.4

GENERAL NOTE: For additional requirements refer to Sections 2 and 3.

TABLE 2 DIMENSIONS OF METRIC HEXAGON SOCKETS

Nominal Socket Size	*J* Socket Width Across Flats		*C* Socket Width Across Corners
	Max.	Min.	Min.
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

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 3, 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.

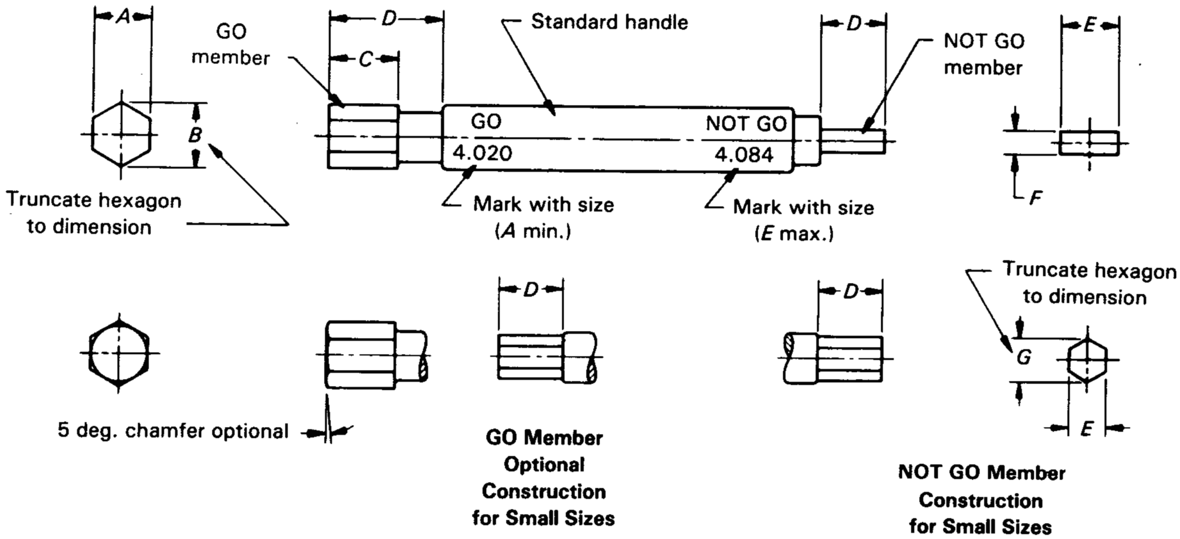


TABLE 3 DIMENSIONS OF METRIC HEXAGON SOCKET GAGES

Nominal Socket Size	A GO Gage Width Across Flats		B GO Gage Width Across Corners		C GO Gage Length	D Usable Gage Length	E NOT GO Gage Width		F NOT GO Gage Thickness		G NOT GO Gage Width Across Corners	
	Max.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
3	3.025	3.020	3.440	3.435	7.0	7.0	3.071	3.066	...	...	3.35	3.33
4	4.025	4.020	4.580	4.575	7.0	7.0	4.084	4.079	1.80	1.75	...	...
5	5.025	5.020	5.720	5.715	7.0	7.0	5.084	5.079	2.30	2.25	...	...
6	6.025	6.020	6.860	6.855	8.0	12.0	6.095	6.090	2.80	2.75	...	...
8	8.030	8.025	9.150	9.145	8.0	16.0	8.115	8.110	3.80	3.75	...	...
10	10.030	10.025	11.500	11.495	12.0	20.0	10.127	10.122	4.80	4.75	...	...
12	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 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.

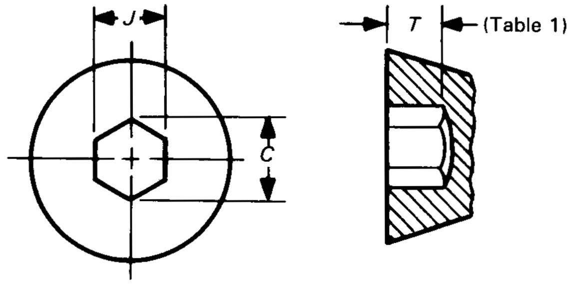


FIG. 1 FORGED HEXAGON SOCKET

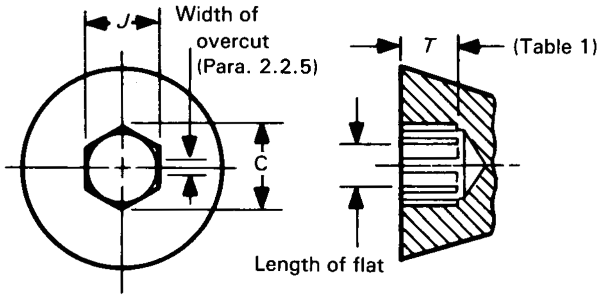


FIG. 2 BROACHED HEXAGON SOCKET

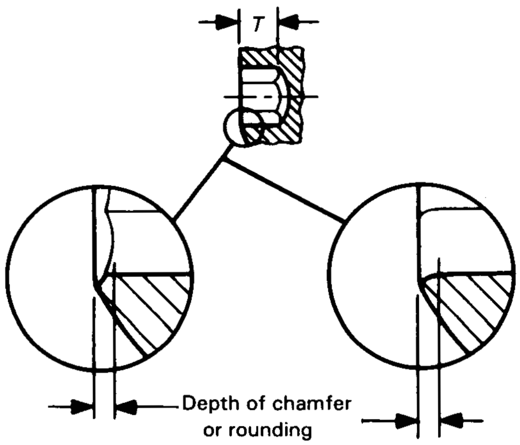


FIG. 3 SOCKET EDGE DETAIL

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 nominal screw size or 0.26 mm, whichever is greater, for nominal screw sizes up to and including 13 mm; and equal to 6% of the nominal screw size for sizes larger than 13 mm, regardless of feature size.

2.3 Shoulder

2.3.1 Diameter. The shoulder is the enlarged unthreaded shank portion of the screw, the diameter of which serves as the basis for the derivation of the nominal screw size. The diameter shall be ground to the limits for *D* specified in Table 1 and a surface roughness not exceeding 0.8 μm R_a.

2.3.2 Length. The basic length of the socket head shoulder screw shall be the nominal length of the shoulder expressed in millimeters.

2.3.2.1 Measurement. The length shall be measured, parallel to the axis of the screw, from the plane of the bearing surface under the head to the plane of the shoulder at the threaded end.

2.3.2.2 Standard Lengths. The standard lengths for hexagon socket head shoulder screws shall be as follows: 10, 12, 16, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 110 and 120 mm.

2.3.3 Edge of Shoulder. The edge of the shoulder may be broken (rounded or chamfered) providing the radius or depth of chamfer on the face of the shoulder does not exceed 0.15 mm for nominal screw sizes up to and including 10 mm nor 0.20 mm for larger sizes.

2.3.4 Concentricity. The shoulder and thread pitch diameter shall be concentric within 0.10 mm full indicator movement (FIM), determined at a distance of 4.75 mm from the face of the shoulder.

Concentricity, parallelism, bow, and squareness of the face of the shoulder with the axis of the thread shall be within 0.125 mm FIM per 25.0 mm of shoulder length, with a maximum of 0.70 mm, when the shoulder face is firmly seated against a threaded bushing and deviation is checked on the shoulder at a distance equal to 2*F* from the underside of the head. The thread in the bushing shall be basic size, and the bushing outside diameter and ends shall be concentric and square with the axis of the thread, respectively.

2.4 Thread Neck

The neck portion between the thread and shoulder shall allow the face of the shoulder to seat against the face of a standard basic GO thread ring gage assembled onto the threaded end.

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 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.

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

2.5.4 Thread Length Tolerance. The tolerance on the length of threaded portion *E* shall be minus 0.50 mm for nominal screw sizes up to and including 10 mm and minus 0.75 mm for larger screw sizes.

2.6 Screw Point Chamfer

The end of the screw shall be flat or slightly concave, approximately perpendicular to the axis of the screw, and chamfered. The included angle of the point shall be approximately 90 deg. and the chamfer shall extend slightly below the root of the thread. The edge between the flat and the chamfer may be slightly rounded.

3 MATERIAL, PROCESSING, AND MECHANICAL PROPERTIES

Socket head shoulder screws shall conform to the following requirements pertaining to materials, processing, mechanical and physical properties, and testing and sampling procedures.

3.1 Material and Heat Treatment

3.1.1 Material. The screws shall be made from alloy steel conforming to the chemical composition given in Table 4.

3.1.2 Heat Treatment Practice. Alloy steel screws shall be heat treated, oil quenched from the austenitizing temperature, and tempered at a minimum tempering temperature of 345 °C to meet the hardness and strength requirements described in para. 3.5.

TABLE 4 CHEMICAL COMPOSITION REQUIREMENTS

Elements: (Percent) [Note (1)]	
Carbon	0.31 to 0.48
Phosphorus	0.035 max.
Sulphur	0.035 max.
Chromium, Nickel, Molybdenum, Vanadium	[Note (2)]

NOTES:
(1) All values are for product analysis (percent by weight).
(2) One or more of these alloying elements shall be present in sufficient quantity to ensure that the specified hardness and strength properties described in para. 3.5 are met after screws are heat treated in accordance with para. 3.1.2.

3.2 Heading Practice

Screw blank forming methods other than upsetting and/or extrusion shall be permitted only by special agreement between the purchaser and the producer. Sockets may be forged or broached at the option of the manufacturer.

3.3 Threading Practice

Threads on screws shall be produced by roll threading process except by special agreement between the purchaser and the manufacturer.

3.4 Finish

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

3.5 Mechanical and Physical Requirements

3.5.1 Hardness. Alloy steel screws shall have a hardness of HRC 36 to 43 at the surface.

Hardness tests shall be conducted on a sample size selected in accordance with para. 3.6.1 and Table 5. For routine inspection, the hardness shall be determined on the head or point end of the screw after removal of any plating or other coating. For referee purposes, the hardness shall be determined on a transverse section through the threaded portion of screw taken at a distance equal to one thread diameter from the point end. The reported hardness shall be the average of four hardness readings located at 90 deg. to each other.

TABLE 5 SAMPLE SIZE FOR MECHANICAL TESTING

Lot Quantity	Sample Size
Up to 50	2
51 to 500	3
501 to 35,000	5
Over 35,000	8

Hardness testing shall be in accordance with ASTM E 18.

3.5.2 Strength Properties. Socket head shoulder screws shall be capable of meeting the following tensile and shear strength requirements:

3.5.2.1 Tensile Strength. Screws shall have an ultimate tensile strength of 1100 MPa, based on the minimum stress area of the thread neck portion of the screw.

3.5.2.2 Shear Strength. The thread neck and shoulder portions of screws shall have a single shear strength of 660 MPa, based on the minimum shear area of the thread neck and of the shoulder, respectively.

3.5.3 Decarburization and Carburization. Surface carbon content variation in the threaded portion of the screws shall conform to the decarburization limits specified in Table 6, when representative screws in a sample size selected in accordance with para. 3.6.1 are examined in compliance with para. 4.2. There shall be no gross decarburization nor carburization allowed. (See the supplementary data pertaining to decarburization and carburization detailed under para. 4.)

3.6 Sampling Procedures

Samples for testing and inspection purposes shall be selected at random from lots of finished screws.

The tests described in paras. 3.5.1 and 4.2 shall be performed on a sample size as specified in Table 5.

4 DECARBURIZATION AND CARBURIZATION

The following supplementary data contains the definitions for terms pertaining to carburization and decarburization, and details the methods used to determine the extent to which it has occurred.

4.1 Definitions

4.1.1 Decarburization. In general, *decarburization* is the term used to describe the loss of carbon content occurring at the surface of commercial ferrous materials that have been subjected to heat to modify the mechanical properties.

4.1.2 Partial Decarburization. *Partial decarburization* is the term used to describe decarburization to such an extent that the loss of carbon is sufficient to cause a lighter shade of tempered martensite than that of the immediate adjacent base metal, when examined metallographically as outlined in para. 4.2.1, but insufficient carbon loss to show clearly defined ferrite grains.

4.1.3 Gross Decarburization. *Gross decarburization* is the term used to describe decarburization with sufficient carbon loss to show only clearly defined ferrite grains under metallographic examination as specified in para. 4.2.1.

4.1.4 Carburization. *Carburization* is the term used to describe the presence of added carbon content at the surface, characterized by a darker shade of tempered martensite than that of the immediate adjacent base metal, when examined metallographically by the method outlined in para. 4.2.1.

4.1.5 Base Metal Hardness. The term *base metal hardness* is used to describe the hardness determined at a point sufficiently distant from the surface as to be free from any decarburization. For threads, the hardness as measured at the root diameter on a line bisecting the included angle of the thread shall be considered base metal hardness. See Location 1 in Fig. 5.

4.2 Methods for Measuring Decarburization

Two methods for measuring decarburization in screws are provided, the microscopic method described under para. 4.2.1 and the hardness method outlined under para. 4.2.2.

4.2.1 Microscopic Method. The microscopic method is intended primarily for routine inspection purposes and in the case of gross decarburization is the only method applicable.

4.2.1.1 Specimens. Specimens shall consist of longitudinal sections taken through the thread axis of the screw after all heat treating operations have been performed and prepared as follows:

(*a*) The specimens shall be mounted for grinding and polishing in clamps or plastic mountings, the latter being preferred. Protection from rounding the surface to be examined is essential.

(*b*) After mounting, the specimen surface shall be ground and polished in accordance with good metallographic practice.

(*c*) After polishing, specimens may be etched in a 3% nital solution, which is usually suitable for accentuating changes in the microstructure caused by decarburization.

4.2.1.2 Measurement. Unless agreed upon otherwise between the purchaser and producer, the specimen shall be examined at 100 × magnification and the microstructure compared with the definitions in paras. 4.1.2, 4.1.3, and 4.1.4. The extent of decarburization measured will determine compliance with the *N* (¾ *h*) values shown in Table 6. See Fig. 4.

If the microscope is of a type with a ground glass screen, the measurement can be made directly with a scale. If an eye piece is used for measurement, it should be an appropriate type containing a cross hair or a graduated scale.

4.2.2 Hardness Method. The hardness method of measurement is intended primarily for referee purposes and is applicable for all thread pitches.

4.2.2.1 Specimens. Specimens shall be prepared as outlined under para. 4.2.1.1(a) and (b).

4.2.2.2 Measurement. Hardness shall be determined at the three points depicted in Fig. 5, along a line bisecting the included angle of the thread, using a DPH 136 deg. or Knoop indenter with a 200 g load, and tested in accordance with ASTM E 384.

4.2.2.3 Interpretation. Hardness readings obtained shall be interpreted as follows.

(*a*) A decrease of more than 30 DPH hardness points from the root diameter (Location 1, Fig. 5) to *N* (Location 2) shall indicate that the part does not conform and is subject to rejection.

(*b*) An increase of more than 30 DPH hardness points between the root diameter (Location 1) and 0.12 mm below the flank surface (Location 3) shall be regarded as carburization, and shall indicate that the part does not conform and is subject to rejection.

It should be noted that careful differentiation must be made between an increase in hardness caused by carburization or caused by cold working the surface, as from thread rolling.

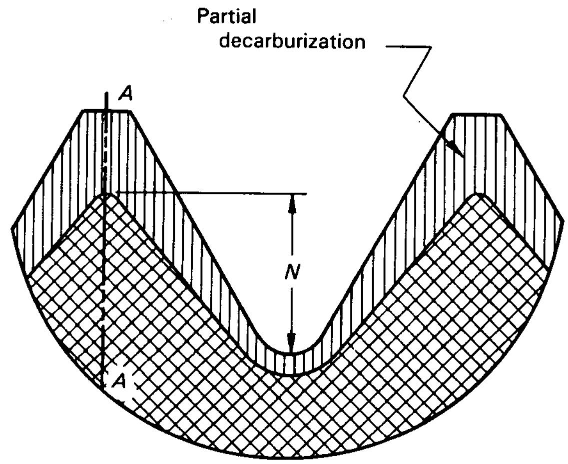


FIG. 4 MICROSCOPIC MEASUREMENT OF THREAD DECARBURIZATION

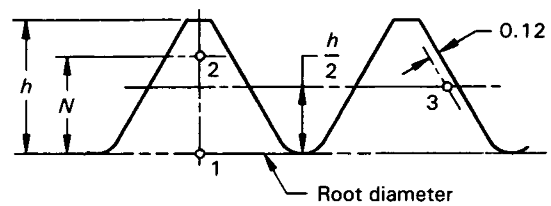


FIG. 5 LOCATION OF HARDNESS TEST POINTS FOR CHECKING THREAD DECARBURIZATION

TABLE 6 DECARBURIZATION LIMITS FOR THREADS

P	*h*	*N*
Thread Pitch	Thread Height (0.54127*P*)	Decarburization Limit (0.75*h*)
	Basic	Min.
0.8	0.433	0.325
1	0.541	0.406
1.25	0.677	0.508
1.5	0.812	0.609
1.75	0.947	0.710
2	1.083	0.812
2.5	1.353	1.015

APPENDIX I
FORMULAS FOR DIMENSIONS

(This Appendix is not part of ASME/ANSI B18.3.3M-1986, and is included here for information purposes only.)

Shoulder Diameter D, Table 1

D (max.)	=	No formula; see table for values	Nominal with tolerance zone f9[1]
D (min.)	=	No formula; see table for values	

Head Diameter A, Table 1

A (max.) = No formula; see table for values
A (min.) = A (max.) — IT13 tolerance[1]

Head Height H, Table 1

H (max.) = No formula; see table for values
H (min.) = H (max.) — IT13 tolerance[1]

Shoulder Neck Diameter K, Table 1

K (min.) = D (basic) — 0.58

[1]Tolerances from International Standard, System of Limits and Fits Part 1: General Tolerances and Deviations, ISO R286-1962. These tolerances also appear in an Appendix of ANSI B4.2.

APPENDIX II

GOVERNMENT STANDARD ITEMS AND PART NUMBERING SYSTEM

(This Appendix is not part of ASME/ANSI B18.3.3M-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 and Length Combinations — as specified in Table II-1

(*b*) Material — alloy steel

(*c*) Finish (cadmium plating or zinc coating) — 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.

PART NUMBERING SYSTEM COVERING STANDARD ITEMS FOR GOVERNMENT USE

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

Document Identifier	Material and Finish	Nominal Diameter	Nominal Length	Special Feature
B 1 8 3 3	A	0 8 0	0 4 0	N
		10ths of mm	mm	

Material and Finish Code

A — Alloy steel with cadmium plating per QQ-P-416, Type II, Class 3 (5 μm plating thickness)

B — Alloy steel with zinc coating per ASTM B 633, Fe/Zn5 (5 μm coating thickness), Type II

Special Feature Code

N — None

L — Self-locking*

*Details will be provided when available.

EXAMPLE: B1833A080040N indicates a screw, shoulder, hexagon socket, head (metric) made of cadmium plated alloy steel, 8 mm in diameter, 40 mm in length, with no special feature.

TABLE II-1 METRIC HEXAGON SOCKET HEAD SHOULDER SCREWS — STANDARD SIZES FOR GOVERNMENT USE

Nominal Shoulder Length	Nominal Shoulder Diameter						
	6.5	8	10	13	16	20	25
10	065010	080010	100010				
12				130012			
16							
20							
25							
30				Standard	160030		
40	065040			Diameter and		200040	
50		080050		Length Combination			250050
60							
70							
80							
90							
100			10010				
110							
120				13012	160120	200120	250120

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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
Mechanical and Performance Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts	B18.16.1M-1979 (R1986)
Torque-Tension Test Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts	B18.16.2M-1979 (R1986)
Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts	B18.16.3M-1982
Wing Nuts, Thumb Screws, and Wing Screws	B18.17-1968 (R1983)
Inspection and Quality Assurance for General Purpose Metric Fasteners	B18.18.1M-1982
Inspection and Quality Assurance for High-Volume Machine Assembly Metric Fasteners	B18.18.2M-1982
Inspection and Quality Assurance for Special Purpose Metric Fasteners	B18.18.3M-1982
Inspection and Quality Assurance for Highly Specialized Engineered Applications — Metric Fasteners	B18.18.4M-1982
Lock Washers	B18.21.1-1972 (R1983)
Metric Plain Washers	B18.22M-1981
Plain Washers	B18.22.1-1965 (R1981)
Beveled Washers	B18.23.1-1967 (R1975)

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