ASME B18.3-2012
[Revision of ASME B18.3-2003 (R2008)]

Socket Cap, Shoulder, Set Screws, and Hex Keys (Inch Series)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

INTENTIONALLY LEFT BLANK

ASME B18.3-2012
[Revision of ASME B18.3-2003 (R2008)]

Socket Cap, Shoulder, Set Screws, and Hex Keys (Inch Series)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers
Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: April 24, 2013

This Standard will be revised when the Society approves the issuance of a new edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Periodically certain actions of the ASME B18 Committee may be published as Cases. Cases and interpretations are published on the ASME Web site under the Committee Pages at http://cstools.asme.org/ as they are issued.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The Committee Pages can be found at http://cstools.asme.org/. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting "Errata" in the "Publication Information" section.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

CONTENTS

FOREWORD

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

Subcommittee No. 9[1] on Socket Head Cap and Set Screws was organized in April 1929 and completed its first report in November 1931. Seven successive drafts were issued during which the content of the proposal was considerably extended and refined, and in March 1933, copies were distributed to industry for criticism and comment. The suggestions received were carefully reviewed, and in April 1935, the proposal was presented to the members of Sectional Committee B18 for letter ballot vote. Following the acceptance by the two sponsor organizations, it was designated as an American Standard (ASA B18.3) in February 1936 by the American Standards Association.

For the purpose of keeping the work of the Subcommittee in line with the developments in industry, the Committee prepared a supplement to the standard in the form of a table covering the dimensions of hexagonal and fluted socket head shoulder screws (stripper bolts) optional, which received approval of the American Standards Association in April 1944 and was designated ASA B18.3a.

In March 1945, the Subcommittee submitted certain fundamental changes and additions to the Standard, and the Sectional Committee recommended issuance of a completely revised standard. Following approval of the Sectional Committee, the revised document was approved by the sponsor organizations and the American Standards Association and designated an American Standard in April 1947.

In accordance with ASA procedure, a review of the standard was undertaken in 1950 and certain additional changes were recommended by the Subcommittee. Cap screw sizes No. 0 and 1 and set screw sizes No. 0, 1, 2, 3, and 4 were added to satisfy increasing demand from various industries. Material, hardness, and thread fit were included to provide a more complete standard. A draft dated November 1951 was distributed to industry for criticism and comment. A further revision, dated November 1953, was presented to Sectional Committee B18 for letter ballot vote. Following approval of the Sectional Committee and sponsors, the proposal was submitted to the American Standards Association. It was approved and designated an American Standard on August 26, 1954.

Shortly after the 1954 standard was issued, work was initiated on the development of standards covering flat countersunk head cap screws, button head cap screws, and cap screws up to 4 in. in diameter. As these proposals evolved with comments received from various industries, it became evident that a major revision was required, particularly in regard to insufficient bearing surface under the head on some sizes as well as increased socket sizes to permit higher set-up torque. The resulting proposed revision was presented to Sectional Committee B18 for letter ballot vote. Following approval of the Sectional Committee and sponsors, the proposal was submitted to the American Standards Association. It was approved and designated an American Standard on December 21, 1961.

Continued surveillance of the 1961 standard by the Subcommittee indicated by 1966 that a complete revision of the document was necessary to provide recognition of technical improvements in materials and manufacturing methods. Work over the next 2 years culminated in a March 1968 draft proposal incorporating revisions in the following areas:

(a) more clearly defined materials for all products

(b) application of Unified radius root threads to all cap screws

(c) refinements to underhead fillets

(d) extension of size coverage for flat countersunk head cap screws to include $\frac{7}{8}$ in. through $1\frac{1}{2}$ in. diameters, and tabulation of body and grip lengths for sizes 0 in. through 1 in.

(e) increased key engagements in socket set screws and implementation of minimum hexagon key engagement in short length set screws

(f) addition of width across corner dimensions for hexagon keys and bits

(g) the inclusion of appendices covering drill and counterbore sizes for socket head cap screws (1960 Series), and gages and gaging for spline sockets.

Following acceptance of this draft by the Subcommittee, it was approved by letter ballot of USA Standards Committee B18 and the sponsor organizations, and submitted to the United States of America

[1] As of April 1, 1966, Subcommittee 9 was redesignated as Subcommittee 3.

Standards Institute. It was approved and designated a USA Standard on September 19, 1969.

A periodic review of the standard, undertaken by Subcommittee 3 in 1973, resulted in agreement that the document be revised to reflect clarification of the underhead fillet on socket head cap screws, add coverage on drilled socket head cap screws, lengthen the thread undercut on socket head shoulder screws, and extend the coverage on the latter to include the $1\frac{1}{2}$-in., $1\frac{3}{4}$-in., and 2-in. sizes. A proposal incorporating these changes together with numerous editorial corrections was prepared and, subsequent to Subcommittee acceptance, approved by letter ballot to American National Standards Committee B18. Following approval by the sponsor organizations, the proposal was submitted to the American National Standards Institute and designated an American National Standard on November 1, 1976.

A periodic review of the standard, undertaken by the Subcommittee in 1980, resulted in agreement that the document be revised

(a) to clarify the notes on screw point chamfers

(b) in socket tolerances for large sockets and in counterbore sizes to reflect standard tooling

(c) to reference ASTM A574 for the appropriate mechanical and chemical requirements

A proposal containing these changes, as well as many editorial corrections, was prepared for and balloted by letter ballot to the ASME Committee B18. Following approval by the sponsor organization, the proposal was submitted to the American National Standards Institute and designated an American National Standard on January 4, 1982.

A periodic review of the standard, undertaken by the Committee in 1985, resulted in agreement that the document be revised to clarify the dimensions with respect to plated products, and to incorporate by reference the new ASTM documents for the appropriate mechanical, chemical, and testing requirements for the button head, flat countersunk head, and set 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 August 7, 1986.

A periodic review of this Standard was undertaken by the Committee in 1990. Based on this review, it was determined that the document needed significant revisions to clarify and update the Standard. These revisions would need to address the technical changes in manufacturing methods and changes in the standards community. To accomplish this objective, established quality standards were recognized and integrated into the Standard. In addition, designated characteristics for each product and product identification were established and gaging techniques for countersunk screws were added. These changes were balloted and approved by the ASME B18 Committee. The proposal was submitted to the American National Standards Institute and designated an American National Standard on January 14, 1998.

A periodic review of this Standard was again undertaken by the Committee in 2000. It was determined that there were many technical printing errors that had to be revised. Inspection definitions were added to clarify bearing surface, runout, and straightness for various products. The radius under the head for socket head screws was clarified by the addition of drawings showing the radius on thread to the head socket screws, and also showing the radius on socket screws with an unthreaded shoulder. The protrusion gage dimensions were changed on flat head socket cap screws. The thread requirements for short length socket set screws were also changed. A standard was also developed for low head socket cap screws. These changes were balloted and approved by the ASME B18 Committee. The proposal was submitted to the American National Standards Institute and designated as an American National Standard on July 8, 2003.

In 2010, a task group was formed to review this Standard. The current revision is a result of their work. Spline driven fasteners, and their associated keys, have been removed from the document and users that wish to use this type of fastener will need to refer to the previous edition. The Type VI (Six Lobe) drive style has been added as a mandatory appendix. The tolerance for protrusion requirements on flat head socket cap screws has been increased. An alternative method for measuring protrusion has been included and corresponds with the metric document ISO 10642.

Other less significant changes in this revision include the addition of some sizes and slight changes to the requirements for drilled heads.

This Standard was approved by the American National Standards Institute on November 16, 2012.

ASME B18 COMMITTEE
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.)

STANDARDS COMMITTEE OFFICERS

J. Greenslade, *Chair*
D. S. George, *Vice Chair*
W. H. King, *Vice Chair*
C. J. Gomez, *Secretary*

STANDARDS COMMITTEE PERSONNEL

V. Cartina, Nylok
D. A. Clever, *Contributing Member,* Consultant
A. P. Cockman, Ford Motor Co.
C. D. de la Garza, TSP, Inc.
D. S. George, Ramco Specialties
C. J. Gomez, The American Society of Mechanical Engineers
J. Greenslade, Industrial Fasteners Institute
J. J. Grey, *Contributing Member,* Fastener Consulting Services, Inc.
A. Herskovitz, *Contributing Member,* Consultant
J. Hubbard, Leland-Powell Fasteners, Inc.
J. Jennings, *Contributing Member,* Naval Surface Warfare Center
W. H. King, Porteous Fastener Co.
M. D. Prasad, *Contributing Member,* Global M & F Solutions, Inc.
S. Savoji, *Contributing Member,* ITW Medalist
Q. M. Smith III, Oregon DOT
D. J. Soscia, General Dynamics Electric Boat Corp.
W. R. Stevens, Consultant
R. D. Strong, Doerken Corp.
S. W. Vass, *Contributing Member,* Consultant
C. B. Wackrow, MNP Corp.
W. K. Wilcox, Consultant
C. B. Williamson, Fastenal Co.
C. J. Wilson, Consultant
J. G. Zeratsky, *Contributing Member,* National Rivet and Manufacturing Co.

SUBCOMMITTEE 3 — SOCKET HEAD, CAP, AND SET SCREWS

C. B. Williamson, *Chair,* Fastenal Co.
J. Finnegan, *Vice Chair,* Safety Socket LLC
A. L. Guzman, *Secretary,* The American Society of Mechanical Engineers
T. Anderson, Bay Bolt
V. Cartina, Nylok
L. Claus, ATF, Inc.
T. Collier, Cam-Tech Industry, Inc.
C. Dugal de la Garza, TSP, Inc.
M. A. Elmi, Caterpillar
J. Foote, Trade Association Management, Inc.
D. S. George, Ramco Specialties
J. Greenslade, Industrial Fasteners Institute
J. J. Grey, Fastener Consulting Services, Inc.
A. Herskovitz, Consultant
J. Hubbard, Leland-Powell Fasteners, Inc.
M. Keller, Consultant
R. W. Kerr, Kerr Lakeside, Inc.
W. H. King, Porteous Fastener Co.
M. L. Levinson, ITW Shakeproof Industrial Products
J. F. McCarrick, Defense Supply Center Philadelphia
R. B. Meade, Atrona Test Labs, Inc.
L. C. Schroeder, Kansas Department of Transportation
G. M. Simpson, Semblex Corp.
D. J. Soscia, General Dynamics Electric Boat Corp.
R. D. Strong, Doerken Corp.
C. B. Wackrow, MNP Corp.
P. H. Werner, Safety Socket Screw Corp.
W. K. Wilcox, Consultant
C. J. Wilson, Consultant
D. Winn, Kamax

CORRESPONDENCE WITH THE B18 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B18 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Interpretations. Upon request, the B18 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B18 Standards Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B18 Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B18 Standards Committee.

INTENTIONALLY LEFT BLANK

SOCKET CAP, SHOULDER, SET SCREWS, AND HEX KEYS (INCH SERIES)

1 INTRODUCTORY NOTES

1.1 Scope

This Standard covers complete general and dimensional data for various types of hexagon socket cap screws, shoulder screws, set screws, and hexagon keys recognized as an American National Standard. Also included are appendices that provide specifications for hexagon socket gages and gaging, tables showing applicability of keys and bits to various socket screw types and sizes, drill and counterbore sizes for socket head cap screws, and formulas used for dimensional data. However, where questions arise concerning acceptance of product, the dimensions in the tables shall govern over recalculation by formula. Recess dimensions for Type VI recesses are given in Mandatory Appendix III.

1.2 Socket Cap Screws

The head types covered by this Standard are specified in paras. 1.2.1 through 1.2.5.

1.2.1 Socket Head Cap Screws. The socket head shall have a flat chamfered top surface with smooth or knurled cylindrical sides and a flat bearing surface. Specifications are given in Tables 1 through 7. Dimensions for drilled holes and counterbores are included in Table A-1 of Nonmandatory Appendix A.

1.2.2 Drilled Hexagon Socket Head Cap Screws. Specifications for hexagon socket head cap screws having two, four, and six holes drilled in the head for lock wire applications are given in Table 7.

1.2.3 Socket Flat Countersunk Head Cap Screws. The flat countersunk head shall have a flat top surface and a conical-bearing surface with an angle of approximately 82 deg. Specifications are given in Tables 8 through 10.

1.2.4 Socket Button Head Cap Screws. The button head shall have a low rounded top surface with a large flat bearing surface. Specifications are given in Table 11.

1.2.5 Socket Low Head Cap Screws. These are similar to socket head cap screws, except they have reduced head height and a smaller socket size. They are designed to be used in applications where height clearance is a problem. Specifications are given in Table 12.

1.3 Socket Head Shoulder Screws

The socket head shoulder screw is a hexagon socket head screw having a cylindrical shoulder under the head. Specifications are given in Table 13.

1.4 Socket Set Screws

The socket set screw is a screw threaded the entire length except for its length of point. The point is designed to bear on a mating part. The common point styles are cup, flat, oval, cone, and half dog. Specifications for set screws are shown in Tables 14 through 16.

1.5 Keys and Bits for Driving Socket Screws

The tools for driving socket screws are hexagon keys and bits. Table 17 contains the requirements for hexagon keys and bits.

1.6 Dimensions

All dimensions in this Standard are given in inches unless stated otherwise. All dimensions apply prior to coating unless stated otherwise.

1.7 Finish

Because of the high hardness of these products, it is recommended that they not be electroplated.

1.8 Identification Marking

Products described in paras. 1.2.1 through 1.2.4 and 1.3 with diameters larger than #10 shall be marked with the identification of the source manufacturer or private label distributor accepting the responsibility for conformance to this Standard. Marking size, type, and location of marks are at manufacturer's option. Products shall not be marked on bearing surface.

1.9 Terminology

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

1.10 Responsibility for Modifications

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.