

ASME B18.13.1M-2011
[Revision of ASME B18.13.1M-1998 (R2008)]

Screw and Washer Assemblies: SEMS (Metric Series)

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

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CONTENTS

Foreword	iv
Committee Roster	vi
Correspondence With the B18 Committee	vii
1 Introduction	1
2 General Data	1
3 Helical Spring Lock Washer SEMS	14
4 Tooth Lock Washer SEMS	15
5 Conical Washer SEMS	15
6 Plain Washer SEMS	15
Figures	
1 Unthreaded Length on Screws With Machine Screw Thread Diameter–Pitch Combinations	12
2 Conical Spring Washer Twist Test	14
3 Unthreaded Length on Tapping Screws With Spaced Thread Diameter–Pitch Combinations	15
Tables	
1 Dimensions of Helical Spring Lock Washers for SEMS With Machine and Tapping Screws Having Machine Screw Thread Diameter–Pitch Combinations	2
2 Dimensions of Helical Spring Lock Washers for SEMS With Screws Having Tapping Screw Thread Diameter–Pitch Combinations	3
3 Dimensions of Internal Tooth Lock Washers for SEMS	4
4 Dimensions of External Tooth Lock Washers for SEMS	5
5 Dimensions of Conical Spring Washers for SEMS	6
6 Dimensions of Plain Washers for SEMS	7
7 Through-Hardened and Tempered SEMS	8
8 Examples of SEMS Product Data	11
Nonmandatory Appendices	
A Reference Information for Users of This Standard	17
B Plain Washers on Tapping Screws	19
C The Relationship of This Revision to Previous Revisions of This Standard and to ISO Standards	20
D Manufacturing	21
E Statistical Expression of Hardness	22
F Recovery Test	23
C How SEMS Function	24

FOREWORD

American National Standards Committee B27 for the Standardization of plain and lock washers was organized in March 1926 as Sectional Committee B27 under the aegis of the American Standards Association (later the United States of America Standards Institute and, as of October 6, 1969, the American National Standards Institute, Inc.) with the Society of Automotive Engineers and The American Society of Mechanical Engineers as joint sponsors. (Since 1950, this Committee has also been assigned responsibility for standardization of washers and machine rings.) The Committee was reorganized in May 1928, at which time two subcommittees were established to carry on development work: Subcommittee 1* on plain washers and Subcommittee 2 on lock washers.

In 1940, the B27 Committee was reactivated, and Subcommittee 2 proceeded to draft a proposal covering helical spring lock washers. It was further amended in 1943 and, following approval by the B27 Committee and sponsor organizations, accepted as an American Standard under the designation ASA B27.1-1994.

A draft proposal completed by Subcommittee 2 in September 1949 incorporated requirements applicable to helical spring lock washers made from materials other than carbon steel and included specifications for tooth lock washers, both helical spring and tooth lock washers, and machine screw assemblies. Subsequent to approval by the B27 Committee and sponsors, the proposal was forwarded to the American Standards Association and declared an American Standard on May 22, 1950.

During the years of 1951 through 1956, Subcommittee 2 considered numerous refinements to the coverage of helical spring lock washers and heat-treated machine screw and lock washer assemblies. A formal draft dated June 1957 was approved by letter ballot of the B27 Committee and the sponsor organization and submitted to the American Standards Association for designation as an American Standard. This was granted on November 3, 1958.

In 1961, a study group comprised of members of the B18 and B27 Committees recommended that the screw and washer assemblies, commonly known as SEMS, be published as a separate document under the jurisdiction of the B18 Committee but subject to approval of both

Sectional Committees and the affected Subcommittees thereof. This recommendation was accepted by the B27 and B18 Committees, respectively, on the 28th and 30th of November 1961. Subcommittee 27[†] of Committee B18 was subsequently appointed.

At the initial meeting of Subcommittee 27 on February 1, 1962, a proposal was submitted consisting of a pertinent date for lock washer SEMS extracted from ASA B27.1-1958 and for plain washer SEMS proposed for inclusion in ASA B27.2, plus information gleaned from SAE Standard J773, Conical Spring Washers. It was agreed that the proposal should be extended to include tapping screw SEMS. Consequently, additional meetings of the subcommittee were held at which new drafts incorporating data for these products were reviewed, and further changes and corrections were recommended. On February 15, 1963, a formal proposal was circulated for comment to Subcommittees 3, 9, and 27 of the B18 Committee and Subcommittees 1 and 2 of the B27 Committee. On November 15, 1963, a revised draft incorporating resolutions to the comments received and additional refinements was letter balloted to Sectional Committees B18 and B27. The resulting comments and disapprovals were resolved at a meeting of Sectional Committee B18 on June 4, 1964 and by circulation of the recommended dispositions to Sectional Committee B27 on February 12, 1965. Subsequent to approval by the sponsor organization and the American Standards Association, the document was formally designated an American Standard, ASA B18.13-1965, on September 29, 1965.

Over the next 18 years, attempts were made to update and refine the document. However, due to extended vacancies in the chairmanship and continual shifts in membership of Subcommittee 13, none of these efforts proved successful, and the Standard was reaffirmed for the three review periods. At the December 5, 1984 meeting of Subcommittee 13, it was agreed the Standard should be revised to incorporate those changes necessary to bring it into agreement with the latest versions of the referenced B18 document covering the screw and washer components and for possible additional refinements. Recommendations for changes were reviewed and discussed further at a meeting held on May 18, 1985, and task groups were established to prepare detailed

* As of April 1, 1966, Subcommittee 1 was redesignated Subcommittee 2 on plain washers; Subcommittee 2 was redesignated Subcommittee 1 on lock washers under American National Standards Committee B27. As of March 16, 1972, Subcommittees 1 and 2 became Subcommittees 22 and 21, respectively, of American National Standards Committee B18.

[†] As of April 1, 1966, Subcommittee 3 was redesignated Subcommittee 6, Subcommittee 9 was redesignated Subcommittee 6, Subcommittee 9 was redesignated Subcommittee 3, and Subcommittee 27 was redesignated Subcommittee 13 of American National Standards Committee B18.

proposals relative to specific product lines. A proposed revision was drafted that relegated the coverage for round and truss head SEMS and Types A and C tapping screw SEMS to appendices under "Not recommended for new design" status. The revision included dimensional coverage for smaller sizes where applicable, changes to the helical spring lock washer sections and hardness, plus other technical and editorial updating previously accepted. This proposal was reviewed at the December 3, 1985 meeting of Subcommittee 13. Numerous editorial refinements were considered and adopted.

A formal proposal dated February 1986 was circulated to Subcommittees 3, 6, 13, 21, and 22 of the B18 Committee. A revised proposal incorporating resolutions to the comments received was given letter ballot approval by Standards Committee B18 in March 1987. Following its acceptance by ASME and the American National Standards Institute, this revision was granted recognition as an American National Standard on January 12, 1996.

A metric equivalent to the Standard was identified in 1998; thus, B18 approved a metric series SEMS standard. The document was accepted by ASME, and the American National Standards Institute granted approval on February 15, 1991.

With draft International Standards for screw and washer assemblies nearing completion in ISO/TC 2, and due to national or regional differences in production methods used, some revisions to this Standard, and an addition of an explanation of the alternative manufacturing practices in Nonmandatory Appendix A, became desirable. This revision was accepted by ASME and approved as an American National Standard on September 9, 1998.

In 2009, a formal proposal was made by the new chairman with a view to update and harmonize the Standard with ISO 898, incorporate information of importance to end users, and recognize manufacturing practices. The proposal was received and a task force was formed. A final draft was submitted by the chairman for ballot in October 2010.

Suggestions for improvement of this Standard are welcome. They should be sent to The American Society of Mechanical Engineers, Secretary, B18 Standards Committee, Three Park Avenue, New York, NY 10016-5990.

This revision was approved as an American National Standard on September 2, 2011.

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.)

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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
Three 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.

SCREW AND WASHER ASSEMBLIES: SEMS (METRIC SERIES)

1 INTRODUCTION

1.1 Scope

This Standard covers the general, dimensional, material, and mechanical requirements for metric through-hardened (property classes 8.8, 9.8, and 10.9) machine screws and case-hardened tapping screws from 5 mm to 12 mm captivated washer assemblies (SEMS). The covered washer types are helical, plain, conical, and toothed.

This Standard describes two different methods of SEMS manufacturing. It also covers standard and modified hardness requirements for machine screw SEMS.

The inclusion of dimensional data in this Standard is not intended to imply that all of the products described herein are stock production items. Consumers should consult with respective suppliers concerning the availability of products.

In addition, this Standard includes Nonmandatory Appendices that contain information considered of significant importance to both purchaser and manufacturer.

1.2 Use and Application

The SEMS covered by this Standard are general purpose fasteners intended for mass production and other assembly operations where speed and convenience are paramount factors. Further attributes of the various washers, recognized herein, are given in detail for each type of SEMS.

1.3 ISO Comparison

See Nonmandatory Appendix C.

1.4 Types of SEMS

Included in this Standard are SEMS comprised of the following types of screws and washers:

- (a) helical spring lock washers and
 - (1) socket head cap screws (see Table 1)
 - (2) hex cap screws (see Table 1)
 - (3) machine screws (see Table 1)
 - (4) tapping screws (see Tables 1 and 2)
- (b) tooth lock washers and
 - (1) machine screws (see Tables 3 and 4)
 - (2) tapping screws (see Tables 3 and 4)
 - (3) hex cap screws (see Tables 3 and 4)
- (c) conical spring washers and
 - (1) hex cap screws (see Table 5)
 - (2) machine screws (see Table 5)

- (3) tapping screws (see Table 5)
- (d) plain washers and
 - (1) machine screws (see Table 6)
 - (2) tapping screws (see Table 6)
 - (3) hex cap screws (see Table 6)

1.4.1 Relevant Information

(a) Hexagon SEMS may be supplied as hex cap screws or as formed hex heads at the option of the manufacturer.

(b) Products having washer styles and shapes not shown in this Standard may be considered SEMS; however, these products must be covered by the purchaser's drawing or standard or the supplier's standard.

(c) These products are made of carbon or alloy steel material compositions as required by the ISO 898 and ISO 2702 Standards. Purchasers of self-tapping screw SEMS are alerted to Nonmandatory Appendix B.

(a) Where the term low carbon steel is used, this indicates steels with a carbon content $< 0.28\%$ carbon. Where high carbon is shown, this indicates steels with a carbon content $> 0.47\%$. When not specified, the material grade employed is at the option of the manufacturer.

(e) Except where shown in Table 7 (Parts A through C) or other places within this Standard, the marking protocol with regard to property class, manufacturer's identification markings, etc., shall be as stated in the referenced standard.

1.5 Screw Heads

The head styles applicable to the various types of SEMS shall be as depicted in the illustrations and designated in the tables for each type. Where only the slotted head SEMS are illustrated, it should be understood that this Standard also applies to other head and recess style SEMS.

1.6 Dimensions

All dimensions in this Standard are given in millimeters.

1.7 Options

Options, where permitted by this Standard, shall be at the discretion of the manufacturer, unless otherwise specified by the purchaser.

1.8 Responsibility for Modification

Parts made to this specification can be subjected to the effects of hydrogen embrittlement, either from electroplating operations or exposure in the environment.