AN AMERICAN NATIONAL STANDARD

ASME B18.13a-1998

ADDENDA

to

ASME B18.13-1996
SCREW AND WASHER ASSEMBLIES — SEMS (INCH SERIES)

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
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ASME B18.13a-1998

Following approval by the ASME B18 Committee and ASME, and after public review, ASME B18.13a-1998 was approved by the American National Standards Institute on September 9, 1998.

Addenda to the 1996 edition of ASME B18.13 are issued in the form of replacement pages. Revisions, additions, and deletions are incorporated directly into the affected pages. It is advisable, however, that this page, the Addenda title and copyright pages, and all replaced pages be retained for reference.

SUMMARY OF CHANGES

This is the first Addenda to be published to ASME B18.13-1996.

Replace or insert the pages listed. Changes given below are identified on the pages by a margin note, **(a)**, placed next to the affected area. The pages not listed are the reverse sides of the listed pages and contain no changes.

Page	*Location*	*Change*
2	1.9	Revised
	1.11.1	Title and paragraph revised
3	1.11.2	Revised
	2.1.1(b)	Revised
4	2.2.1(b)	Revised
	2.3(b)	Revised
5, 6	2.4(b)	Revised
	2.6	Last sentence revised
	2.7	Revised
	2.8	Added
	3.1	Revised
	3.2	(1) Redesignated as 3.3 and revised in its entirety (2) New 3.2 added
	3.3	Redesignated as 3.4 and revised
	Fig. 3	Callout at bottom of figure revised
	4.2	(1) Redesignated as 4.3 and revised in its entirety (2) New 4.2 added

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Page	*Location*	*Change*
5, 6	4.3	Redesignated as 4.4 and revised
	5.2.1	Revised
8	5.2.4(c)	Revised
9	6.2.3(b)	Revised
10	Table 2	Revised
11	Table 3	Revised
12	Table 4	Revised
13	Table 5	Revised
14	Table 6	Revised
20	Table B1	Revised
25	Table C2	Revised
28	Table D1	Revised

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ASME B18.13-1996
[Revision of ASME B18.13-1987 (R1993)]

SCREW AND WASHER ASSEMBLIES—SEMS (INCH SERIES)

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AN AMERICAN NATIONAL STANDARD

SCREW AND WASHER ASSEMBLIES—SEMS (INCH SERIES)

ASME B18.13-1996
[Revision of ASME B18.13-1987 (R1993)]

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FOREWORD

(This Foreword is not part of ASME B18.13-1996.)

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[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, this proposal was forwarded to the American Standards Association and declared an American Standard on May 22, 1950.

During the years 1951 through 1956, Subcommittee 2 considered numerous refinements to the coverage for 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 organizations 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[2] of Committee B18 was subsequently appointed.

At the initial meeting of Subcommittee 27 on February 1, 1962 a proposal was submitted consisting of pertinent data 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

[1] 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.

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

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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 organizations 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 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 proposals relative to specific product lines. A proposed revision was drafted that relegated the coverage for round and truss head sems and Type A and Type 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.

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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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SCREW AND WASHER ASSEMBLIES — SEMS (Inch Series)

1 INTRODUCTORY NOTES

1.1 Scope

(a) This Standard covers general and dimensional data pertinent to the various types of screw and captive washer assemblies, otherwise known as *sems*. The word sems is recognized in the United States as a generic term applicable to screw and washer assemblies.

Also included in this Standard are appendices to illustrate the relative proportions of plain and conical washer sems and provide documentation on the washer dimensions for sems with screw types and head styles that have been relegated to "not recommended for new design" status.

(b) This Standard does not duplicate the general and dimensional data pertaining to components of sems as found in the following standards:

ASME B18.2.1 Square and Hex Bolts and Screws (Inch Series)

ASME B18.6.3 Machine Screws and Machine Screw Nuts

ASME B18.6.4 Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series)

ASME B18.21.1 Lock Washers

ASME B18.22.1 Plain Washers

SAE J773 Conical Spring Washers

NOTE: The word lock, which appears in the names of products in this Standard, is a generic term historically associated with their identification and is not intended to imply an indefinite fixity in attachments where the fasteners are used.

(c) Copies of referenced standards may be obtained from the following: SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001; ANSI, 11 West 42nd Street, New York, NY 10036-8002; ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959; ASME, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300, (800) 843-2763.

(d) 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 suppliers concerning the availability of products.

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 Types of Sems

Included in these specifications are sems comprised of the following types of screws and washers.

(a) Helical Spring Lock Washers
- *(1)* socket head cap screws (see Table 1)
- *(2)* hex cap screws (see Table 2)
- *(3)* machine screws (see Tables 2 and 3)
- *(4)* tapping screws (see Tables 2 and 3)

(b) Tooth Lock Washers
- *(1)* machine screws (see Tables 4 and 5)
- *(2)* tapping screws (see Tables 4 and 5)
- *(3)* hex cap screws (see Tables 4 and 5)

(c) Conical Spring Washers
- *(1)* hex cap screws (see Table 6)
- *(2)* machine screws (see Table 6)
- *(3)* tapping screws (see Table 6)

(d) Plain Washers
- *(1)* machine screws (see Table 7)
- *(2)* tapping screws (see Table 7)
- *(3)* hex cap screws (see Table 7)

(e) Products having washers of 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.

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1.4 Screw Heads

1.4.1 Head Styles. 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 the corresponding cross-recessed head sems.

(a) Round Head. In recognition of the superior slot-driving characteristics of pan head screws over round head screws and the overlap in dimensions of pan heads and round heads, it is recommended that pan head sems be used in new designs and, wherever possible, be substituted in existing designs. To expedite elimination of the necessity for perpetuating stocks of finished products and tooling, it should be recognized that during the transition period manufacturers may, when it is agreeable to the purchasers, substitute pan head sems where round head sems have been specified. Dimensions applicable to washers used for round head sems are documented for reference purposes in Appendices B through D.

(b) Truss Head. In the interest of product simplification and recognizing that the truss head is an inherently weak design, sems incorporating this head style are not recommended for use in new designs. Dimensions applicable to washers used for truss head sems are documented for reference purposes in Appendices B through D.

1.5 Dimensions

All dimensions in this Standard are given in inches unless stated otherwise.

1.6 Options

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

1.7 Responsibility for Modification

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

1.8 Terminology

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

1.9 Designation (a)

Sems products conforming to this Standard shall be designated by the following data, in the sequence shown: nominal size (number, fraction, or decimal equivalent) and threads per inch, nominal length, point (tapping screw or header point for machine screws), head style and driving provision, screw type, washer type, and the product name ("sems"), material and protective finish as required; or optionally by ASME B18.24.1, PIN Code. See examples below.

EXAMPLES:

(1) ¼-14 × 1¼ Type AB Slotted Pan Head Tapping Screw and Wide Plain Washer Sems, Steel, Zinc Plated

M130NJAJTAD19155NNCEW

(2) 6-32 × ¾ Type 1A Cross-Recessed Pan Head Machine Screw and Type H Regular Conical Spring Washer Sems, Steel

M130NGACCA614155NNAA1

(3) 0.375-16 × 1.50 Hex Head Machine Screw, Header Point and Header Pointed Hex Head Machine Screw and External Tooth Lock Washer Sems, Steel, Phosphate Coated

M130NEABCAK21155NNNE1

(4) 8-32 × ½ Type T Hex Head Tapping Screw and Helical Spring Lock Washer Sems, Steel

M130NG20TA810155NNAA1

1.10 Lot

For all inspections referenced in this Standard, the sems lot shall consist of screws of one type, grade, washer style, finish, and size fabricated by the same production process from the same heat number of metal as provided by the metal manufacturer and submitted for inspection and testing at the same time.

1.11 Quality Assurance

1.11.1 Characteristics. Products shall conform to the specifications of this Standard. The designated characteristics as defined below shall be inspected to the inspection levels shown in accordance with ASME B18.18.2M. For nondesignated characteristics the provisions of ASME B18.18.1M shall apply. Should a nondesignated characteristic be determined to be outside of its specified limits, it shall be deemed conforming to this Standard if the user, who is the installer, accepts the dimension based on fit, form, and function. If verifiable in-process inspection is used, inspection sample sizes and reporting shall be in accordance with the applicable ASME, ASTM, or SAE quality system consensus standard. (a)

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(a) **1.11.2 Designated Characteristics and Inspection Levels**

(a) Machine Screws

Characteristic	Inspection Level
Thread Acceptance	C
Tensile Strength (Wedge Test for all hexagon configurations and Axial Test for recess heads)	B
Hardness	B
Washer Retention/Rotation	C

(b) Tapping Screws

Characteristic	Inspection Level
Torsional Strength	A
Washer Retention/Rotation	C

(c) Cap Screws

Characteristic	Inspection Level
Thread Acceptance	C
Tensile Test	B
Hardness	B
Washer Retention/Rotation	C

(d) Helical Spring Lock Washers

Characteristic	Inspection Level
Hardness	B
Outside Diameter	C

(e) Tooth Lock Washers

Characteristic	Inspection Level
Hardness	B
Outside Diameter	C

(f) Conical Spring Washers

Characteristic	Inspection Level
Hardness	B
Outside Diameter	C

(g) Plain Washers

Characteristic	Inspection Level
Hardness only when specified	B

(h) Conical Washers

Characteristic	Inspection Level
Hardness	B
Thickness	B

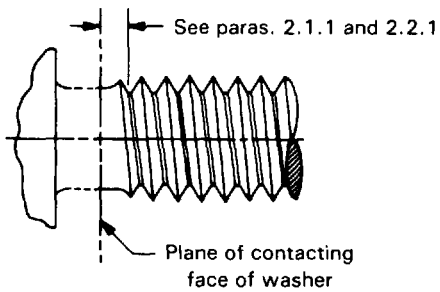

FIG. 1 UNTHREADED LENGTH ON SCREWS WITH MACHINE SCREW THREAD DIAMETER-PITCH COMBINATIONS

2 GENERAL DATA

2.1 Machine Screws for Sems

2.1.1 General. The machine screw component of sems shall conform to the specifications for machine screws published in ASME B18.6.3, except for the following.

(a) The maximum diameter of the unthreaded shank shall be less than the maximum major diameter of the thread by an amount sufficient to prevent disassembly of the washer from the screw.

(b) On screws threaded full length, the unthreaded length is the distance measured parallel to the axis of the screw from the underside of the washer to the face of a nonchamfered or noncounterbored standard GO ring gage. The unthreaded length is a maximum of one pitch (see Fig. 1). (a)

(c) The minimum underhead fillet radius shall be equivalent to 5% of the basic screw diameter on protruding head styles and 20% of the basic screw diameter for countersunk head styles.

(d) If so specified, the sems for greater strength shall be heat treated in accordance with para. 2.1.2.

2.1.2 Heat Treated Hex Cap Screws and Machine Screws

(a) Material and heat treatment shall comply with the requirements shown in SAE J429.

(b) Identification. Markings. Heat treated hex and hex washer head sems of nominal thread diameters 1/4 in. and larger shall be permanently and legibly marked with the strength, grade, and manufacturer's identification. Markings for these sizes shall comply with the requirements shown in SAE J429.

(c) Methods of Test. Tests for hardness, proof load, and tensile strength shall conform with the tests specified

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in SAE J429, Mechanical and Material Requirements for Externally Threaded Fasteners, or ASTM F 606, Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets, except the tensile strength test shall be conducted with a 6 deg. wedge under the head.

(d) Ductility Test. Whereas the wedge tensile test shall be considered the referee method, the following test for ductility of through-hardened screws may be used.

(1) The test for ductility of screws with protruding heads requires a test block with a hole approximately 5% larger in diameter than the basic diameter of the screw to be tested and having a top surface at an angle 70 deg. to the axis of the hole. The hole shall be countersunk 100 deg. to 120 deg. included angle on the top surface to a diameter 0.031 in. larger than the hole diameter. The screw and washer assembly shall be inserted into the hole and the head shall be hammered or pressed down until the underneath surface of the head bears on the angular surface of the block. Washers may be removed prior to testing. For referee testing, washers shall be removed.

(2) Flat and oval countersunk head screws shall be held in a vise and shall be capable of taking a 20 deg. bend when the head is hammered to one side.

(3) The screws so tested shall exhibit no sign of failure.

2.2 Tapping Screws for Sems

2.2.1 General. The tapping screw component of sems shall conform to the specifications for the respective types of tapping screws published in ASME B18.6.4, except for the following.

(a) The maximum diameter of the unthreaded shank shall be less than the maximum major diameter of the thread by an amount sufficient to prevent disassembly of the washer from the screws.

(a) *(b)* On screws threaded full length, the unthreaded length is the distance measured parallel to the axis of the screw from the underside of the washer to the point where the minor diameter is at the maximum dimension specified in ASME B18.6.4. The unthreaded length is a maximum of one pitch (see Figs. 1 and 2).

(c) The minimum underhead fillet radius shall be equivalent to 5% of the basic screw diameter on protruding head styles and 20% of the basic screw diameter on countersunk head styles.

2.2.2 Type A Tapping Screws. Type A tapping screw sems are not recommended for new design. These should be supplanted by sems employing Type AB tapping screws in new designs and existing designs wherever possible. The dimensions applicable to washers used for Type A tapping screw sems are documented for reference purposes in Appendices B through D.

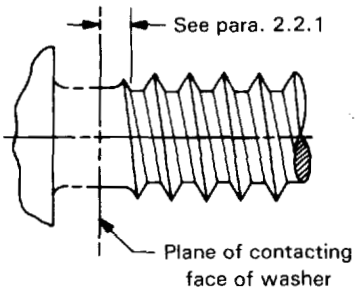

FIG. 2 UNTHREADED LENGTH ON TAPPING SCREWS WITH SPACED THREAD DIAMETER-PITCH COMBINATIONS

2.2.3 Type C Tapping Screws. In view of the declining use of Type C tapping screws (which in general require high-driving torques) in favor of more efficient designs of thread-forming tapping screws, sems employing Type C tapping screws are not recommended for new design. However, the dimensions applicable to washers used for Type C tapping screw sems are documented for reference purposes in Appendices B through D.

2.3 Socket Head Cap Screws for Sems

The socket head cap screw component of sems shall conform to the specifications for cap screws published in ASME B18.3, except for the following.

(a) The maximum diameter of the unthreaded shank shall be less than the maximum major diameter of the thread by an amount sufficient to prevent disassembly of the washer from the screw.

(b) On socket cap screws threaded full length, the (a) unthreaded length is the distance measured parallel to the axis of the screw from the underside of the washer to the face of a nonchamfered or noncounterbored standard GO ring gage. The unthreaded length is a maximum of two thread pitches (see Fig. 1). When required, threads extending closer than two pitches to the contacting face of the washer may be negotiated between the manufacturer and purchaser.

2.4 Hex Cap Screws for Sems

The hex head cap screws component of sems shall conform to the specifications for cap screws published in ASME B18.2.1, except for the following.

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(a) The maximum diameter of the unthreaded shank shall be sufficient to allow free assembly and rotation of the washer relative to the screw.

(a) *(b)* On hexagon cap screws threaded full length, the unthreaded length is the distance measured parallel to the axis of the screw from the underside of the washer to the face of a nonchamfered or noncounterbored standard GO ring gage. The unthreaded length is a maximum of two thread pitches (see Fig. 1). When required, threads extending closer than two pitches to the contacting face of the washer may be negotiated between the manufacturer and purchaser.

2.5 Applicability of Screw Sizes

To the extent that coverage is provided in the respective dimensional tables, numbered nominal sizes shall apply to all types of screws, including Type A tapping screws, and fractional nominal sizes shall apply to all types of screws except Type A tapping screws. Numbered nominal sizes 14, 16, 18, 20, and 24 appearing in the tables in the appendices shall apply only to Type A tapping screws.

(a) 2.6 Washers for Sems

The washer components of sems shall conform with the dimensions and specifications given for the various types in this Standard. It should be noted that the washers for sems may differ dimensionally from the equivalent over-the-thread washers as specified in ASME B18.21.1 and ASME B18.22.1. Except for helical spring lock washers where the inside diameters are included for manufacturing purposes, the holes in the sems washers are not specified inasmuch as the washers shall be assembled onto the screw blanks before the threads are rolled. The edge contour of the hole on the head side of the washer and the size relationship between the washer inside diameter and the diameter of the unthreaded shank on the screw shall be such that the washer will be retained on the screw after the threads are rolled, and shall be free to rotate after assembly.

(a) 2.7 Finish

Unless otherwise specified by the purchaser, sems shall be supplied with a natural (as-processed) finish, unplated or uncoated. Where corrosion preventive treatment is required, sems shall be plated or coated as specified by the purchaser. The application of heavy coating deposits or supplemental treatments entailing organic compounds may result in a bonding of the sems components at points that abut. In such instances, the washers shall turn freely on the screw after breaking of the initial bond.

2.8 Embrittlement Test (a)

Carbon steel fastener/washer assemblies, sems, which are subsequently plated to enhance corrosion resistance shall be tested for embrittlement. A minimum of five specimens from each lot of fasteners shall be torqued to failure and the average failure torque determined. A further minimum of five parts per lot of sems shall be torqued to 80% of the previously determined average failure torque with the head bearing surface against a flat parallel surface and held under load for 24 h. The fasteners shall then be retorqued at the same value and held under load for an additional 24 h. No failure of either component is permitted.

3 DATA FOR HELICAL SPRING LOCK WASHER SEMS

3.1 Application (a)

The helical spring lock washers covered herein are intended for general applications. Helical spring lock washers compensate for developed looseness between component parts of an assembly, distribute the load over a larger area for some head styles, and provide a hardened bearing surface.

3.2 Specifications (a)

The washers shall conform to the specifications for helical spring washers published in ASME B18.21.1, except for modifications contained herein.

3.3 Washer Components (a)

3.3.1 Dimensions. The dimensions of helical spring lock washers shall be as specified in Tables 1, 2, and 3. The corners at the outer and inner peripheries of the washer may be slightly rounded. However, the extent of the rounding shall be such that the bearing width of the washer section is not reduced to less than the equivalent of 70% of the specified minimum section width. See Fig. 3 for the check method.

3.3.2 Tests. After heat treatment of the sems, the washers shall be removed, undamaged, from the screws for testing. The washers shall meet a hardness of 38 to 48 HRC, or 372 to 484 HV, and shall meet all other test requirements for standard over-the-thread washers specified in ASME B18.21.1.

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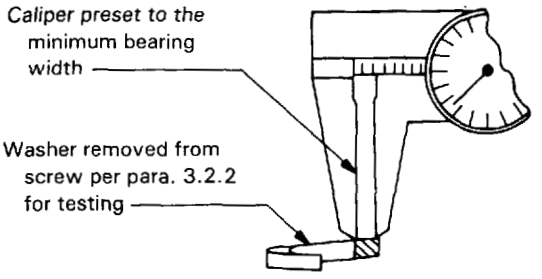

(a) **FIG. 3 VERIFICATION OF BEARING WIDTH ON HELICAL SPRING LOCK WASHERS**

(a) **3.4 Screw Components**

(a) Socket head cap screws shall be assembled with washers shown in Table 1.

(b) Machine screws, hex cap screws, and tapping screws having machine thread diameter-pitch combinations, in the head styles indicated, shall be assembled with washers shown in Table 2.

(c) Tapping screws having Type B spaced thread diameter-pitch combinations, in the head styles indicated, shall be assembled with washers shown in Table 3.

4 DATA FOR TOOTH LOCK WASHER SEMS

4.1 Application

The tooth lock washer sems covered herein are intended for general industrial application. The tooth lock washers serve to increase the friction between the screws and the assembly. Internal tooth lock washer sems are preferred where it is desirable to provide a smooth periphery.

(a) **4.2 Specifications**

The washers shall conform to the specifications for toothed washers published in ASME B18.21.1 except for modifications contained herein.

(a) **4.3 Washer Components**

4.3.1 Dimensions. The dimensions of internal and external tooth lock washers shall be as specified in Tables 4 and 5, respectively. Extrusion of a slight collar at the inside diameter of countersunk external tooth washers for use on flat and oval head screws shall be optional.

4.3.2 Tooth Design. Type A or Type B tooth design shall be optional. Refer to ASME B18.21.1 for details pertaining to tooth design.

4.3.3 Tests. After heat treatment of the sems, the washers shall be removed undamaged from the screws for testing. The washers shall meet a hardness of 40 to 50 HRC, or 392 to 513 HV, and shall meet all other test requirements for standard over-the-thread washers specified in ASME B18.21.1.

4.4 Screw Components

Machine screws, hex cap screws, and tapping screws of the sizes and head styles shown in Tables 4 and 5 shall be assembled with internal or external tooth washers specified. (a)

5 DATA FOR CONICAL SPRING WASHER SEMS

5.1 Application

The conical spring washer sems covered herein are intended for general application where it is desirable to:

(a) compensate for loss of screw tension due to such factors as smoothing out or wearing of parts, thermal expansion, or compression set of gaskets;

(b) distribute load over larger areas;

(c) span large or elongated clearance holes.

5.2 Washer Components

5.2.1 Dimensions. The dimensions of Type L and Type H conical washer components of sems are given in Table 6. Washers generally conform to the specifications in SAE J773 except that the crown height on some sizes is increased in order to facilitate the sems assembly operation. In the cases where the crown has been increased, the recovery test should be based on the SAE standard crown heights. (a)

5.2.2 Types. Conical spring washers are available in a light series (Type L) and heavy series (Type H) for use with screws as described in the following.

(a) Type L conical spring washers are intended for use on machine screw sems with screw components of materials having a specified minimum ultimate tensile strength of 74,000 psi or less. They shall also be used on tapping screw sems capable of safely accommodating these tensile requirements.

(b) Type H conical spring washers are intended for use on heat treated sems with screw components of materials having a specified minimum ultimate tensile strength of 120,000 psi.

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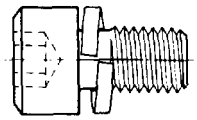

Socket Head Cap Screw

TABLE 1 DIMENSIONS OF HELICAL SPRING LOCK WASHERS FOR SOCKET HEAD CAP SCREW SEMS

Nominal Size [Note (1)] of Basic Screw Diameter		Washer Inside Diameter		Washer Section		Washer Outside Diameter	
		Max.	Min.	Width Min.	Thickness Min	Max.	Min.
2	0.0860	0.080	0.075	0.022	0.022	0.129	0.119
3	0.0990	0.091	0.086	0.030	0.030	0.158	0.147
4	0.1120	0.106	0.101	0.030	0.030	0.174	0.161
5	0.1250	0.118	0.113	0.040	0.040	0.206	0.193
6	0.1380	0.129	0.124	0.040	0.040	0.217	0.204
8	0.1640	0.155	0.149	0.047	0.047	0.257	0.243
10	0.1900	0.179	0.173	0.062	0.047	0.311	0.297
1/4	0.2500	0.238	0.230	0.062	0.062	0.380	0.354
5/16	0.3125	0.298	0.290	0.078	0.078	0.462	0.446
3/8	0.3750	0.361	0.353	0.094	0.094	0.557	0.541
7/16	0.4375	0.420	0.411	0.109	0.109	0.646	0.629
1/2	0.5000	0.482	0.473	0.125	0.125	0.740	0.723
5/8	0.6250	0.601	0.592	0.156	0.156	0.921	0.904
3/4	0.7500	0.722	0.713	0.188	0.188	1.106	1.069

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

NOTE:

(1) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

(c) Tooth Washers. Tooth type conical spring washers having the same dimensions and characteristics as those defined above may also be used on sems for nonslip or positive electrical grounding purposes. Unless designated otherwise by the purchaser, when tooth type washers are specified they shall be furnished with six sharp-edged teeth equally spaced about the outer periphery on the bottom face of the washer conforming with the dimensions shown in Fig. 4.

5.2.3 Series. Both the Type L and Type H conical spring washers for each screw size are specified in the same narrow, regular, and wide series having proportions designed to fulfill the purpose of distributing load over larger areas. Where used in conjunction with large clearance holes, it is recommended that the hole relationship be such as to permit washers to be in contact over at least 70% of their bearing area.

5.2.4 Tests for Washers on Heat Treated Sems. After heat treatment of sems, the washers shall be removed, undamaged, from the screws and subjected to the following tests.

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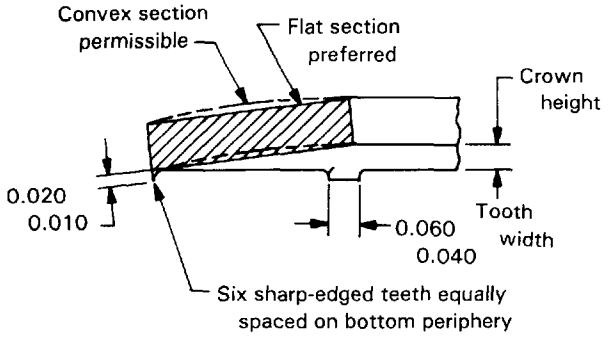

FIG. 4 ENLARGED CONICAL SPRING WASHER SECTION AND TOOTH WASHER DIMENSIONS

(a) Hardness. The washers shall have a hardness of 40 to 48 HRC, or the equivalent. Hardness shall be checked by grinding or filing a flat spot on the top side of the washer to permit seating on an anvil with the reading to be taken on the undisturbed inner face of the washer. If the hardness as obtained above is not within specified limits, washers may be qualified by checking hardness on a cut-out section of the washer on which both sides have been ground flat. However, an excessively decarburized surface, especially on lighter gage materials, may be grounds for rejection if the performance of the washer is adversely affected.

(b) Twist Test. The rim of the washer shall be cut and the ends shall be gripped by pliers, vise and pliers, or wrench, whichever is most suitable for the washer section under test. Separation of the severed ends in the form of a helix to a distance equal to the inside diameter of the washer shall not result in fracture. (See Fig. 5.) When, at a greater degree of twist the washer fractures, the structure at the point of fracture shall exhibit a fine grain, and the washer up to the instant of fracture shall deliver a tough springy reaction.

(a) *(c) Recovery Test.* The washers shall retain at least one-third of the minimum crown height specified in SAE J773 after flattening between two hardened plates and then released.

5.3 Screw Components

Machine screws, hex cap screws, and tapping screws of the sizes and head styles indicated shall be assembled with the washers shown in Table 6. Care should be taken, however, to assure that mating materials will provide tensile requirements consistent with the selection of washer type.

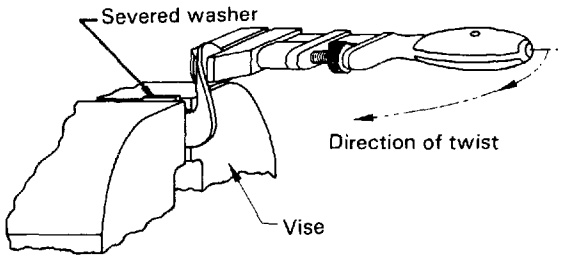

FIG. 5 CONICAL SPRING WASHER TWIST TEST

5.4 Assembly Detail

The washers shall be assembled on headed screw blanks with the convex side adjacent to the screw head.

5.5 Assembly Considerations

5.5.1 Installation. The desired installed position shall be with the washer flat.

5.5.2 Load Conditions. Since it is intended that the washers in this Standard be loaded beyond the elastic limit of their material, they should not be used in applications involving dynamic loading of the washer.

6 DATA FOR PLAIN WASHER SEMS

6.1 Application

The plain washer sems covered herein are intended for general application where it is desirable to:

(a) increase the area of bearing under the head of the screw when used against soft materials such as aluminum, plastic, wood, etc.;

(b) span large or elongated clearance holes;

(c) provide uniform bearing surfaces on rough workpiece surfaces.

6.2 Washer Components

6.2.1 Dimensions. The dimensions of plain washer components of sems are given in Table 7. The tolerances specified are intended to apply to metal washers but do not preclude the use of other materials. Washers shall conform to specifications for Type B plain washers published in ASME B18.22.1, except for the modifications contained herein.

(a) Concentricity. The inside and outside diameters of the washers shall be concentric within 0.005 in. for

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No. 10 and smaller sizes, and within 0.010 in. for larger sizes.

(b) Flatness. The washers shall be flat within 0.005 in. for washers having outside diameters up to and including 0.890 in., and within 0.010 in. for washers having larger outside diameters.

6.2.2 Series. The plain washers for each screw size are specified in narrow, regular, and wide series having proportions designed to fulfill the purpose of distributing load over larger areas.

6.2.3 Materials. Plain washers for sems may be steel, soft or hardened; nonferrous metals; plastics; or other suitable materials as specified by the purchaser.

(a) Soft steel washers, where no hardness requirement is specified, shall normally be made from low carbon steel. Where incorporated in tapping screw sems and heat treated machine screw sems, the washers may be surface hardened at heat treatment of the screws, but must not be brittle so as to break on application.

(b) Hardened steel washers, where specified by the purchaser, shall be alloy or carbon steel, quenched and tempered to a hardness of 40 to 50 HRC or the equivalent. **(a)**

6.3 Screw Components

Machine and tapping screws of the sizes and head styles indicated shall be assembled with washers specified in Table 7.

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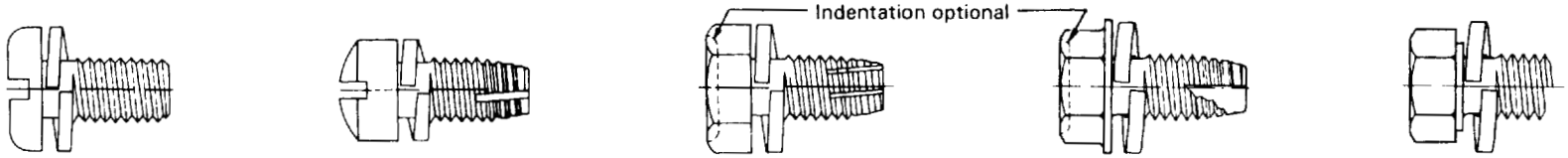

Pan Head Machine Screw | Fillister Head Type D Tapping Screw | Hex Head [Note (1)] Type F Tapping Screw | Hex Washer Head Type T Tapping Screw | Hex Cap Screw

Representative Examples of Helical Spring Lock Washer Sems

TABLE 2 DIMENSIONS OF HELICAL SPRING LOCK WASHERS FOR SEMS WITH MACHINE AND TAPPING SCREWS HAVING MACHINE SCREW THREAD DIAMETER-PITCH COMBINATIONS (a)

Nominal Size [Note (2)] or Basic Screw Diameter		Washer Inside Diameter		Pan Head Screw				Fillister Head Screw				Hex Head Screw [Note (1)]				Hex Washer Head Screw			
				Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter	
				Width	Thick-ness			Width	Thick-ness			Width	Thick-ness			Width	Thick-ness		
		Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.
2	0.0860	0.080	0.075	0.035	0.020	0.156	0.145	0.030	0.020	0.146	0.135	0.030	0.020	0.146	0.135	0.035	0.020	0.156	0.145
3	0.0990	0.091	0.086	0.040	0.025	0.178	0.166	0.035	0.020	0.168	0.156	0.035	0.020	0.168	0.156	0.040	0.025	0.178	0.166
4	0.1120	0.106	0.101	0.047	0.031	0.208	0.195	0.035	0.020	0.184	0.171	0.040	0.025	0.192	0.181	0.047	0.031	0.208	0.195
5	0.1250	0.118	0.113	0.047	0.031	0.220	0.207	0.035	0.020	0.196	0.183	0.047	0.031	0.220	0.207	0.047	0.031	0.220	0.207
6	0.1380	0.129	0.124	0.062	0.034	0.261	0.248	0.047	0.031	0.231	0.218	0.047	0.031	0.231	0.218	0.062	0.034	0.261	0.248
8	0.1640	0.155	0.149	0.078	0.031	0.319	0.305	0.047	0.031	0.257	0.243	0.055	0.040	0.271	0.259	0.078	0.031	0.319	0.305
10	0.1900	0.179	0.173	0.093	0.047	0.373	0.359	0.055	0.040	0.297	0.283	0.062	0.047	0.311	0.297	0.093	0.047	0.373	0.359
12	0.2160	0.203	0.196	0.109	0.062	0.429	0.414	0.062	0.047	0.335	0.320	0.070	0.056	0.351	0.336	0.109	0.062	0.429	0.414
1/4	0.2500	0.238	0.230	0.125	0.062	0.496	0.480	0.077	0.063	0.400	0.384	0.109	0.062	0.464	0.448	0.125	0.062	0.496	0.480
5/16	0.3125	0.298	0.290	0.156	0.078	0.618	0.602	0.109	0.062	0.524	0.508	0.125	0.078	0.556	0.540	0.156	0.078	0.618	0.602
3/8	0.3750	0.361	0.353	0.171	0.093	0.711	0.695	0.125	0.062	0.619	0.603	0.141	0.094	0.651	0.635	0.171	0.093	0.711	0.695
7/16	0.4375	0.420	0.411	...	...	...	...	...	...	...	...	0.156	0.109	0.740	0.723	...	...	...	...
1/2	0.5000	0.482	0.473	...	...	...	...	...	...	...	...	0.171	0.125	0.834	0.815	...	...	...	...

GENERAL NOTES:
(a) For additional requirements, refer to Sections 2 and 3.
(b) Dimensions of helical spring lock washers applicable to "not recommended for new design" status round and truss head screw sems and Type C tapping screw sems are documented for reference purposes in Appendix B.

NOTES:
(1) The regular trimmed or upset hex head screws shall apply for the washers shown. Where upset large hex head screws in sizes No. 4, 5, 8, 12, and 1/4 in. are specified by the purchaser, the washers shown for the corresponding size hex washer head screw shall apply. Refer to appropriate tables for hex head machine and tapping screws in ASME B18.6.3 and ASME B18.6.4, respectively. Refer to the appropriate tables for hex cap screws in ASME B18.2.1.
(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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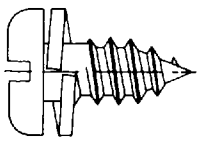
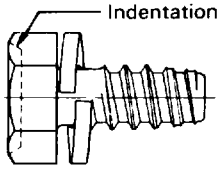


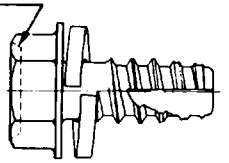
Pan Head Type AB
Tapping Screw



Fillister Head Type BF
Tapping Screw



Hex Head [Note (1)]
Type B Tapping Screw



Hex Washer Head Type BT
Tapping Screw

Representative Examples of Helical Spring Lock Washer Sems

TABLE 3 DIMENSIONS OF HELICAL SPRING LOCK WASHERS FOR SEMS WITH SCREWS HAVING TYPE B TAPPING SCREW THREAD DIAMETER–PITCH COMBINATIONS (a)

Nominal Size [Note (2)] or Basic Screw Diameter		Washer Inside Diameter		Pan Head Screw				Fillister Head Screw				Hex Head Screw [Note (1)]				Hex Washer Head Screw			
				Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter	
				Width	Thick-ness			Width	Thick-ness			Width	Thick-ness			Width	Thick-ness		
		Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.
4	0.1120	0.101	0.096	0.047	0.031	0.201	0.190	0.035	0.020	0.179	0.166	0.040	0.025	0.187	0.176	0.047	0.031	0.201	0.190
5	0.1250	0.112	0.107	0.050	0.034	0.218	0.207	0.035	0.020	0.190	0.177	0.047	0.031	0.214	0.201	0.050	0.034	0.218	0.207
6	0.1380	0.121	0.116	0.062	0.034	0.253	0.240	0.047	0.031	0.223	0.210	0.047	0.031	0.223	0.210	0.062	0.034	0.253	0.240
7	0.1510	0.135	0.130	0.062	0.034	0.267	0.254	0.047	0.031	0.237	0.224	0.047	0.031	0.237	0.224	0.062	0.034	0.267	0.254
8	0.1640	0.144	0.138	0.078	0.031	0.308	0.294	0.047	0.031	0.246	0.232	0.055	0.040	0.262	0.248	0.078	0.031	0.308	0.294
10	0.1900	0.162	0.156	0.081	0.056	0.332	0.318	0.055	0.040	0.280	0.266	0.062	0.047	0.294	0.280	0.081	0.056	0.332	0.318
12	0.2160	0.188	0.181	0.081	0.056	0.358	0.343	0.062	0.047	0.320	0.305	0.070	0.056	0.336	0.321	0.081	0.056	0.358	0.343
1/4	0.2500	0.217	0.209	0.120	0.062	0.465	0.449	0.077	0.063	0.379	0.363	0.109	0.062	0.443	0.427	0.120	0.062	0.465	0.449
5/16	0.3125	0.278	0.270	0.125	0.078	0.536	0.520	0.109	0.062	0.504	0.488	0.125	0.078	0.536	0.520	0.125	0.078	0.536	0.520
3/8	0.3750	0.338	0.330	0.141	0.094	0.628	0.612	0.125	0.062	0.596	0.580	0.141	0.094	0.628	0.612	0.141	0.094	0.628	0.612
7/16	0.4375	0.397	0.388	...	...	...	...	...	...	...	...	0.156	0.109	0.716	0.700	...	...	...	...
1/2	0.5000	0.460	0.451	...	...	...	...	...	...	...	...	0.171	0.125	0.812	0.793	...	...	...	...

GENERAL NOTES:
(a) For additional requirements, refer to Sections 2 and 3.
(b) Dimensions of helical spring lock washers applicable to "not recommended for new design" status round and truss head screw sems and Type A tapping screw sems are documented for reference purposes in Appendix B.

NOTES:
(1) The regular trimmed or upset hex head screws shall apply for the washers shown. Where upset large hex head screws in sizes No, 4, 5, 8, 12, and 1/4 in. are specified by the purchaser, the washers shown for the corresponding size hex washer head screw shall apply. Refer to appropriate tables for hex head tapping screws in ASME B18.6.4.
(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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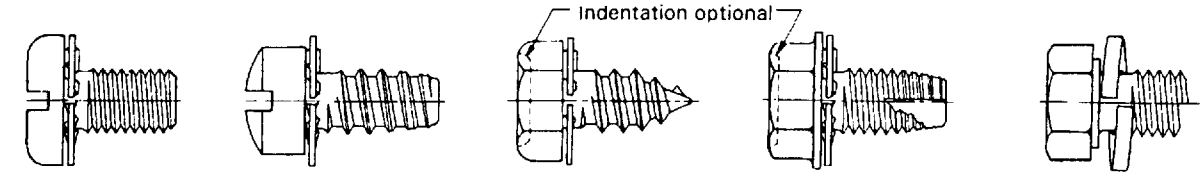

Pan Head Machine Screw | Fillister Head Type B Tapping Screw | Hex Head [Note (1)] Type AB Tapping Screw | Hex Washer Head Type T Tapping Screw | Hex Cap Screw

Representative Examples of Internal Tooth Lock Washer Sems

TABLE 4 DIMENSIONS OF INTERNAL TOOTH LOCK WASHERS FOR SEMS (a)

Nominal Size [Note (3)] or Basic Screw Diameter		Pan, Fillister, Hex [Note (1)], and Hex Washer [Note (2)] Head Screws			
		Washer Thickness		Washer Outside Diameter	
		Max.	Min.	Max.	Min.
2 [Note (2)]	0.0860	0.016	0.010	0.185	0.175
3 [Note (2)]	0.0990	0.016	0.010	0.225	0.215
4 [Note (2)]	0.1120	0.018	0.012	0.268	0.258
5 [Note (2)]	0.1250	0.018	0.012	0.268	0.258
6	0.1380	0.022	0.016	0.288	0.278
7	0.1510	0.022	0.016	0.288	0.278
8	0.1640	0.023	0.018	0.338	0.327
10	0.1900	0.024	0.018	0.383	0.372
12	0.2160	0.027	0.020	0.408	0.396
1/4	0.2500	0.028	0.023	0.478	0.466
5/16	0.3125	0.034	0.028	0.610	0.597
3/8	0.3750	0.040	0.032	0.692	0.678

GENERAL NOTES:

(a) For additional requirements, refer to Sections 2 and 4.

(b) Dimensions of internal tooth lock washers applicable to "not recommended for new design" status round and truss head screw sems and Types A and C tapping screw sems are documented for reference purposes in Appendix C.

NOTES:

(1) The regular trimmed or upset hex head screws shall apply except for sizes No. 4, 5, 8, 12, and 1/4 in., which shall have upset large hex head screws. Refer to appropriate tables for hex head machine and tapping screws in ASME B18.6.3 and ASME B18.6.4, respectively. Refer to appropriate tables for hex cap screws in ASME B18.2.1.

(2) Hex washer head sems are not available in sizes smaller than No. 6.

(3) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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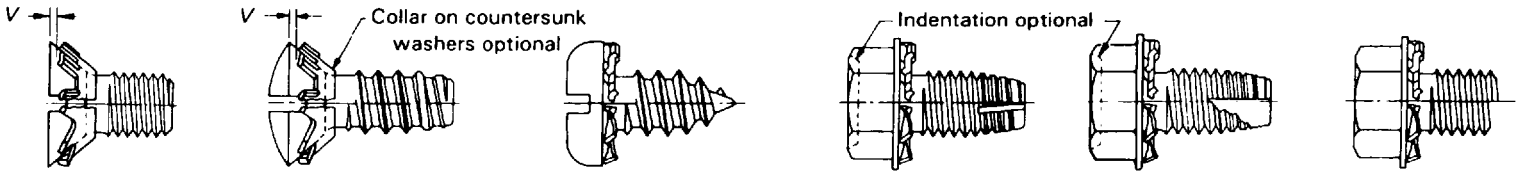

Flat Head Machine Screw | Oval Head Type B Tapping Screw | Pan Head Type AB Tapping Screw | Hex Head [Note (1)] Type D Tapping Screw | Hex Washer Head Type T Tapping Screw | Hex Cap Screw

Representative Examples of External Tooth Lock Washer Sems

TABLE 5 DIMENSIONS OF EXTERNAL TOOTH LOCK WASHERS FOR SEMS (a)

Nominal Size [Note (2)] or Basic Screw Diameter		Flat and Oval Head Screws			Pan Head Screw				Hex Head and Hex Cap Screws [Note (1)]				Hex Washer Head Screw			
		Washer Thickness		V	Washer Thickness		Washer Outside Diameter		Washer Thickness		Washer Outside Diameter		Washer Thickness		Washer Outside Diameter	
		Max.	Min.	Flush to Minus Tolerance of	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
2	0.0860	...	...	...	0.016	0.010	0.180	0.170	0.016	0.010	0.180	0.170	0.016	0.010	0.180	0.170
3	0.0990	0.014	0.009	0.019	0.016	0.010	0.205	0.195	0.016	0.010	0.205	0.195	0.016	0.010	0.205	0.195
4	0.1120	0.014	0.009	0.022	0.018	0.012	0.230	0.220	0.018	0.012	0.230	0.220	0.018	0.012	0.230	0.220
5	0.1250	0.019	0.015	0.024	0.020	0.014	0.255	0.245	0.020	0.014	0.255	0.245	0.020	0.014	0.255	0.245
6	0.1380	0.020	0.016	0.026	0.022	0.016	0.285	0.270	0.022	0.016	0.285	0.270	0.022	0.016	0.317	0.306
7	0.1510	0.020	0.016	0.047	0.022	0.016	0.285	0.270	0.022	0.016	0.285	0.270	0.022	0.016	0.317	0.306
8	0.1640	0.020	0.016	0.030	0.023	0.018	0.320	0.305	0.023	0.018	0.320	0.305	0.023	0.018	0.317	0.306
10	0.1900	0.025	0.019	0.036	0.024	0.018	0.381	0.365	0.024	0.018	0.381	0.365	0.024	0.018	0.406	0.395
12	0.2160	0.025	0.019	0.041	0.027	0.020	0.410	0.395	0.027	0.020	0.410	0.395	0.027	0.020	0.406	0.395
1/4	0.2500	0.025	0.019	0.047	0.028	0.023	0.510	0.494	0.028	0.023	0.475	0.460	0.028	0.023	0.580	0.567
5/16	0.3125	0.028	0.023	0.060	0.034	0.028	0.610	0.588	0.034	0.028	0.580	0.567	0.034	0.028	0.654	0.640
3/8	0.3750	0.034	0.028	0.072	0.040	0.032	0.760	0.740	0.040	0.032	0.660	0.640	0.040	0.032	0.760	0.740

GENERAL NOTES:
(a) For additional requirements, refer to Sections 2 and 3.
(b) Dimensions of internal tooth lock washers applicable to "not recommended for new design" status round and truss head screw sems and Types A and C tapping screw sems are documented for reference purposes in Appendix C.

NOTES:
(1) The regular trimmed or upset hex head screws shall apply except for sizes No. 4, 5, 8, 12, and 1/4 in., which shall have upset large hex head screws. Refer to appropriate tables for hex head machine and tapping screws in ASME B18.6.3 and ASME B18.6.4, respectively. Refer to appropriate tables for hex cap screws in ASME B18.2.1.
(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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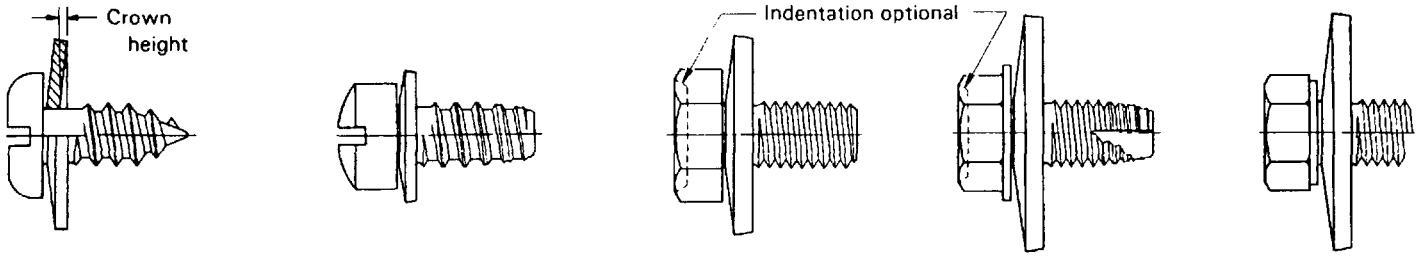

Pan Head Type AB Tapping Screw and Type L Regular Washer

Fillister Head Type B Tapping Screw and Type L Narrow Washer

Hex Head [Note (1)] Machine Screw and Type H Regular Washer

Hex Washer Head Type T Tapping Screw and Type H Wide Washer

Hex Cap Screw

Representative Examples of Conical Spring Washer Sems

TABLE 6 DIMENSIONS OF CONICAL SPRING WASHERS FOR SEMS (a)

Nominal Size [Note (2)] or Basic Screw Diameter		Pan, Fillister, Hex [Note (1)], Hex Washer Head, and Hex Cap Screws												
			Washer Outside Diameter		Type L Washer					Type H Washer				
					Thickness			Crown Height		Thickness			Crown Height	
		Washer Series	Max.	Min.	Basic	Max.	Min.	Max.	Min.	Basic	Max.	Min.	Max.	Min.
6	0.1380	Narrow	0.320	0.307	0.025	0.029	0.023	0.025	0.015	0.035	0.040	0.033	0.025	0.015
		Regular	0.446	0.433	0.030	0.034	0.028	0.025	0.015	0.040	0.046	0.037	0.025	0.015
		Wide	0.570	0.557	0.030	0.034	0.028	0.031	0.021	0.040	0.046	0.037	0.029	0.019
8	0.1640	Narrow	0.383	0.370	0.035	0.040	0.033	0.025	0.015	0.040	0.046	0.037	0.025	0.015
		Regular	0.508	0.495	0.035	0.040	0.033	0.030	0.020	0.045	0.050	0.042	0.026	0.016
		Wide	0.640	0.620	0.035	0.040	0.033	0.037	0.027	0.045	0.050	0.042	0.040	0.030
10	0.1900	Narrow	0.446	0.433	0.035	0.040	0.033	0.025	0.015	0.050	0.056	0.047	0.025	0.015
		Regular	0.570	0.557	0.040	0.046	0.037	0.027	0.017	0.055	0.060	0.052	0.026	0.016
		Wide	0.765	0.743	0.040	0.046	0.037	0.036	0.026	0.055	0.060	0.052	0.034	0.024
12	0.2160	Narrow	0.446	0.433	0.040	0.046	0.037	0.025	0.015	0.055	0.060	0.052	0.025	0.015
		Regular	0.640	0.620	0.040	0.046	0.037	0.033	0.023	0.055	0.060	0.052	0.026	0.016
		Wide	0.890	0.868	0.045	0.050	0.042	0.044	0.034	0.064	0.071	0.059	0.033	0.023
1/4	0.2500	Narrow	0.515	0.495	0.045	0.050	0.042	0.025	0.015	0.064	0.071	0.059	0.025	0.015
		Regular	0.765	0.743	0.050	0.056	0.047	0.033	0.023	0.079	0.087	0.074	0.032	0.022
		Wide	1.015	0.993	0.055	0.060	0.052	0.040	0.030	0.079	0.087	0.074	0.039	0.029
5/16	0.3125	Narrow	0.640	0.620	0.055	0.060	0.052	0.026	0.016	0.079	0.087	0.074	0.026	0.016
		Regular	0.890	0.868	0.064	0.071	0.059	0.041	0.031	0.095	0.103	0.090	0.029	0.019
		Wide	1.140	1.118	0.064	0.071	0.059	0.044	0.034	0.095	0.103	0.090	0.040	0.030
3/8	0.3750	Narrow	0.765	0.743	0.071	0.079	0.066	0.025	0.015	0.095	0.103	0.090	0.025	0.015
		Regular	1.015	0.993	0.071	0.079	0.066	0.043	0.033	0.118	0.126	0.112	0.033	0.023
		Wide	1.265	1.243	0.079	0.087	0.074	0.047	0.037	0.118	0.126	0.112	0.045	0.035
7/16	0.4375	Narrow	0.890	0.868	0.079	0.087	0.074	0.028	0.018	0.128	0.136	0.122	0.026	0.016
		Regular	1.140	1.118	0.095	0.103	0.090	0.041	0.031	0.128	0.136	0.122	0.038	0.028
		Wide	1.530	1.493	0.095	0.103	0.090	0.059	0.049	0.132	0.140	0.126	0.049	0.039
1/2	0.5000	Narrow	1.015	0.993	0.100	0.108	0.094	0.031	0.021	0.142	0.150	0.136	0.030	0.020
		Regular	1.265	1.243	0.111	0.120	0.106	0.043	0.033	0.142	0.150	0.136	0.037	0.027
		Wide	1.780	1.743	0.111	0.120	0.106	0.062	0.052	0.152	0.160	0.146	0.052	0.042

(Notes follow on next page)

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NOTES TO TABLE 6

GENERAL NOTES:
(a) For additional requirements, refer to Sections 2 and 3.
(b) Dimensions on conical spring washers applicable to "not recommended for new design" status round and truss head screw sems and Type A and C tapping screw sems are documented for reference purposes in Appendix D.
(c) For relative proportions of screw heads and conical spring washers, see Appendix A.

NOTES:
(1) The regular trimmed or upset hex head screws shall apply unless upset large hex head screws in sizes No. 8, 12, and 1/4 in. are specified by the purchaser. Refer to appropriate tables for hex head machine and tapping screws in ASME B18.6.3 and ASME B18.6.4. Refer to appropriate tables for hex cap screws in ASME B18.2.1.
(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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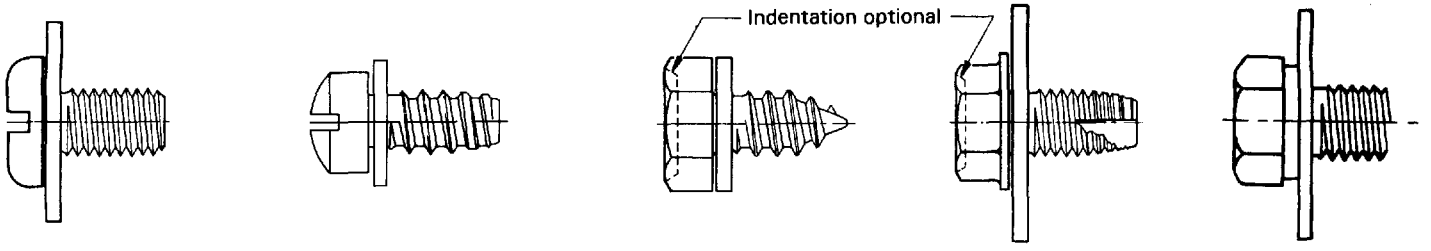

Pan Head Machine Screw and Regular Washer

Fillister Head Type B Tapping Screw and Narrow Washer

Hex Head [Note (1)] Type AB Tapping Screw and Narrow Washer

Hex Washer Head Type T Tapping Screw and Wide Washer

Hex Cap Screw

Representative Examples of Plain Washer Sems

TABLE 7 DIMENSIONS OF PLAIN WASHERS FOR SEMS

Nominal Size [Note (2)] or Basic Screw Diameter		Pan, Fillister, Hex [Note (1)], and Hex Washer Head Screws					Nominal Size [Note (2)] or Basic Screw Diameter		Pan, Fillister, Hex [Note (1)], and Hex Washer Head Screws					
		Washer Series	Washer Outside Diameter		Washer Thickness				Washer Series	Washer Outside Diameter		Washer Thickness		
			Max.	Min.	Basic	Max.	Min.			Max.	Min.	Basic	Max.	Min.
2	0.0860	Narrow	0.188	0.183	0.025	0.028	0.022	10	0.1900	Narrow	0.446	0.433	0.040	0.045	0.036
		Regular	0.250	0.245	0.032	0.036	0.028			Regular	0.570	0.557	0.040	0.045	0.036
		Wide	0.312	0.307	0.032	0.036	0.028			Wide	0.749	0.727	0.063	0.071	0.056
3	0.0990	Narrow	0.219	0.214	0.025	0.028	0.022	12	0.2160	Narrow	0.446	0.433	0.040	0.045	0.036
		Regular	0.312	0.307	0.032	0.036	0.028			Regular	0.640	0.620	0.063	0.071	0.056
		Wide	0.383	0.370	0.040	0.045	0.036			Wide	0.890	0.868	0.063	0.071	0.056
4	0.1120	Narrow	0.250	0.245	0.032	0.036	0.028	1/4	0.2500	Narrow	0.515	0.495	0.063	0.071	0.056
		Regular	0.383	0.370	0.040	0.045	0.036			Regular	0.749	0.727	0.063	0.071	0.056
		Wide	0.446	0.433	0.040	0.045	0.036			Wide	1.015	0.993	0.063	0.071	0.056
5	0.1250	Narrow	0.281	0.276	0.032	0.036	0.028	5/16	0.3125	Narrow	0.640	0.620	0.063	0.071	0.056
		Regular	0.446	0.433	0.040	0.045	0.036			Regular	0.890	0.868	0.063	0.071	0.056
		Wide	0.508	0.495	0.040	0.045	0.036			Wide	1.140	1.118	0.063	0.071	0.056
6	0.1380	Narrow	0.312	0.307	0.032	0.036	0.028	3/8	0.3750	Narrow	0.749	0.727	0.063	0.071	0.056
		Regular	0.446	0.433	0.040	0.045	0.036			Regular	1.015	0.993	0.063	0.071	0.056
		Wide	0.570	0.557	0.040	0.045	0.036			Wide	1.280	1.243	0.100	0.112	0.090
7	0.1510	Narrow	0.312	0.307	0.032	0.036	0.028	7/16	0.4375	Narrow	0.890	0.868	0.063	0.071	0.056
		Regular	0.446	0.433	0.040	0.045	0.036			Regular	1.140	1.118	0.063	0.071	0.056
		Wide	0.570	0.557	0.040	0.045	0.036			Wide	1.499	1.462	0.100	0.112	0.090
8	0.1640	Narrow	0.383	0.370	0.032	0.036	0.028	1/2	0.5000	Narrow	1.015	0.993	0.063	0.071	0.056
		Regular	0.508	0.495	0.040	0.045	0.036			Regular	1.280	1.243	0.100	0.112	0.090
		Wide	0.640	0.620	0.063	0.071	0.056			Wide	1.780	1.743	0.100	0.112	0.090

GENERAL NOTES:
(a) For additional requirements, refer to Sections 2 and 3.
(b) Dimensions of plain washers applicable to "not recommended for new design" status round and truss head screw sems and Type A and C tapping screw sems are documented for reference purposes in Appendix E.
(c) For relative proportions of screw heads and plain washers, see Appendix A.

NOTES:
(1) The regular trimmed or upset hex head screw shall apply unless upset large hex head screws in sizes No. 4, 5, 8, 12, and 1/4 in. are specified by the purchaser. Refer to appropriate tables for hex head machine and tapping screws in ASME B18.6.3 and ASME B18.6.4, respectively. Refer to appropriate tables for hex cap screws in ASME B18.2.1.
(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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APPENDIX A
RELATIVE PROPORTIONS OF SCREW HEADS AND PLAIN OR CONICAL SPRING WASHERS

(This Appendix is not part of ASME B18.13-1996, and is included here for information purposes only.)

(See table on following page.)

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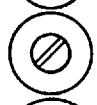
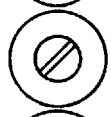
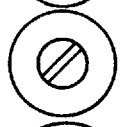
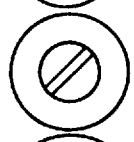
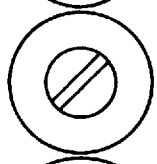
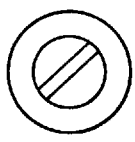
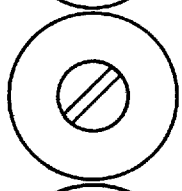
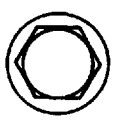
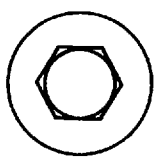
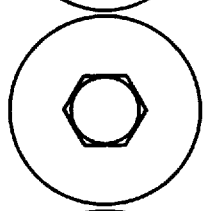
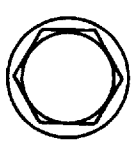
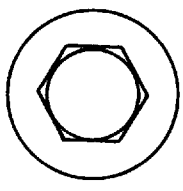
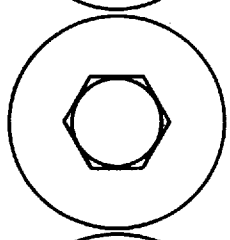
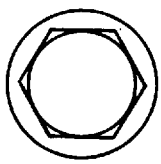
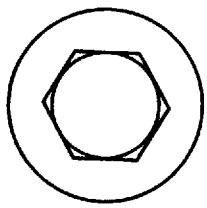
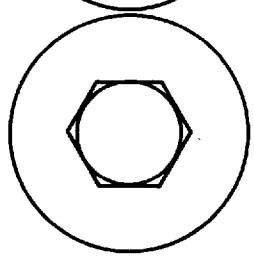
Nominal Size or Basic Screw Diameter		Head Type	Washer Series		
			Narrow	Regular	Wide
2	0.0860	Pan			
3	0.0990	Pan			
4	0.1120	Pan			
5	0.1250	Pan			
6	0.1380	Pan			
8	0.1640	Pan			
10	0.1900	Pan			
12	0.2160	Pan			
1/4	0.2500	Hex			
5/16	0.3125	Hex			
3/8	0.3750	Hex			

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APPENDIX B
DIMENSIONS OF HELICAL SPRING LOCK WASHERS FOR SEMS WITH "NOT RECOMMENDED" HEAD STYLES AND SCREW TYPES

(This Appendix is not part of ASME B18.13-1996, and is included here for information purposes only.)

This Appendix documents, for reference purposes, the dimensions applicable to helical spring lock washers for sems incorporating round and truss head screws and Type A and C tapping screws, all of which have been relegated to "not recommended for new design" status.

The helical spring lock washer dimensions for all sizes of machine screws and Type C tapping screw sems in the round and truss head styles shall be as specified in Table B1. Washer dimensions for pan, fillister, hex, and hex washer head styles in sizes No. 4, 5, 6, 8, 10, 12, and 1/4, 5/16, 3/8, 7/16, and 1/2 in. (unless otherwise shown) Type C tapping screw sems shall be the same as those tabulated in Table 2 for the corresponding nominal size.

The helical spring lock washer dimensions for all sizes (unless otherwise shown) of Type A tapping screw sems in the round and truss head styles and for sizes No. 14, 16, 18, 20, and 24 in other head styles shall be as specified in Table B2. Washer dimensions for pan, fillister, hex, and hex washer head styles in sizes No. 4, 5, 6, 7, 8, 10, and 12 Type A tapping screw sems shall conform with those of corresponding nominal size in Table 3.

The helical spring lock washer dimensions for sems with round and truss head screws having Type B tapping screw thread diameter-pitch combinations in all sizes (unless otherwise shown) shall conform with Table B2.

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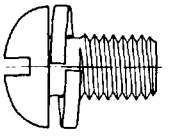
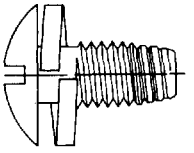


Round Head Machine Screw



Truss Head Type C Tapping Screw

Representative Examples of Helical Spring Lock Washer Sems

TABLE B1 DIMENSIONS OF HELICAL SPRING LOCK WASHERS FOR SEMS WITH ROUND AND TRUSS HEAD MACHINE SCREWS AND TYPE C TAPPING SCREWS (a)

Nominal Size [Note (1)] or Basic Screw Diameter		Washer Inside Diameter		Round Head Screw				Truss Head Screw			
				Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter	
				Width	Thick-ness			Width	Thick-ness		
		Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.
4	0.1120	0.106	0.101	0.047	0.031	0.208	0.195	0.062	0.034	0.238	0.225
5	0.1250	0.118	0.113	0.062	0.034	0.250	0.237	0.093	0.031	0.312	0.299
6	0.1380	0.129	0.124	0.062	0.034	0.261	0.248	0.093	0.031	0.323	0.310
8	0.1640	0.155	0.149	0.078	0.031	0.319	0.305	0.109	0.047	0.381	0.367
10	0.1900	0.179	0.173	0.093	0.047	0.373	0.359	...	...	...	...
12	0.2160	0.203	0.196	0.093	0.047	0.397	0.382	...	...	...	...
1/4	0.2500	0.238	0.230	0.109	0.062	0.464	0.448	...	...	...	...
5/16	0.3125	0.298	0.290	0.136	0.070	0.578	0.562	...	...	...	...
3/8	0.3750	0.361	0.353	0.171	0.093	0.711	0.695	...	...	...	...
7/16	0.4375	0.420	0.411	0.156	0.109	0.740	0.723	...	...	...	...
1/2	0.5000	0.482	0.473	0.160	0.133	0.812	0.793	...	...	...	...

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

NOTE:
(1) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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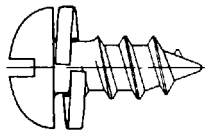
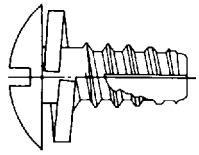
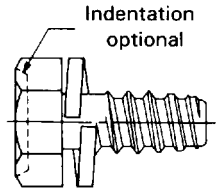


Round Head Type A
Tapping Screw



Truss Head Type BT
Tapping Screw



Hex Head [Note (1)]
Type B Tapping Screw

Representative Examples of Helical Spring Lock Washer Sems

TABLE B2 DIMENSIONS OF HELICAL SPRING LOCK WASHERS FOR SEMS WITH TYPE A TAPPING SCREWS AND ROUND AND TRUSS HEAD STYLES OF TYPE B TAPPING SCREWS

Nominal Size [Note (2)] or Basic Screw Diameter		Washer Inside Diameter		Round Head Screw				Truss Head Screw			
				Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter	
				Width	Thick-ness			Width	Thick-ness		
		Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.
4	0.1120	0.101	0.096	0.055	0.034	0.219	0.206	0.062	0.034	0.233	0.220
5	0.1250	0.112	0.107	0.055	0.034	0.230	0.217	0.093	0.047	0.306	0.293
6	0.1380	0.121	0.116	0.062	0.034	0.253	0.240	0.093	0.047	0.315	0.302
7	0.1510	0.135	0.130	0.062	0.034	0.267	0.254	0.093	0.047	0.329	0.316
8	0.1640	0.144	0.138	0.078	0.040	0.308	0.294	0.109	0.047	0.370	0.356
10	0.1900	0.162	0.156	0.093	0.047	0.356	0.342	...	...	...	...
12	0.2160	0.188	0.181	0.109	0.056	0.414	0.399	...	...	...	...
14	0.2420	0.214	0.207	0.120	0.062	0.462	0.447	...	...	...	...
1/4	0.2500	0.217	0.209	0.120	0.062	0.465	0.449	...	...	...	...
16	0.2680	0.233	0.226	0.120	0.062	0.482	0.466	...	...	...	...
18	0.2940	0.257	0.250	0.156	0.078	0.578	0.562	...	...	...	...
5/16	0.3125	0.278	0.270	0.156	0.078	0.598	0.582	...	...	...	...
20	0.3200	0.276	0.269	0.156	0.078	0.597	0.581	...	...	...	...
24	0.3720	0.333	0.325	0.171	0.093	0.683	0.667	...	...	...	...
3/8	0.3750	0.338	0.330	0.171	0.093	0.688	0.672	...	...	...	...
7/16	0.4375	0.397	0.388	0.156	0.109	0.712	0.695	...	...	...	...
1/2	0.5000	0.460	0.451	0.160	0.133	0.786	0.767	...	...	...	...

(Notes follow at end of table)

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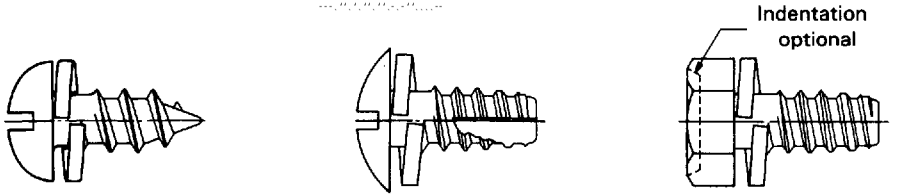

Round Head Type A Tapping Screw

Truss Head Type BT Tapping Screw

Hex Head [Note (1)] Type B Tapping Screw

Representative Examples of Helical Spring Lock Washer Sems

TABLE B2 DIMENSIONS OF HELICAL SPRING LOCK WASHERS FOR SEMS WITH TYPE A TAPPING SCREWS AND ROUND AND TRUSS HEAD STYLES OF TYPE B TAPPING SCREWS (CONT'D)

Nominal Size [Note (2)] or Basic Screw Diameter		Pan Head Screw				Fillister Head Screw				Hex Head Screw [Note (1)]				Hex Washer Head Screw			
		Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter		Washer Section		Washer Outside Diameter	
		Width	Thick-ness			Width	Thick-ness			Width	Thick-ness			Width	Thick-ness		
		Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Min.	Min.	Max.	Min.
14	0.2420	0.120	0.062	0.462	0.447	0.109	0.062	0.440	0.425	0.109	0.062	0.440	0.425	0.120	0.062	0.462	0.447
16	0.2680	0.120	0.062	0.482	0.466	0.109	0.062	0.460	0.444	0.109	0.062	0.460	0.444	0.120	0.062	0.482	0.466
18	0.2940	0.156	0.078	0.577	0.562	0.125	0.078	0.516	0.500	0.125	0.078	0.516	0.500	0.156	0.078	0.577	0.562
20	0.3200	0.156	0.078	0.597	0.581	0.125	0.078	0.535	0.519	0.125	0.078	0.535	0.519	0.156	0.078	0.597	0.581
24	0.3720	0.171	0.093	0.683	0.667	0.141	0.094	0.623	0.607	0.141	0.094	0.623	0.607	0.171	0.093	0.683	0.667

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

NOTES:

(1) The regular trimmed or upset hex head screws shall apply for the washers shown. Where upset large hex head screws in size No. 14 are specified by the purchaser, the washers shown for the corresponding size hex washer head screw shall apply. Refer to appropriate table for hex head tapping screws in ASME B18.6.4.

(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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APPENDIX C
DIMENSIONS OF TOOTH LOCK WASHERS FOR SEMS WITH "NOT RECOMMENDED" HEAD STYLES AND SCREW TYPES

(This Appendix is not part of ASME B18.13-1996, and is included here for information purposes only.)

This Appendix documents, for reference purposes, the dimensions applicable to internal and external tooth lock washers for sems incorporating round and truss head screws and Type A and C tapping screws, all of which have been relegated to "not recommended for new design" status.

The internal tooth washer thickness and outside diameter dimensions for round and truss head styles and for sizes No. 4, 5, 6, 7, 8, 10, and 12 of Type A tapping screw sems shall be the same as those tabulated in Table 4 for the corresponding nominal sizes. The washer dimensions for sizes No. 14, 16, 18, 20, and 24 (unless otherwise shown) Type A tapping screw sems shall be as specified in Table C1 for all of the head styles listed.

The internal tooth washer thickness and outside diameter dimensions for round and truss head styles and for sizes No. 4, 5, 6, 8, 10, and 1/4, 5/16, and 3/8 in. Type C tapping screw sems shall be the same as those specified in Table 4 for the corresponding nominal sizes.

The external tooth washer thickness and outside diameter dimensions for all sizes of Type A and C tapping screw sems in the round and truss head styles and for sizes No. 14, 16, 18, 20, and 24 (unless otherwise shown) Type A tapping screw sems shall be as specified in Table C2 for the respective head styles. The washer dimensions for the flat, oval, pan, hex, and hex washer head styles in sizes No. 4, 5, 6, 7, 8, 10, and 12 Type A tapping screw sems shall conform with those of corresponding nominal size in Table 5.

The external tooth washer thickness and outside diameter dimensions for flat, oval, pan, hex, and hex washer head styles in sizes No. 4, 5, 6, 8, 10, 12, and 1/4, 5/16, and 3/8 in. Type C tapping screw sems shall be the same as those tabulated in Table 5 for the corresponding nominal sizes.

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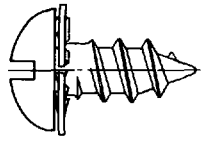
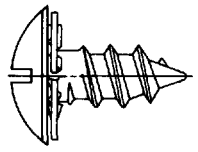
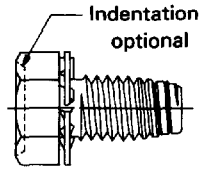


Round Head Type A
Tapping Screw



Truss Head Type A
Tapping Screw



Hex Head [Note (1)]
Type C Tapping Screw

Representative Examples of Internal Tooth Lock Washer Sems

TABLE C1 DIMENSIONS OF INTERNAL TOOTH LOCK WASHERS FOR SEMS WITH TYPE A TAPPING SCREWS

Nominal Size [Note (2)] or Basic Screw Diameter		Pan, Fillister, Truss, Round, Hex [Note (1)], and and Hex Washer Head Screws			
		Washer Thickness		Washer Outside Diameter	
		Max.	Min.	Max.	Min.
14	0.2420	0.028	0.023	0.478	0.466
16	0.2680	0.028	0.023	0.506	0.494
18	0.2940	0.034	0.028	0.569	0.556
20	0.3200	0.034	0.028	0.610	0.597
24	0.3720	0.040	0.032	0.692	0.678

GENERAL NOTE: For additional requirements, refer to Sections 2 and 4.

NOTES:
(1) The regular trimmed or upset hex head screws shall apply except for size No. 14, which shall have upset large hex head screws. Refer to appropriate table for hex head tapping screws in ASME B18.6.4.
(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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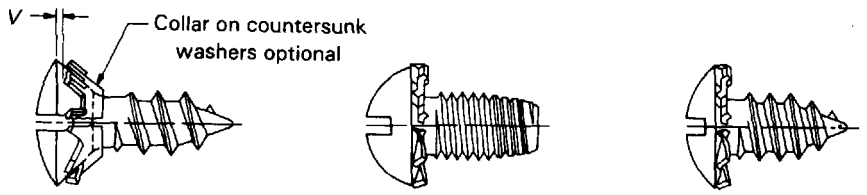

Oval Head Type A Tapping Screw | Round Head Type C Tapping Screw | Truss Head Type A Tapping Screw

Representative Examples of External Tooth Lock Washer Sems

TABLE C2 DIMENSIONS OF EXTERNAL TOOTH LOCK WASHERS FOR SEMS WITH TYPE A TAPPING SCREWS AND ROUND AND TRUSS HEAD STYLES OF ALL SCREW TYPES (a)

Nominal Size [Note (1)] or Basic Screw Diameter		Round Head Screw				Truss Head Screw			
		Washer Thickness		Washer Outside Diameter		Washer Thickness		Washer Outside Diameter	
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
4	0.1120	0.018	0.012	0.230	0.220	0.018	0.012	0.255	0.245
5	0.1250	0.020	0.014	0.255	0.245	0.020	0.014	0.285	0.270
6	0.1380	0.022	0.016	0.285	0.270	0.022	0.016	0.320	0.305
7	0.1510	0.022	0.016	0.285	0.270	0.022	0.016	0.355	0.345
8	0.1640	0.023	0.018	0.320	0.305	0.023	0.018	0.381	0.365
10	0.1900	0.024	0.018	0.381	0.365	0.024	0.018	0.475	0.460
12	0.2160	0.027	0.020	0.410	0.395	0.027	0.020	0.510	0.494
14	0.2420	0.028	0.023	0.440	0.428	0.028	0.023	0.510	0.494
1/4	0.2500	0.028	0.023	0.475	0.460	0.028	0.023	0.590	0.567
16	0.2680	0.028	0.023	0.510	0.494	0.028	0.023	0.590	0.567
18	0.2940	0.034	0.028	0.580	0.567	0.034	0.028	0.654	0.640
5/16	0.3125	0.034	0.028	0.610	0.588	...	...	...	...
20	0.3200	0.034	0.028	0.610	0.588	0.034	0.028	0.695	0.680
24	0.3720	0.040	0.032	0.695	0.680	0.040	0.032	0.760	0.740
3/8	0.3750	0.040	0.032	0.695	0.680	...	...	...	...

Nominal Size [Note (1)] or Basic Screw Diameter		Flat and Oval Head Screws			Pan Head Screw				Hex Head Screw [Note (2)]				Hex Washer Head Screw			
		Washer Thickness		V Flush to Minus Tolerance of	Washer Thickness		Washer Outside Diameter		Washer Thickness		Washer Outside Diameter		Washer Thickness		Washer Outside Diameter	
		Max.	Min.		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
14	0.2420	0.025	0.019	0.030	0.028	0.023	0.475	0.460	0.028	0.023	0.440	0.428	0.028	0.023	0.510	0.494
16	0.2680	0.025	0.019	0.060	0.028	0.023	0.510	0.494	...	...	...	...	...	...	...	...
18	0.2940	0.028	0.023	0.060	0.034	0.028	0.590	0.567	...	...	...	...	...	...	...	...
20	0.3200	0.034	0.028	0.060	0.034	0.028	0.610	0.588	0.034	0.028	0.580	0.567	0.034	0.028	0.654	0.640
24	0.3720	0.040	0.032	0.060	0.040	0.032	0.695	0.680	0.040	0.032	0.610	0.588	0.040	0.032	0.760	0.740

GENERAL NOTE: For additional requirements, refer to Sections 2 and 4.

NOTES:
(1) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.
(2) The regular trimmed or upset hex head screws shall apply except for size No. 14, which shall have upset large hex head screws. Refer to appropriate table for hex head tapping screws in ASME B18.6.4.

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APPENDIX D
DIMENSIONS OF CONICAL SPRING WASHERS FOR SEMS WITH "NOT RECOMMENDED" HEAD STYLES AND SCREW TYPES

(This Appendix is not part of ASME B18.13-1996, and is included here for information purposes only.)

This Appendix documents, for reference purposes, the dimensions applicable to conical spring washers for sems incorporating round and truss head screws and Type A and C tapping screws, all of which have been relegated to "not recommended for new design" status.

The washer thickness, crown height, and outside diameter dimensions for round and truss head styles and for sizes No. 6, 8, 10, and 12 Type A tapping screw sems shall be the same as those tabulated in Table 6 for the corresponding nominal sizes. The washer dimensions for sizes No. 14, 20, and 24 Type A tapping screw sems shall be as specified in Table D1 for all of the head styles listed.

The washer thickness, crown height, and outside diameter dimensions for round and truss head styles and for sizes No. 6, 8, 10, 12, and 1/4, 5/16, 3/8, 7/16, and 1/2 in. Type C tapping screw sems shall be the same as those tabulated in Table 6 for the corresponding nominal sizes.

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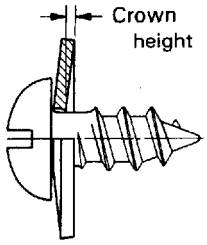
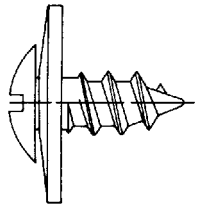
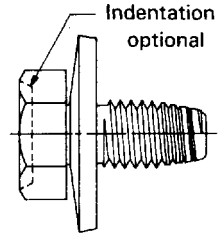


Round Head Type A Tapping Screw and Type L Regular Washer



Truss Head Type A Tapping Screw and Type L Wide Washer



Hex Head [Note (1)] Type C Tapping Screw and Type H Regular Washer

Representative Examples of Conical Spring Washer Sems

TABLE D1 DIMENSIONS OF CONICAL SPRING WASHERS FOR SEMS WITH TYPE A TAPPING SCREWS (a)

Nominal Size [Note (2)] or Basic Screw Diameter		Pan, Fillister, Truss, Round, Hex [Note (1)], and Hex Washer Head Screws											
				Type L Washer					Type H Washer				
			Washer Outside Diameter		Thickness			Crown Height		Thickness			Crown Height	
		Washer Series	Max.	Min.	Basic	Max.	Min.	Max.	Min.	Basic	Max.	Min.	Max.	Min.
14	0.2420	Narrow	0.515	0.495	0.045	0.050	0.042	0.025	0.015	0.064	0.071	0.059	0.025	0.015
		Regular	0.765	0.743	0.050	0.056	0.047	0.033	0.023	0.079	0.087	0.074	0.032	0.022
		Wide	1.015	0.993	0.055	0.060	0.052	0.040	0.030	0.079	0.087	0.074	0.039	0.029
20	0.3200	Narrow	0.640	0.620	0.055	0.060	0.052	0.026	0.016	0.079	0.087	0.074	0.026	0.016
		Regular	0.890	0.868	0.064	0.071	0.059	0.041	0.031	0.095	0.103	0.090	0.029	0.019
		Wide	1.140	1.118	0.064	0.071	0.059	0.044	0.034	0.095	0.103	0.090	0.040	0.030
24	0.3720	Narrow	0.765	0.743	0.071	0.079	0.066	0.025	0.015	0.095	0.103	0.090	0.025	0.015
		Regular	1.015	0.993	0.071	0.079	0.066	0.043	0.033	0.118	0.126	0.112	0.033	0.023
		Wide	1.265	1.243	0.079	0.087	0.074	0.047	0.037	0.118	0.126	0.112	0.045	0.035

GENERAL NOTE: For additional requirements, refer to Sections 2 and 5.

NOTES:
(1) The regular trimmed or upset hex head screws shall apply unless upset large hex head screws in size No. 14 are specified by the purchaser. Refer to appropriate table for hex head tapping screws in ASME B18.6.4
(2) Where specifying nominal size in decimals, zeros preceding the decimal and in the fourth place shall be omitted.

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Large Rivets ..... B18.1.2-1972(R1995)
Metric Small Solid Rivets ..... B18.1.3M-1983(R1995)
Square and Hex Bolts and Screws (Inch Series) B18.2.1-1996
Square and Hex Nuts (Inch Series) ..... B18.2.2-1987(R1993)
Metric Hex Cap Screws ..... B18.2.3.1M-1979(R1995)
Metric Formed Hex Screws ..... B18.2.3.2M-1979(R1995)
Metric Heavy Hex Screws ..... B18.2.3.3M-1979(R1995)
Metric Hex Flange Screws ..... B18.2.3.4M-1984(R1995)
Metric Hex Bolts ..... B18.2.3.5M-1979(R1995)
Metric Heavy Hex Bolts ..... B18.2.3.6M-1979(R1995)
Metric Heavy Hex Structural Bolts ..... B18.2.3.7M-1979(R1995)
Metric Hex Lag Screws ..... B18.2.3.8M-1981(R1991)
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Square Head Bolts (Metric Series) B18.2.3.10M-1996
Metric Hex Nuts, Style 1 ..... B18.2.4.1M-1996
Metric Hex Nuts, Style 2 ..... B18.2.4.2M-1979(R1995)
Metric Slotted Hex Nuts ..... B18.2.4.3M-1979(R1995)
Metric Hex Flange Nuts ..... B18.4.4.4M-1982(R1993)
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Metric Round Head Square Neck Bolts B18.5.2.2M-1982
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Wood Screws (Inch Series) ..... B18.6.1-1981(R1991)
Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws ..... B18.6.2-1972(R1993)
Machine Screws and Machine Screw Nuts ..... B18.6.3-1972(R1983)
Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) ..... B18.6.4-1981(R1991)
Metric Thread Forming and Thread Cutting Tapping Screws ..... B18.6.5M-1986(R1993)
Metric Machine Screws ..... B18.6.7M-1985(R1993)
General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps ..... B18.7-1972(R1992)
Metric General Purpose Semi-Tubular Rivets ..... B18.7.1M-1984(R1992)
Clevis Pins and Cotter Pins (Inch Series) B18.8.1-1994
Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) B18.8.2-1995
Spring Pins — Coiled Type (Metric Series) B18.8.3M-1995
Spring Pins — Slotted (Metric Series) B18.8.4M-1994
Machine Dowel Pins — Hardened Ground (Metric Series) B18.8.5M-1994
Cotter Pins (Metric Series) B18.8.6M-1995
Headless Clevis Pins (Metric Series) B18.8.7M-1994
Headed Clevis Pins (Metric Series) B18.8.8M-1994
Plow Bolts (Inch Series) B18.9-1996
Track Bolts and Nuts ..... B18.10-1982(R1992)
Miniature Screws ..... B18.11-1961(R1992)
Glossary of Terms for Mechanical Fasteners ..... B18.12-1962(R1991)
Screw and Washer Assemblies — Sems (Inch Series) B18.13-1996
Screw and Washer Assemblies — Sems (Metric Series) B18.13.1M-1991
Forged Eyebolts ..... B18.15-1985(R1995)
Mechanical and Performance Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts ..... B18.16.1M-1979(R1995)
Torque-Tension Test Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts ..... B18.16.2M-1979(R1995)

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Metric Hex Nuts and Hex Flange Nuts ..... B18.16.3M-1982(R1993)
Wing Nuts, Thumb Screws, and Wing Screws ..... B18.17-1968(R1983)
Inspection and Quality Assurance for General Purpose Fasteners ..... B18.18.1M-1987(R1993)
Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners ..... B18.18.2M-1987(R1993)
Inspection and Quality Assurance for Special Purpose Fasteners ..... B18.18.3M-1987(R1993)
Inspection and Quality Assurance for Fasteners for Highly Specialized
Engineered Applications ..... B18.18.4M-1987(R1993)
Lock Washers (Inch Series) B18.21.1-1994
Lock Washers (Metric Series) B18.21.2M-1994
Metric Plain Washers ..... B18.22M-1981(R1990)
Plain Washers ..... B18.22.1-1965(R1990)
Part Identifying Number (Pin) Code System Standard for B18 Externally
Threaded Products B18.24.1-1996
Square and Rectangular Keys and Keyways B18.25.1M-1996
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