ASME B18.21.1-2009

(Revision and consolidation of ASME B18.21.1 and ASME B18.22.1)

Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Date of Issuance: January 22, 2010

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

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

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

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FOREWORD

In response to the request of the U.S. War Department the American National Standards Committee B27, for the standardization of plain and lock washers was organized between August 1925 and March 1926 as Sectional Committee B27 under the aegis of the American Standards Association (later the American Engineering Standards, then The United States of America Standards Institute, the American National Standards Institute and in subsequent years, the committee came under the sole sponsorship of the American Society of Mechanical Engineers (ASME).

In May 1928, the B27 Committee established two subcommittees to carry on development work, Subcommittee 1 on plain washers and Subcommittee 2 on lock washers.

Subcommittee 2 circulated a tentative standard for helical spring-lock washers for industry comment in November 1931, but failed to achieve acceptance and committee activity was dormant for some years. In 1940 the Subcommittee 2 project was reactivated and proceeded to draft a proposal covering three series of helical spring-lock washers designated light, medium, and heavy. In 1943 this proposal was amended to include the extra-heavy series washers and following approval by the B27 Committee and sponsor organizations it was accepted as an American Standard under the designation ASA B27.1-1944.

Subcommittee 1 submitted a proposed standard for plain washers in October 1932, after circulation it was revised and distributed in May 1935. This led to a third revision and was referred to the sectional committee but did not receive the votes necessary for approval. From 1937 until 1946 the Subcommittee 1 activity was dormant owing in part to industry preoccupation with the war effort and to the development of a standard for lock washers, there being some resistance to the concurrent development of both projects.

In 1946 the Subcommittee 1 project for plain washers was reactivated and in December of that year a new proposal for the standard was approved at a meeting of the sectional committee subject to confirming approval by letter ballot. The proposal received an overwhelming vote of approval in the letter ballot and at the sectional committee meeting in December 1948 ordered its referral to the sponsor societies. Following approval by the B27 Committee and sponsor organizations it was accepted as an American Standard on August 31, 1949 under the designation ASA B27.2-1949.

Subcommittee 2 considered minor refinements during the ensuing years to the hardness requirements and methods of testing for lock washers. In December 1948, the B27 Committee accepted, in principle, expansion of the Standard to cover helical spring-lock washers made from materials other than carbon steel. A draft proposal incorporating requirements applicable to corrosion-resistant steel, phosphor bronze, silicon bronze, aluminum-zinc alloy, K-monel for helical spring-lock washers, the inclusion of specifications for tooth-lock washers, and machine screw assemblies was completed in September 1949. Following 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.

Subcommittee 1 reviewed the plain washer and revised it editorially to include notes covering general applications, material, thickness, and defects which were inadvertently omitted from the 1949 original printing. A proposed revision dated June 1952, was approved by letter ballot vote of the sectional committee, sponsors, and American Standards Association. Official designation as an American Standard was given March 30, 1953. Subsequent to publication of the 1953 issue certain changes and inclusion of an additional series of washers were proposed. A proposed revision dated February 1956 was approved by letter ballot. Following the approval by the B27 Committee and sponsors, this proposal was forwarded to the American Standards Association and declared an American Standard on August 5, 1958.

Subcommittee 2 held five meetings from 1951 through 1958 at which time members agreed to extend the light and heavy series helical spring-lock washer, to include sizes $1\frac{5}{8}$ in. through 3 in., establish tolerances on the nominal thickness of helical spring-lock washers, and recognize

hardened 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.

Subcommittee 1 continued to refine the specifications for plain washers following issuance of the 1958 standard. Several meetings resulted in adjustment of the tolerances for inside and outside diameters to conform with good commercial stamping practices and the application of the same tolerances to both Type A and Type B washers. Also, to provide better guidance for users, it was agreed to tabulate the preferred sizes of Type A washers separately. A proposed revision dated November 1963, was circulated for simultaneous letter ballot approval of Subcommittee 1 and the Sectional Committee on November 18, 1963. Following acceptance by the subcommittee, the proposal was letter balloted to the B27 Committee on February 12, 1965. The proposal was approved by the sponsor organizations and the American Standards Association and granted formal recognition as an American Standard on September 20, 1965.

From 1959 through 1961, a number of changes were recommended by the Helical Washer Institute, which had undertaken a program to refine the helical spring-lock washers to meet more exacting demands of consumer industries. Also, at a meeting held on November 28, 1961 the B27 Committee recognized the desirability of publishing the screw and washer assemblies as a separate document under the jurisdiction of the B18 Committee, but subject to joint approval by the B27 Committee and affected subcommittees thereof. Subsequently, a draft proposal deleting the coverage on screw and washer assemblies and incorporating revisions to the helical spring-lock washers was prepared. The latter included changing the designation of medium series to regular series and extra-heavy series to extra-duty series, and the addition of the high-collar series, for use with socket head cap screws. Following acceptance by the subcommittee, the proposal was letter balloted to the B27 Committee on November 18, 1963. The proposal was approved by the sponsor organizations and the American Standards Association and granted formal recognition as an American Standard on September 20, 1965.

As of April 1, 1966, Subcommittee 1 was redesignated Subcommittee 2 on plain washers, and Subcommittee 2 was redesignated Subcommittee 1 on lock washers to align with the standard(s) numbering.

After continued studies conducted by the Helical Washer institute, the group submitted further recommendations for changes at a meeting of the American National Standards Committee B27 in October 1969. Subcommittee 1 then prepared a proposal in May 1970 to incorporate the recommended changes to helical spring-lock washers. These changes consisted of deleting coverage for the light series and Type 420 corrosion-resistant steels, adding control on section-corner radius, adjusting the inside diameter, and relegating the heavy series to "Not Recommended for New Applications" status. Other minor corrections to dimensional data and extensive editorial refinements were also included. This draft was approved by letter ballot of Standards Committee B27 on August 11, 1970 and by the sponsor organizations and submitted to American National Standards Institute for designation as an American National Standard. After approval of this revision by the American National Standards Committee B27, the washer activities were transferred to American National Standards Committee B18. This revision was approved as an American National Standard on April 28, 1972.

After the transfer Subcommittee 1 of B27 was redesignated as Subcommittee 21 (Lock Washers) and Subcommittee 2 of B27 was redesignated as Subcommittee 22 (Plain Washers) of Standards Committee B18.

Revisions were made to the lock washer in 1972 and at the December 1985 Subcommittee 21 meeting a draft of these revisions was reviewed by its members. Between that meeting and the December 1987 subcommittee meeting the Standard was reviewed, refinements completed and it was sent out for balloting. All ballot comments were reviewed, editorial changes made and at the May 1989 meeting the revised draft was submitted for publication. Changes to the helical spring lock washers included a graphic illustration with tables to help define the flat face after the allowable radii dimension was subtracted, lowering of the Rockwell hardness for carbon steel, the addition of a table of hardness values for other materials, and a table covering materials. Dimensional changes were made to the inside and outside diameters for regular, heavy, and extra-duty series ¼ in. through 1½ in., and up to the 3 in. size for high-collar. The regular, heavy,

and extra duty tables were expanded to include the sizes from 1½ in. up to 3 in. The data for tooth-lock washers remained the same. Following approval by ASME, the document was submitted to the American National Standards Institute, and was approved as an American National Standard on July 5, 1990.

On December 9, 1992, a proposal to revise the dimensions of the inside diameter for ⅝ in. and larger helical spring-lock washers was developed to correct an excessive reduction in the tolerance for these sizes. In addition, the trapezoid dimensions were replaced with the formula used in prior standards; several materials and hardness values were added; paragraphs covering lot size, inspection and quality assurance requirements, and inspection characteristics were added; and editorial changes were made. The proposal was sent out for balloting, and at the December 7, 1993 meeting, comments were reviewed and acted upon as needed. Following approval by ASME, the document was submitted to the American National Standards Institute, and was approved as an American National Standard on October 6, 1994.

On December 4, 1995, a proposal was developed to revise and clarify several items in this Standard. For helical spring-lock washers the changes included adding clearance to the washers inside diameter for heavier coatings such as those mechanically galvanized, moving the decarburization measuring requirement into the proper designated heading, and correcting illustrations above tables. For tooth-lock washers, the changes included clarifying the wording used in the measurement of the tooth projections on both sides, removing the need for twist testing, and changing some thickness dimensions in Tables 6 and 8 and the notes for Table 9. In addition, this Standard was revised to conform to the standard format of B18 documents. This new edition of the Standard was approved as an American National Standard on November 2, 1999.

During the ASME B18 Standards Committee meeting on November 28, 2007 a suggestion was made to incorporate the B18.22.1 Plain Washers into the B18.21.1 Lock Washers (Inch Series) standard. Both documents were reviewed and a determination was made that the proposal was feasible. With a new name, Washers: Helical Spring-Lock, Tooth-Lock, and Plain Washers (Inch Series) and a reference noting that ASME B18.21.1-2009 was a "Revision and consolidation of ASME B18.21.1 and ASME B18.22.1" the consolidation which included editorial and technical changes was made. The lock washer changes were mostly editorial with the tooth washers received additional figures to help differentiate Type A from Type B. The plain washer tables 1B and 2 included dimensions that were actually considered specials so tables with preferred sizes were adapted and fender washer dimensions were included. After balloting and revisions were made the standard was reballoted and B18.21.1-2009 was approved by B18 Subcommittee 21, Subcommittee 22 and the B18 Standards Committee. This Standard was approved by the American National Standard Institute on October 13, 2009.

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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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 Standards 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 an 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, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B18 Standards Committee.

WASHERS: HELICAL SPRING-LOCK, TOOTH LOCK, AND PLAIN WASHERS (INCH SERIES)

1 GENERAL DATA RELATED TO ALL WASHERS

1.1 Scope

1.1.1 This Standard covers the dimensional requirements, physical properties, and related test methods for helical spring-lock washers (# 0 through 3 in.), tooth-lock washers (# 2 through $1\frac{3}{4}$ in.), and plain washers (# 0 through 3 in.).

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

NOTE: The word *lock* appearing 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 permanency of fixity in attachments where the fasteners are used.

1.2 Comparison to ISO Standards

No comparable ISO standards exist for these parts.

1.3 Types

1.3.1 Helical Spring-Lock Washers. This Standard covers helical spring-lock washers of the following sections: regular, heavy, extra duty, and high-collar.

1.3.2 Tooth-Lock Washers. This Standard covers tooth-lock washers of the following types: internal tooth, external tooth, countersunk external tooth, internal/external tooth, and of two constructions, designated Types A and B.

1.3.3 Plain Washers. This Standard covers plain (flat) washers of three constructions designated Type A, Type B, and Fender washers.

1.4 Dimensions

All dimensions in this Standard are given in inches and are applicable before any coating is applied.

1.5 Responsibility for Modifications

The washer manufacturers 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 performed under the control or direction of the manufacturer.

1.6 Terminology

For definitions of terms relating to washers or features thereof used in this Standard, refer to ASME B18.12.

1.7 References

The following is a list of publications referenced in this Standard. Unless otherwise specified, the latest issue shall apply.

ASME B18.12, Glossary of Terms for Mechanical Fasteners

ASME B18.18.2M, Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners Engineered Applications

ASME B18.24, Part Identifying Number (PIN) Code System Standard

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007 (www.asme.org)

ASTM B 99, Standard Specification for Copper-Silicon Alloy Wire for General Applications

ASTM B 159, Standard Specification for Phosphor Bronze Wire

ASTM B 211, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire

ASTM B 591, Standard Specification for Copper-Zinc-Tin and Copper-Zinc-Tin-Iron-Nickel Alloys Plate, Sheet, Strip, and Rolled Bar

ASTM B 695, Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM E 140, Standard Hardness Conversion Tables for Metals (Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness, Knoop Hardness, and Scleroscope Hardness)

ASTM F 436, Standard Specification for Hardened Steel Washers

ASTM F 844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

Publisher: The American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

Federal Specification QQ-N-286, Nickel-Copper-Aluminum Alloy, Wrought (UNS N05500)

Publisher: Department of Defense Single Stock Point for Military Specifications and Standards (DODSSP), Defense Automated Printing Service, 700 Robbins Avenue, Building 4/D, Philadelphia, PA 19111-5094 (www.dodssp.daps.dla.mil)

SAE J403, Chemical Composition of SAE Carbon Steels
SAE J404, Chemical Composition of SAE Alloy Steels
SAE J405, Chemical Composition of SAE Wrought Stainless Steels
SAE J411, Carbon and Alloy Steels
SAE J419, Methods of Measuring Decarburization
Publisher: Society of Automotive Engineers (SAE International), 400 Commonwealth Drive, Warrendale, PA 15096 (www.sae.org)

1.8 Lot

For all inspections referenced in this Standard, the lot shall consist of all washers of one type, grade, 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. The maximum lot size shall be restricted to one shift of production.

1.8.1 Unless otherwise specified by the purchaser, unhardened plain washers (see para. 1.3.3) do not require lot control or heat control and are not subject to the maximum lot size requirement.

NOTE: It is common to produce unhardened plain washers from scrap steel that does not normally have material heat traceability.

1.9 Inspection and Quality Assurance

Unless otherwise specified, acceptability of this Standard shall be evaluated in accordance with ASME B18.18.2.

2 GENERAL DATA FOR HELICAL SPRING-LOCK WASHERS

2.1 Application: Helical Spring-Lock Washers

The helical spring-lock washers covered in this Standard are intended for general applications. Helical spring-lock washers compensate for developed looseness between component parts of an assembly, and provide a hardened bearing surface.

2.2 Dimensions: Helical Spring-Lock Washers

The dimensions of regular, extra duty, and high-collar helical spring-lock washers shall be specified in Tables 1 through 4. Selection should be made from the regular, heavy, extra duty, or high-collar series in Tables 1, 2, 3, and 4, respectively, to suit design requirements.

2.3 Material and Hardness: Helical Spring-Lock Washers

2.3.1 Material Composition: Helical Spring-Lock Washers. Washers shall be made from material meeting the chemical composition requirements of one of the following standards:

(a) Carbon Steel. SAE J403 1055–1065 (UNS G10550–G10650).

(b) Boron Steel. SAE J411 10B55–10B65.

(c) Stainless Steel. SAE J405 302–305 (UNS S30200–S30500) or SAE J405 316 (UNS S31600).

(d) Aluminum Alloy. ASTM B 211, Alloy 7075 (UNS A97075).

(e) Phosphor-Bronze. ASTM B 159, Copper Alloy No. 510 (UNS C51000).

(f) Silicon-Bronze. ASTM B 99, Copper Alloy No. 651 or 655 (UNS C65100 or C65500).

(g) Nickel-Copper-Aluminum. Federal Specification QQ-N-286 (UNS N05500).

(h) Alloy Steel. SAE J404 4037 (UNS G40370) or other alloy steel having at least 0.35% carbon.

Other materials and grades shall be as agreed upon by the supplier and purchaser.

2.3.2 Hardness: Helical Spring-Lock Washers. All washers shall be prepared for checking the material hardness by cold (water) grinding or filing the sides sufficiently flat and parallel to ensure correct readings. If applicable, be sure to remove the decarburized or plated surface. If the size or shape of the washer does not allow flat grinding, the washer may be sectioned, mounted, and tested using micro-hardness. During these operations, care shall be exercised to prevent the surface temperature of the washer from exceeding 250°F. Hardness requirements applicable to washers of the respective materials shall be as follows. Refer to ASTM E 140 for hardness conversion.

(a) Carbon Steel. 38 HRC to 46 HRC, 372 HV to 458 HV.

(b) Boron Steel. 38 HRC to 46 HRC, 372 HV to 458 HV.

(c) Stainless Steel. 35 HRC to 43 HRC, for lock washers up to and including $\frac{5}{8}$ in., for larger sizes 32 HRC to 43 HRC, 318 HV to 423 HV.

(d) Aluminum Alloy. 75 HRB to 97 HRB, 137 HV to 222 HV.

(e) Phosphor-Bronze. 90 min. HRB, 185 min. HV, or equivalent.

(f) Silicon-Bronze. 90 min. HRB, 185 min. HV, or equivalent.

(g) Nickel-Copper-Aluminum. 33 HRC to 40 HRC, 327 HV to 392 HV.

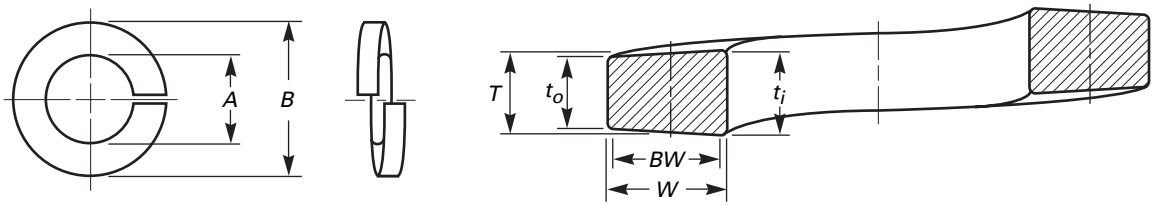
(h) Alloy Steel. 38 HRC to 46 HRC, 372 HV to 458 HV.

2.3.3 Decarburization: Helical Spring-Lock Washers. Carbon steel-, boron steel-, and alloy steel-lock washers shall meet the limits for decarburization shown in Table 5. The method of testing for decarburization limits shall conform with SAE J419.

2.4 Designation: Helical Spring-Lock Washers

Nominal washer sizes are intended for use with comparable nominal screw or nut sizes. Fasteners conforming to this Standard shall be designated by the following

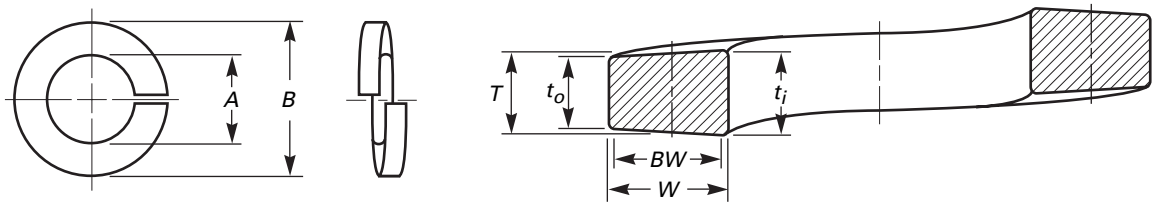
Table 1 Dimensions of Regular Helical Spring-Lock Washers



				Enlarged Section		
Nominal Washer Size	Inside Diameter, *A*		Maximum Outside Diameter, *B*	Minimum Mean Section Thickness $(t_i + t_o)/2$, *T*	Minimum Section Width, *W*	Minimum Bearing Width, *BW*
	Max.	Min.				
No. 2 (0.086)	0.094	0.088	0.172	0.020	0.035	0.024
No. 3 (0.099)	0.107	0.101	0.195	0.025	0.040	0.028
No. 4 (0.112)	0.120	0.114	0.209	0.025	0.040	0.028
No. 5 (0.125)	0.133	0.127	0.236	0.031	0.047	0.033
No. 6 (0.138)	0.148	0.141	0.250	0.031	0.047	0.033
No. 8 (0.164)	0.174	0.167	0.293	0.040	0.055	0.038
No. 10 (0.190)	0.200	0.193	0.334	0.047	0.062	0.043
No. 12 (0.216)	0.227	0.220	0.377	0.056	0.070	0.049
1/4 (0.250)	0.260	0.252	0.487	0.062	0.109	0.076
5/16 (0.3125)	0.322	0.314	0.583	0.078	0.125	0.087
3/8 (0.375)	0.385	0.377	0.680	0.094	0.141	0.099
7/16 (0.4375)	0.450	0.440	0.776	0.109	0.156	0.109
1/2 (0.500)	0.512	0.502	0.869	0.125	0.171	0.120
9/16 (0.5625)	0.574	0.564	0.965	0.141	0.188	0.132
5/8 (0.625)	0.641	0.628	1.073	0.156	0.203	0.142
11/16 (0.6875)	0.704	0.691	1.170	0.172	0.219	0.153
3/4 (0.750)	0.766	0.753	1.265	0.188	0.234	0.164
13/16 (0.8125)	0.832	0.816	1.363	0.203	0.250	0.175
7/8 (0.875)	0.894	0.878	1.459	0.219	0.266	0.186
15/16 (0.9375)	0.958	0.941	1.556	0.234	0.281	0.197
1 (1.000)	1.024	1.003	1.656	0.250	0.297	0.208
1 1/16 (1.0625)	1.087	1.066	1.751	0.266	0.312	0.218
1 1/8 (1.125)	1.153	1.129	1.847	0.281	0.328	0.230
1 3/16 (1.1875)	1.217	1.192	1.943	0.297	0.344	0.241
1 1/4 (1.250)	1.280	1.254	2.036	0.312	0.359	0.251
1 5/16 (1.3125)	1.344	1.317	2.133	0.328	0.375	0.262
1 3/8 (1.375)	1.408	1.379	2.219	0.344	0.391	0.274
1 7/16 (1.4375)	1.472	1.442	2.324	0.359	0.406	0.284
1 1/2 (1.500)	1.534	1.504	2.419	0.375	0.422	0.295
1 5/8 (1.625)	1.663	1.633	2.553	0.389	0.424	0.297
1 3/4 (1.750)	1.789	1.758	2.679	0.389	0.424	0.297
1 7/8 (1.875)	1.914	1.883	2.811	0.422	0.427	0.299
2 (2.000)	2.039	2.008	2.936	0.422	0.427	0.299
2 1/4 (2.250)	2.293	2.262	3.221	0.440	0.442	0.309
2 1/2 (2.500)	2.543	2.512	3.471	0.440	0.442	0.309
2 3/4 (2.750)	2.793	2.762	3.824	0.458	0.491	0.344
3 (3.000)	3.043	3.012	4.074	0.458	0.491	0.344

GENERAL NOTES:
(a) For additional requirements, refer to section 2.
(b) Dimensions are in inches.

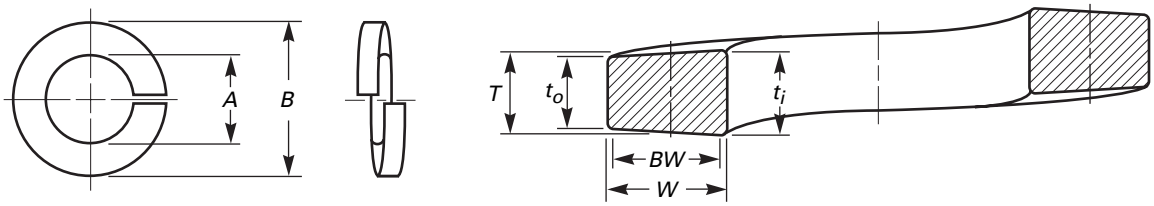
Table 2 Dimensions of Heavy Helical Spring-Lock Washers



Nominal Washer Size	Inside Diameter, *A*		Maximum Outside Diameter, *B*	Enlarged Section: Minimum Mean Section Thickness $(t_i + t_o)/2$, *T*	Enlarged Section: Minimum Section Width, *W*	Enlarged Section: Minimum Bearing Width, *BW*
	Max.	Min.				
No. 2 (0.086)	0.094	0.088	0.182	0.025	0.040	0.028
No. 3 (0.099)	0.107	0.101	0.209	0.031	0.047	0.033
No. 4 (0.112)	0.120	0.114	0.223	0.031	0.047	0.033
No. 5 (0.125)	0.133	0.127	0.252	0.040	0.055	0.038
No. 6 (0.138)	0.148	0.141	0.266	0.040	0.055	0.038
No. 8 (0.164)	0.174	0.167	0.307	0.047	0.062	0.043
No. 10 (0.190)	0.200	0.193	0.350	0.056	0.070	0.049
No. 12 (0.216)	0.227	0.220	0.391	0.063	0.077	0.054
1/4 (0.250)	0.260	0.252	0.489	0.077	0.110	0.077
5/16 (0.3125)	0.322	0.314	0.593	0.097	0.130	0.091
3/8 (0.375)	0.385	0.377	0.688	0.115	0.145	0.101
7/16 (0.4375)	0.450	0.440	0.784	0.133	0.160	0.112
1/2 (0.500)	0.512	0.502	0.879	0.151	0.176	0.123
9/16 (0.5625)	0.574	0.564	0.975	0.170	0.193	0.135
5/8 (0.625)	0.641	0.628	1.087	0.189	0.210	0.147
11/16 (0.6875)	0.704	0.691	1.186	0.207	0.227	0.159
3/4 (0.750)	0.766	0.753	1.285	0.226	0.244	0.171
13/16 (0.8125)	0.832	0.816	1.387	0.246	0.262	0.183
7/8 (0.875)	0.894	0.878	1.489	0.266	0.281	0.197
15/16 (0.9375)	0.958	0.941	1.590	0.284	0.298	0.209
1 (1.000)	1.024	1.003	1.700	0.306	0.319	0.223
1 1/16 (1.0625)	1.087	1.066	1.803	0.326	0.338	0.237
1 1/8 (1.125)	1.153	1.129	1.903	0.345	0.356	0.249
1 3/16 (1.1875)	1.217	1.192	2.001	0.364	0.373	0.261
1 1/4 (1.250)	1.280	1.254	2.104	0.384	0.393	0.275
1 5/16 (1.3125)	1.344	1.317	2.203	0.403	0.410	0.287
1 3/8 (1.375)	1.408	1.379	2.301	0.422	0.427	0.299
1 7/16 (1.4375)	1.472	1.442	2.396	0.440	0.442	0.309
1 1/2 (1.500)	1.534	1.504	2.491	0.458	0.458	0.321
1 5/8 (1.625)	1.663	1.633	2.694	0.458	0.491	0.344
1 3/4 (1.750)	1.789	1.758	2.820	0.458	0.491	0.344
1 7/8 (1.875)	1.914	1.883	2.945	0.458	0.491	0.344
2 (2.000)	2.039	2.008	3.144	0.496	0.526	0.368
2 1/4 (2.250)	2.293	2.262	3.398	0.496	0.526	0.368
2 1/2 (2.500)	2.543	2.512	3.648	0.496	0.526	0.368
2 3/4 (2.750)	2.793	2.762	3.910	0.526	0.532	0.372
3 (3.000)	3.043	3.012	4.160	0.526	0.532	0.372

GENERAL NOTES:
(a) For additional requirements, refer to section 2.
(b) Dimensions are in inches.

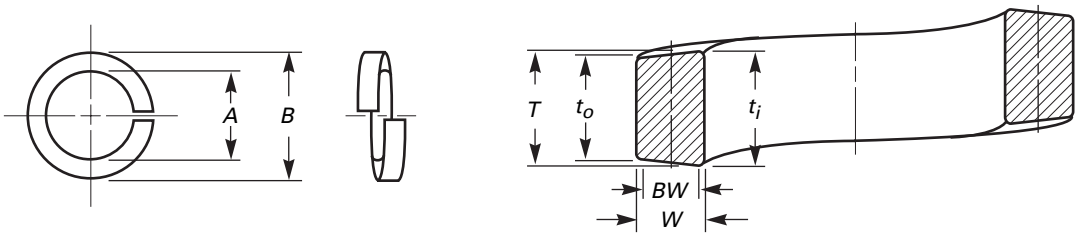
Table 3 Dimensions of Extra-Duty Helical Spring-Lock Washers



				Enlarged Section		
Nominal Washer Size	Inside Diameter, *A*		Maximum Outside Diameter, *B*	Minimum Mean Section Thickness $(t_i + t_o)/2$, *T*	Minimum Section Width, *W*	Minimum Bearing Width, *BW*
	Max.	Min.				
No. 2 (0.086)	0.094	0.088	0.208	0.027	0.053	0.037
No. 3 (0.099)	0.107	0.101	0.239	0.034	0.062	0.043
No. 4 (0.112)	0.120	0.114	0.253	0.034	0.062	0.043
No. 5 (0.125)	0.133	0.127	0.300	0.045	0.079	0.055
No. 6 (0.138)	0.148	0.141	0.314	0.045	0.079	0.055
No. 8 (0.164)	0.174	0.167	0.375	0.057	0.096	0.067
No. 10 (0.190)	0.200	0.193	0.434	0.068	0.112	0.078
No. 12 (0.216)	0.227	0.220	0.497	0.080	0.130	0.091
1/4 (0.250)	0.260	0.252	0.533	0.084	0.132	0.092
5/16 (0.3125)	0.322	0.314	0.619	0.108	0.143	0.100
3/8 (0.375)	0.385	0.377	0.738	0.123	0.170	0.119
7/16 (0.4375)	0.450	0.440	0.836	0.143	0.186	0.130
1/2 (0.500)	0.512	0.502	0.935	0.162	0.204	0.143
9/16 (0.5625)	0.574	0.564	1.035	0.182	0.223	0.156
5/8 (0.625)	0.641	0.628	1.151	0.202	0.242	0.169
11/16 (0.6875)	0.704	0.691	1.252	0.221	0.260	0.182
3/4 (0.750)	0.766	0.753	1.355	0.241	0.279	0.195
13/16 (0.8125)	0.832	0.816	1.458	0.261	0.298	0.209
7/8 (0.875)	0.894	0.878	1.571	0.285	0.322	0.225
15/16 (0.9375)	0.958	0.941	1.684	0.308	0.345	0.241
1 (1.000)	1.024	1.003	1.794	0.330	0.366	0.256
1 1/16 (1.0625)	1.087	1.066	1.905	0.352	0.389	0.272
1 1/8 (1.125)	1.153	1.129	2.013	0.375	0.411	0.288
1 3/16 (1.1875)	1.217	1.192	2.107	0.396	0.431	0.302
1 1/4 (1.250)	1.280	1.254	2.222	0.417	0.452	0.316
1 5/16 (1.3125)	1.344	1.317	2.327	0.438	0.472	0.330
1 3/8 (1.375)	1.408	1.379	2.429	0.458	0.491	0.344
1 7/16 (1.4375)	1.472	1.442	2.530	0.478	0.509	0.356
1 1/2 (1.500)	1.534	1.504	2.627	0.496	0.526	0.368
1 5/8 (1.625)	1.663	1.633	2.784	0.496	0.526	0.368
1 3/4 (1.750)	1.789	1.758	2.902	0.526	0.532	0.372
1 7/8 (1.875)	1.914	1.883	3.027	0.526	0.532	0.372
2 (2.000)	2.039	2.008	3.156	0.526	0.532	0.372

GENERAL NOTES:
(a) For additional requirements, refer to section 2.
(b) Dimensions are in inches.

Table 4 Dimensions of High-Collar Helical Spring-Lock Washers



Enlarged Section

Nominal Washer Size	Inside Diameter, *A*		Maximum Outside Diameter, *B*	Minimum Mean Section Thickness $(t_i + t_o)/2$, *T*	Minimum Section Width, *W*	Minimum Bearing Width, *BW*
	Max.	Min.				
No. 4 (0.112)	0.120	0.114	0.173	0.022	0.022	0.015
No. 5 (0.125)	0.133	0.127	0.202	0.030	0.030	0.021
No. 6 (0.138)	0.148	0.141	0.216	0.030	0.030	0.021
No. 8 (0.164)	0.174	0.167	0.267	0.047	0.042	0.029
No. 10 (0.190)	0.200	0.193	0.294	0.047	0.042	0.029
1/4 (0.250)	0.260	0.252	0.363	0.078	0.047	0.033
5/16 (0.3125)	0.322	0.314	0.457	0.093	0.062	0.043
3/8 (0.375)	0.385	0.377	0.550	0.125	0.076	0.053
7/16 (0.4375)	0.450	0.440	0.644	0.140	0.090	0.063
1/2 (0.500)	0.512	0.502	0.733	0.172	0.103	0.072
5/8 (0.625)	0.641	0.628	0.917	0.203	0.125	0.087
3/4 (0.750)	0.766	0.753	1.105	0.218	0.154	0.108
7/8 (0.875)	0.894	0.878	1.291	0.234	0.182	0.127
1 (1.000)	1.024	1.003	1.478	0.250	0.208	0.146
1 1/8 (1.125)	1.153	1.129	1.663	0.313	0.236	0.165
1 1/4 (1.250)	1.280	1.254	1.790	0.313	0.236	0.165
1 3/8 (1.375)	1.408	1.379	2.031	0.375	0.292	0.204
1 1/2 (1.500)	1.534	1.504	2.159	0.375	0.292	0.204
1 3/4 (1.750)	1.789	1.758	2.596	0.469	0.383	0.268
2 (2.000)	2.039	2.008	2.846	0.469	0.383	0.268
2 1/4 (2.250)	2.293	2.262	3.345	0.508	0.508	0.356
2 1/2 (2.500)	2.543	2.512	3.595	0.508	0.508	0.356
2 3/4 (2.750)	2.793	2.762	4.095	0.633	0.633	0.443
3 (3.000)	3.043	3.012	4.345	0.633	0.633	0.443

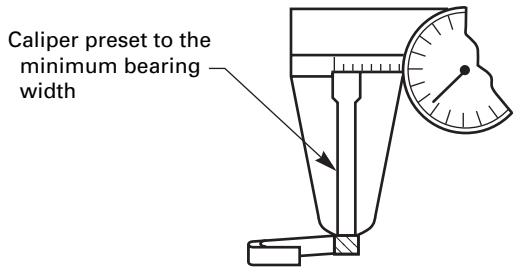
GENERAL NOTES:
(a) For additional requirements, refer to section 2.
(b) Dimensions are in inches.

Table 5 Decarburization Limits

Diameters of Round Wire or Sections of Equivalent Area	Maximum Depth of Free Ferrite	Maximum Total Affected Depth (Free Ferrite Plus Partial Decarburization)
Up to 0.140, incl.	0.002	0.006
Over 0.140 to 0.250, incl.	0.003	0.008
Over 0.250 to 0.375, incl.	0.004	0.010
Over 0.375 to 0.500, incl.	0.006	0.015

GENERAL NOTE: Dimensions are in inches.

Fig. 1 Verifying Minimum Bearing Width



data and sequence shown, or optionally by the code system in ASME B18.24:

(a) product name and style, where applicable
(b) ASME document number (ASME B18.21.1)
(c) nominal size
(d) series (see para. 2.2)
(e) material (alloy or UNS number if required)
(f) surface protective finish standard number and thickness, if applicable

EXAMPLES:
(1) Helical Spring-Lock Washer, ASME B18.21.1, 3/8 in., Extra Duty, Carbon Steel, Mechanical Zinc per ASTM B 695, Class 55.
(2) Helical Spring-Lock Washer, ASME B18.21.1, 1/2 in., High-Collar, 304 Stainless Steel.

2.5 Washer Cross-Section: Helical Spring-Lock Washers

The section of finished washers shall be slightly trapezoidal with thickness at the inner periphery greater than the thickness at the outer periphery by a minimum of 0.0005 in. to a maximum of 0.001 in. per 0.0156 in. of the section width. The minimum section thickness specified in the dimensional tables represents the nominal mean thickness, *T*, of the trapezoid. Reduced to formulas, the increase in thickness from the outer periphery to inner periphery is t_i minus t_o or $0.032W$ (min.) to $0.064W$ (max.). The tolerance on the nominal mean thickness of the trapezoid shall be subject to a plus tolerance equal to the following:

Size	Tolerance, +, in.
No. 12 and smaller	0.006
1/4 in. to 13/16 in.	0.010
7/8 in. to 1 1/2 in.	0.020
1 5/8 in. to 3 in.	0.030

The corners at the inner and outer peripheries of the washers shall 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 *BW* values shown in Tables 1 through 4. It is recommended that conformance to this limitation be determined by presetting a suitable caliper measuring device to the tabulated minimum bearing width dimension and comparing the setting to the flat bearing face on each side of the washer as shown in Fig. 1.

2.6 Coiling: Helical Spring-Lock Washers

Washers shall be coiled to form a helix. The gap and relationship of the severed ends shall be such as to prevent washers from tangling and to ensure that washers compress flatly.

2.7 Processing: Helical Spring-Lock Washers

2.7.1 Finishes: Helical Spring-Lock Washers. Unless otherwise specified by the purchaser, lock washers shall be supplied with a plain (as-processed) finish, not plated or coated. Where corrosion preventative treatment is required, washers shall be plated or coated as specified by the purchaser. When helical spring-lock washers are to be furnished with coatings over 0.0005 in. thick and are to be used with bolts or screws also having thicker coatings, they are to be coiled to limits of 0.020 in. in excess of those specified in Tables 1 through 4 for minimum inside diameter and maximum outside diameter. Heavy coating of washers under 1/4 in. nominal size is not recommended.

2.7.2 Embrittlement: Helical Spring-Lock Washers. Electroplating carbon and boron steel-lock washers is not recommended because of the possibility of hydrogen embrittlement failures. When the purchaser specifies electroplated lock-washers they must be baked after plating using times and temperatures suitable for relieving potentially trapped hydrogen. All lots of electroplated lock-washers shall be tested by compressing them to a flat condition for a minimum of 48 hr, within which time they must not fracture. Compression shall be accomplished between parallel flat surfaces.

2.8 Workmanship: Helical Spring-Lock Washers

The flat surfaces (faces) of helical spring-lock washers shall be free from such surface imperfections as knurling, serrations, die marks, deep scratches, loose scale, burrs, or other irregularities that would affect serviceability. Moderate feed roll marks shall be permissible on the outer periphery.

2.9 Twist Tests: Helical Spring-Lock Washers

The washer shall be gripped in vise jaws. The ends of the washer shall be free, and an axis passing through the slot shall be parallel to and slightly above the top of the vise so less than 50% of the washer is gripped. A 90-deg maximum segment of the free end of the washer shall be gripped in wrench jaws so at least 25% of the washer is exposed when twisting, as shown in Fig. 2. Edges of the wrench jaws shall be in a plane parallel to the vise. Movement of the wrench that increases the free height of the spring-lock washer shall twist carbon steel, boron steel, and alloy steel washers through an angle approximating 90 deg, and corrosion resistant steel and nonferrous washers through an angle approximating 45 deg with no sign of fracture.

Fig. 2 Washer Twist Test

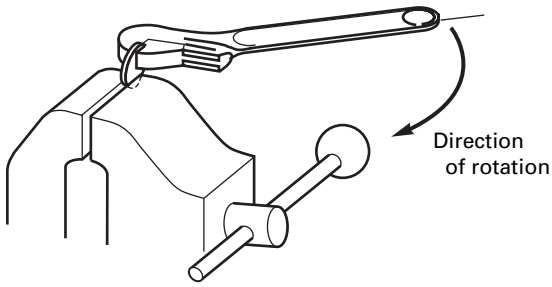
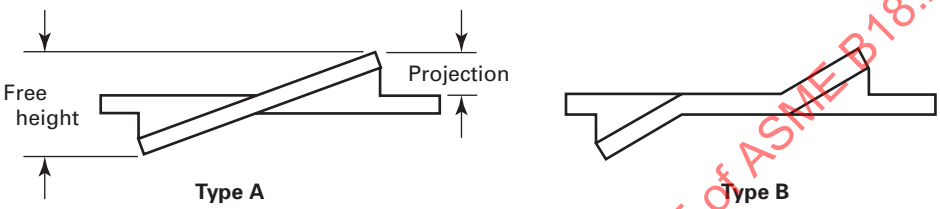


Fig. 3 Tooth Lock Washers



3 GENERAL DATA FOR TOOTH-LOCK WASHERS

3.1 Application: Tooth-Lock Washers

The tooth-lock washers covered in this Standard are intended for general application. The tooth-lock washers serve to increase the friction between the screw and the assembly. Internal tooth-lock washers are preferred where it is desirable to provide a smooth periphery.

3.2 Tooth Design: Tooth-Lock Washers

The selection of Type A or Type B tooth designs as shown in Fig. 3 and in Tables 6 through 10 shall be at the manufacturer's option unless a specific design is designated by the purchaser.

The number of teeth, the length of the teeth, the width of the rim, and the thickness of the washer over the teeth (free height) shall be optional with the manufacturer. The projection of the teeth on both sides of the washer shall be relatively uniform.

3.3 Styles and Dimensions: Tooth-Lock Washers

Dimensions for the various types of washers are as follows; internal tooth-lock washers (Table 6), heavy internal tooth-lock washers (Table 7), external tooth-lock washers (Table 8), external tooth countersunk washers (Table 9), and internal/external tooth lock washers (Table 10).

3.4 Material and Hardness: Tooth-Lock Washers

3.4.1 Material Composition: Tooth-Lock Washers. Washers shall be made from material meeting the chemical composition requirements of one of the following standards:

(a) Carbon Steel. SAE J403 1050–1065 (UNS G10500–G10650).

(b) Stainless Steel. SAE J405 301–305 (UNS S30100–S30500) or SAE J405 316 (UNS S31600).

(c) Stainless Steel. SAE J405 410 (UNS S41000).

(d) Copper Alloy. ASTM B 591 Type 425 (UNS C42500).

Other materials and grades shall be as agreed upon by the supplier and purchaser.

3.4.2 Hardness: Tooth-Lock Washers. Washers that are manufactured from carbon steel that show evidence of decarburization, or parts that were plated, shall have these surface layers removed before checking. During this operation, care shall be exercised to prevent the surface temperature of the washer from exceeding 250°F. It is recommended that the lighter, more sensitive depth reading HRA scale be used in lieu of HRC when testing washers of a thin section. Hardness requirements applicable to washers of the respective materials shall be as follows. Refer to ASTM E 140 for hardness conversions:

(a) Carbon Steel. 40 HRC to 50 HRC, 392 HV to 513 HV.

(b) Stainless Steel 301–305. Annealed 88 minimum HRB, ¼ hard through full hard 20 HRC to 45 HRC.

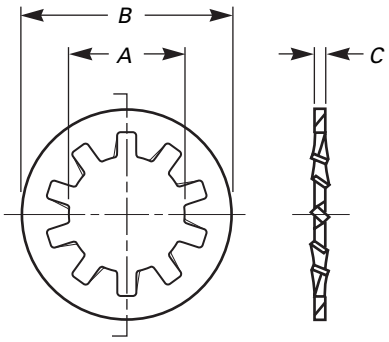
(c) Stainless Steel 410. 40 HRC to 50 HRC, 392 HV to 513 HV.

(d) Copper Alloy. Temper H06 minimum.

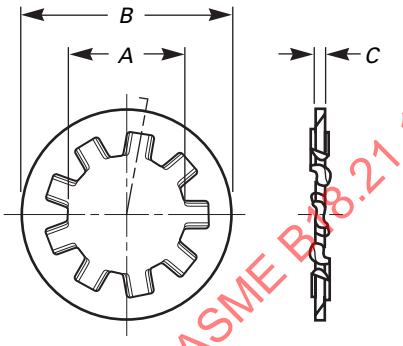
3.5 Designation: Tooth-Lock Washers

Nominal washer sizes are intended for use with comparable screw or nut sizes. Fasteners conforming to this Standard shall be designated by the following data, in

Table 6 Dimensions of Internal Tooth-Lock Washers



Type A

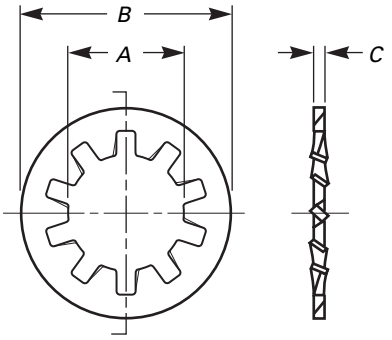


Type B

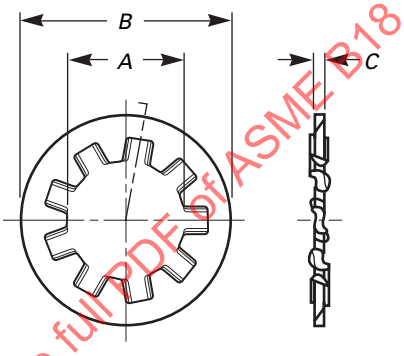
Nominal Washer Size	Inside Diameter, *A*		Outside Diameter, *B*		Thickness, *C*	
	Max.	Min.	Max.	Min.	Max.	Min.
No. 2 (0.086)	0.095	0.089	0.200	0.175	0.016	0.010
No. 3 (0.099)	0.109	0.102	0.232	0.215	0.016	0.010
No. 4 (0.112)	0.123	0.115	0.270	0.245	0.018	0.012
No. 5 (0.125)	0.136	0.129	0.280	0.255	0.020	0.014
No. 6 (0.138)	0.150	0.141	0.295	0.275	0.022	0.016
No. 8 (0.164)	0.176	0.168	0.340	0.325	0.023	0.018
No. 10 (0.190)	0.204	0.195	0.381	0.365	0.024	0.018
No. 12 (0.216)	0.231	0.221	0.410	0.394	0.027	0.020
1/4 (0.250)	0.267	0.256	0.478	0.460	0.028	0.023
5/16 (0.3125)	0.332	0.320	0.610	0.594	0.034	0.028
3/8 (0.375)	0.398	0.384	0.692	0.670	0.040	0.032
7/16 (0.4375)	0.464	0.448	0.789	0.740	0.040	0.032
1/2 (0.500)	0.530	0.512	0.900	0.867	0.045	0.037
9/16 (0.5625)	0.596	0.576	0.985	0.957	0.045	0.037
5/8 (0.625)	0.663	0.640	1.071	1.045	0.050	0.042
11/16 (0.6875)	0.728	0.704	1.166	1.130	0.050	0.042
3/4 (0.750)	0.795	0.769	1.245	1.220	0.055	0.047
13/16 (0.8125)	0.861	0.832	1.315	1.290	0.055	0.047
7/8 (0.875)	0.927	0.894	1.410	1.364	0.060	0.052
1 (1.000)	1.060	1.019	1.637	1.590	0.067	0.059
1 1/8 (1.125)	1.192	1.144	1.830	1.799	0.067	0.059
1 1/4 (1.250)	1.325	1.275	1.975	1.921	0.067	0.059

GENERAL NOTES:
(a) For additional requirements, refer to section 3.
(b) Dimensions are in inches.

Table 7 Dimensions of Heavy Internal Tooth-Lock Washers



Type A



Type B

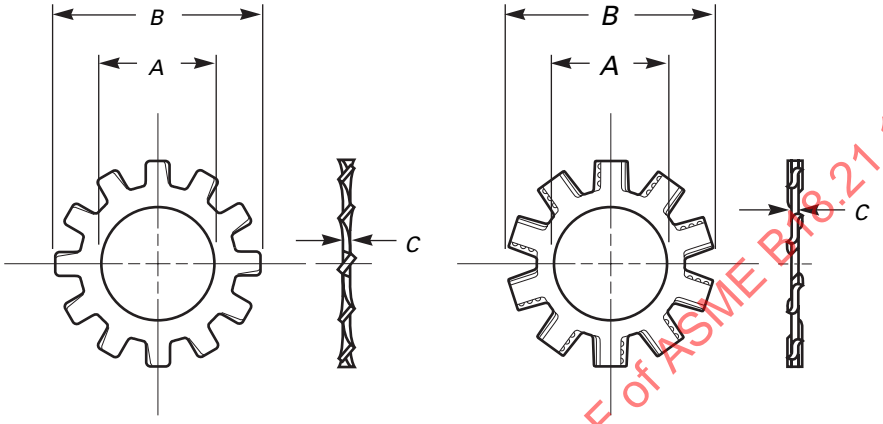
Nominal Washer Size	Inside Diameter, *A*		Outside Diameter, *B*		Thickness, *C*	
	Max.	Min.	Max.	Min.	Max.	Min.
1/4 (0.250)	0.267	0.256	0.536	0.500	0.045	0.035
5/16 (0.3125)	0.332	0.320	0.607	0.590	0.050	0.040
3/8 (0.375)	0.398	0.384	0.748	0.700	0.050	0.042
7/16 (0.4375)	0.464	0.448	0.858	0.800	0.067	0.050
1/2 (0.500)	0.530	0.512	0.924	0.880	0.067	0.055
9/16 (0.5625)	0.596	0.576	1.034	0.990	0.067	0.055
5/8 (0.625)	0.663	0.640	1.135	1.100	0.067	0.059
3/4 (0.750)	0.795	0.768	1.265	1.240	0.084	0.070
7/8 (0.875)	0.927	0.894	1.447	1.400	0.084	0.075

GENERAL NOTES:

(a) For additional requirements, refer to section 3.

(b) Dimensions are in inches.

Table 8 Dimensions of External Tooth-Lock Washers

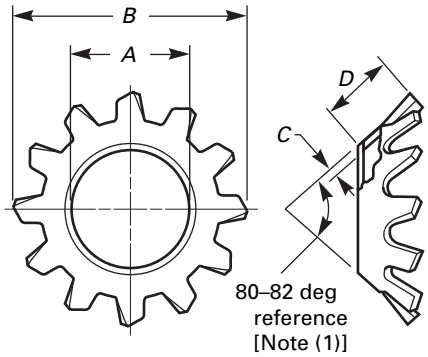


Type A Type B

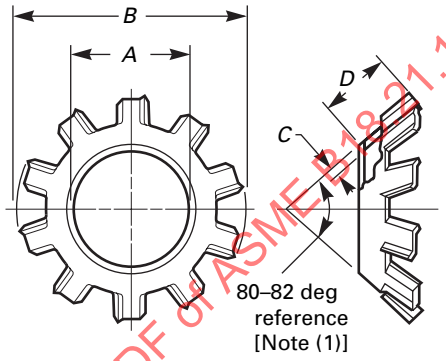
Nominal Washer Size	Inside Diameter, *A*		Outside Diameter, *B*		Thickness, *C*	
	Max.	Min.	Max.	Min.	Max.	Min.
No. 3 (0.099)	0.109	0.102	0.235	0.220	0.016	0.010
No. 4 (0.112)	0.123	0.115	0.260	0.245	0.018	0.012
No. 5 (0.125)	0.136	0.129	0.285	0.270	0.020	0.014
No. 6 (0.138)	0.150	0.141	0.320	0.305	0.022	0.016
No. 8 (0.164)	0.176	0.168	0.381	0.365	0.023	0.018
No. 10 (0.190)	0.204	0.195	0.410	0.395	0.024	0.018
No. 12 (0.216)	0.231	0.221	0.475	0.460	0.027	0.020
1/4 (0.250)	0.267	0.256	0.510	0.494	0.028	0.023
5/16 (0.3125)	0.332	0.320	0.610	0.588	0.034	0.028
3/8 (0.375)	0.398	0.384	0.694	0.670	0.040	0.032
7/16 (0.4375)	0.464	0.448	0.760	0.740	0.040	0.032
1/2 (0.500)	0.530	0.513	0.900	0.880	0.045	0.037
9/16 (0.5625)	0.596	0.576	0.985	0.960	0.045	0.037
5/8 (0.625)	0.663	0.641	1.070	1.045	0.050	0.042
11/16 (0.6875)	0.728	0.704	1.155	1.130	0.050	0.042
3/4 (0.750)	0.795	0.768	1.260	1.220	0.055	0.047
13/16 (0.8125)	0.861	0.833	1.315	1.290	0.055	0.047
7/8 (0.875)	0.927	0.897	1.410	1.380	0.060	0.052
1 (1.000)	1.060	1.025	1.620	1.590	0.067	0.059

GENERAL NOTES:
(a) For additional requirements, refer to section 3.
(b) Dimensions are in inches.

Table 9 Dimensions of Countersunk External Tooth-Lock Washers



Type A



Type B

Nominal Washer Size [Note (2)]	Inside Diameter, *A*		Outside Diameter, *B* [Note (3)]	Thickness, *C*		Length, *D*	
	Max.	Min.	Reference	Max.	Min.	Max.	Min.
No. 4 (0.112)	0.123	0.113	0.213	0.019	0.015	0.065	0.050
No. 6 (0.138)	0.150	0.140	0.289	0.021	0.017	0.092	0.082
No. 8 (0.164)	0.177	0.167	0.322	0.021	0.017	0.099	0.083
No. 10 (0.190)	0.205	0.195	0.354	0.025	0.020	0.105	0.088
No. 12 (0.216)	0.231	0.220	0.421	0.025	0.020	0.128	0.118
1/4 (0.250)	0.267	0.255	0.454	0.025	0.020	0.128	0.113
No. 16 (0.268)	0.287	0.273	0.505	0.028	0.023	0.147	0.137
5/16 (0.3125)	0.333	0.318	0.599	0.028	0.023	0.192	0.165
3/8 (0.375)	0.398	0.383	0.765	0.034	0.028	0.255	0.242
7/16 (0.4375)	0.463	0.448	0.867	0.045	0.037	0.270	0.260
1/2 (0.500)	0.529	0.512	0.976	0.045	0.037	0.304	0.294

GENERAL NOTES:

(a) For additional requirements, refer to section 3.

(b) Dimensions are in inches.

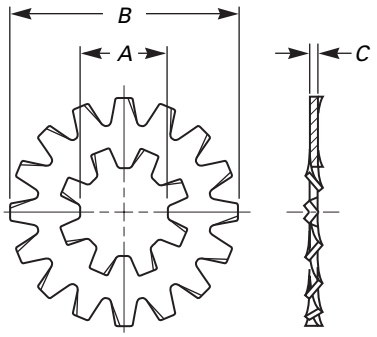
NOTES:

(1) Suggested angle or mating component is 80 deg to 82 deg.

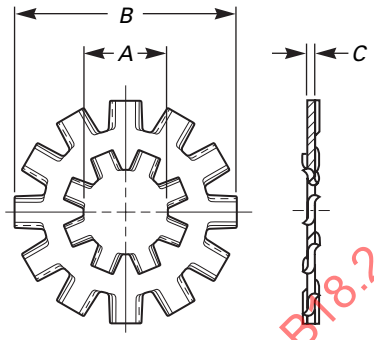
(2) Washer sizes are intended for use with comparable nominal screw sizes.

(3) For reference purposes only; not subject to inspection.

Table 10 Dimensions of Internal/External Tooth-Lock Washers



Type A



Type B

Nominal Washer Size	Inside Diameter, A		Outside Diameter, B		Thickness, C	
	Max.	Min.	Max.	Min.	Max.	Min.
No. 4 (0.112)	0.123	0.115	0.475	0.460	0.021	0.016
			0.510	0.495	0.021	0.017
			0.610	0.580	0.021	0.017
No. 6 (0.138)	0.150	0.141	0.510	0.495	0.028	0.023
			0.610	0.580	0.028	0.023
			0.690	0.670	0.028	0.023
No. 8 (0.164)	0.176	0.168	0.610	0.580	0.034	0.028
			0.690	0.670	0.034	0.028
			0.760	0.740	0.034	0.028
No. 10 (0.190)	0.204	0.195	0.610	0.580	0.034	0.028
			0.690	0.670	0.040	0.032
			0.760	0.740	0.040	0.032
			0.900	0.880	0.040	0.032
No. 12 (0.216)	0.231	0.221	0.690	0.670	0.040	0.032
			0.760	0.725	0.040	0.032
			0.900	0.880	0.040	0.032
			0.985	0.965	0.045	0.037
1/4 (0.250)	0.267	0.256	0.760	0.725	0.040	0.032
			0.900	0.880	0.040	0.032
			0.985	0.965	0.045	0.037
			1.070	1.045	0.045	0.037
5/16 (0.312)	0.332	0.320	0.900	0.865	0.040	0.032
			0.985	0.965	0.045	0.037
			1.070	1.045	0.050	0.042
			1.155	1.130	0.050	0.042
3/8 (0.375)	0.398	0.384	0.985	0.965	0.045	0.037
			1.070	1.045	0.050	0.042
			1.155	1.130	0.050	0.042
			1.260	1.220	0.050	0.042
7/16 (0.438)	0.464	0.448	1.070	1.045	0.050	0.042
			1.155	1.130	0.050	0.042
			1.260	1.220	0.055	0.047
			1.315	1.290	0.055	0.047
1/2 (0.500)	0.530	0.512	1.260	1.220	0.055	0.047
			1.315	1.290	0.055	0.047
			1.410	1.380	0.060	0.052
			1.620	1.590	0.067	0.059
9/16 (0.562)	0.596	0.576	1.315	1.290	0.055	0.047
			1.430	1.380	0.060	0.052
			1.620	1.590	0.067	0.059
			1.830	1.797	0.067	0.059
5/8 (0.625)	0.663	0.640	1.410	1.380	0.060	0.052
			1.620	1.590	0.067	0.059
			1.830	1.797	0.067	0.059
			1.975	1.935	0.067	0.059

GENERAL NOTES:
(a) For additional requirements, refer to section 3.
(b) Dimensions are in inches.

the sequence shown or by use of the code system in ASME B18.24:

(a) product style (see para.3.3)

(b) tooth type if purchaser has preference (see para. 3.2)

(c) ASME document number (ASME B18.21.1)

(d) nominal size (number, fraction, or decimal equivalent)

(e) maximum washer outside diameter (internal/external tooth washers only)

(f) washer type

(g) material (alloy or UNS number if applicable)

(h) surface protective finish standard number and thickness, if applicable

EXAMPLES:

(1) Internal Tooth-Lock Washer, ASME B18.21.1, ¼ in., Type A, 304 Stainless Steel.

(2) External Tooth-Lock Washer, ASME B18.21.1, 0.562 in., Type B, Carbon Steel.

(3) Internal/External Tooth-Lock Washer, ASME B18.21.1, No. 12 (0.900 O.D.), Type A, Carbon Steel, Mechanical Zinc per ASTM B 695, Class 55.

3.6 Processing: Tooth-Lock Washers

3.6.1 Finishes: Tooth-Lock Washers. Unless otherwise specified by the purchaser, lock washers shall be supplied with a plain (as-processed) finish, not plated or coated. Where corrosion preventative treatment is required, washers shall be plated or coated as specified by the purchaser.

3.6.2 Embrittlement: Tooth-Lock Washers. Electroplating carbon and boron steel-lock washers is not recommended because of the possibility of hydrogen embrittlement failures. When the purchaser specifies electroplated lock-washers, they must be baked immediately after plating using times and temperatures suitable for relieving all potentially trapped hydrogen. All lots of electroplated lock-washers shall be tested by compressing them to a flat condition for a minimum of 48 hr, within which time they must not fracture. Compression shall be accomplished between parallel flat surfaces for flat varieties of tooth washers, and between mating countersunk holes and cones for countersunk tooth washers.

3.6.3 Compression Test: Tooth-Lock Washers. Washers, after being compressed to a height equal to the actual material thickness and then released, shall have a free height greater than the compressed height. Compression shall be accomplished between parallel flat surfaces for flat varieties of tooth washers, and between mating countersunk holes and cones for countersunk tooth washers.

3.7 Workmanship: Tooth-Lock Washers

Washers shall be symmetrical in shape and free from rust, loose scale, and defects that might affect their serviceability.

4 GENERAL DATA FOR PLAIN WASHERS (FLAT AND FENDER)

4.1 Application: Plain Washers

4.1.1 The Type A plain washers covered in this Standard are intended for general application. The Type A plain washers serve to minimize embedding and to aid tightening.

4.1.2 The Type B plain washers covered in this Standard are intended for general application. The Type B plain washers fulfill the customary purpose of distributing load over larger areas of lower strength materials.

4.1.3 The Fender washers covered in this Standard are intended for use in covering oversized holes or slots or for distributing load over very larger areas of extremely low strength materials.

4.2 Dimensions: Plain Washers

4.2.1 Type A: Plain Washers. The Type A plain washers selection should be made from the preferred sizes shown in Table 11.

NOTE: Sometimes Type A narrow washers are referred to as SAE and Type A wide washers are referred to as USS washers even though they are not covered by SAE or USS standards.

4.2.2 Type B: Plain Washers. The Type B plain washers are designated as, narrow, regular, and wide series. Suitable washer selection can be made by referring to the nominal screw or bolt size and selecting the appropriate width series for the application in Table 12.

4.2.3 Fender: Plain Washers. The Fender washers are available in one series with multiple outside diameters. Suitable washer selection can be made by referring to the washer size equivalent to the nominal screw size in Table 13.

4.3 Materials: Plain Washers

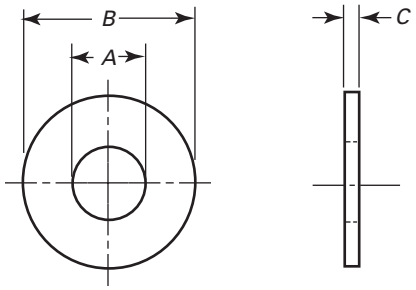
4.3.1 Plain and Fender washers shall be made of low carbon steel, stainless steel, non-ferrous metal, plastic, or other material as specified by the purchaser. The tolerances indicated in the tables are intended for metal washers only. Material or lot traceability is not required for unhardened steel washers identified as low carbon steel that are often manufactured from scrap materials.

4.3.2 Hardened plain washers shall conform to the chemical and mechanical requirements in ASTM F 436.

4.4 Designation: Plain Washers

Nominal washer sizes are intended for use with comparable screw or nut sizes. Fasteners conforming to this Standard shall be designated by the following data, in the sequence shown or by use of the code system in ASME B18.24:

Table 11 Dimensions of Preferred Sizes of Type A Plain Washers



Nominal Washer Size		Series [Note (1)]	Inside Diameter, *A*			Outside Diameter, *B*			Thickness, *C*		
				Tolerance			Tolerance				
			Basic	Plus	Minus	Basic	Plus	Minus	Basic	Max.	Min.
No. 0	...	...	0.078	0.000	0.005	0.188	0.000	0.005	0.020	0.025	0.016
No. 2	...	...	0.094	0.000	0.005	0.250	0.000	0.005	0.020	0.025	0.016
No. 4	...	...	0.125	0.008	0.005	0.312	0.008	0.005	0.032	0.040	0.025
No. 6	0.138	...	0.156	0.008	0.005	0.375	0.015	0.005	0.049	0.065	0.036
No. 8	0.164	...	0.188	0.008	0.005	0.438	0.015	0.005	0.049	0.065	0.036
No. 10	0.190	...	0.219	0.008	0.005	0.500	0.015	0.005	0.049	0.065	0.036
3/16	0.188	...	0.250	0.015	0.005	0.562	0.015	0.005	0.049	0.065	0.036
No. 12	0.216	...	0.250	0.015	0.005	0.562	0.015	0.005	0.065	0.080	0.051
1/4	0.250	N	0.281	0.015	0.005	0.625	0.015	0.005	0.065	0.080	0.051
1/4	0.250	W	0.312	0.015	0.005	0.734 [Note (2)]	0.015	0.007	0.065	0.080	0.051
5/16	0.312	N	0.344	0.015	0.005	0.688	0.015	0.007	0.065	0.080	0.051
5/16	0.312	W	0.375	0.015	0.005	0.875	0.030	0.007	0.083	0.104	0.064
3/8	0.375	N	0.406	0.015	0.005	0.812	0.015	0.007	0.065	0.080	0.051
3/8	0.375	W	0.438	0.015	0.005	1.000	0.030	0.007	0.083	0.104	0.064
7/16	0.438	N	0.469	0.015	0.005	0.922	0.015	0.007	0.065	0.080	0.051
7/16	0.438	W	0.500	0.015	0.005	1.250	0.030	0.007	0.083	0.104	0.064
1/2	0.500	N	0.531	0.015	0.005	1.062	0.030	0.007	0.095	0.121	0.074
1/2	0.500	W	0.562	0.015	0.005	1.375	0.030	0.007	0.109	0.132	0.086
9/16	0.562	N	0.594	0.015	0.005	1.156 [Note (2)]	0.030	0.007	0.095	0.121	0.074
9/16	0.562	W	0.625	0.015	0.005	1.469 [Note (2)]	0.030	0.007	0.109	0.132	0.086
5/8	0.625	N	0.656	0.030	0.007	1.312	0.030	0.007	0.095	0.121	0.074
5/8	0.625	W	0.688	0.030	0.007	1.750	0.030	0.007	0.134	0.160	0.108
3/4	0.750	N	0.812	0.030	0.007	1.469	0.030	0.007	0.134	0.160	0.108
3/4	0.750	W	0.812	0.030	0.007	2.000	0.030	0.007	0.148	0.177	0.122
7/8	0.875	N	0.938	0.030	0.007	1.750	0.030	0.007	0.134	0.160	0.108
7/8	0.875	W	0.938	0.030	0.007	2.250	0.030	0.007	0.165	0.192	0.136
1	1.000	N	1.062	0.030	0.007	2.000	0.030	0.007	0.134	0.160	0.108
1	1.000	W	1.062	0.030	0.007	2.500	0.030	0.007	0.165	0.192	0.136
1 1/8	1.125	N	1.250	0.030	0.007	2.250	0.030	0.007	0.134	0.160	0.108
1 1/8	1.125	W	1.250	0.030	0.007	2.750	0.030	0.007	0.165	0.192	0.136

Table 11 Dimensions of Preferred Sizes of Type A Plain Washers (Cont'd)

Nominal Washer Size		Series [Note (1)]	Inside Diameter, *A*			Outside Diameter, *B*			Thickness, *C*		
				Tolerance			Tolerance				
			Basic	Plus	Minus	Basic	Plus	Minus	Basic	Max.	Min.
1¼	1.250	N	1.375	0.030	0.007	2.500	0.030	0.007	0.165	0.192	0.136
1¼	1.250	W	1.375	0.030	0.007	3.000	0.030	0.007	0.165	0.192	0.136
1⅜	1.375	N	1.500	0.030	0.007	2.750	0.030	0.007	0.165	0.192	0.136
1⅜	1.375	W	1.500	0.045	0.010	3.250	0.045	0.010	0.180	0.213	0.153
1½	1.500	N	1.625	0.030	0.007	3.000	0.030	0.007	0.165	0.192	0.136
1½	1.500	W	1.625	0.045	0.010	3.500	0.045	0.010	0.180	0.213	0.153
1⅝	1.625	...	1.750	0.045	0.010	3.750	0.045	0.010	0.180	0.213	0.153
1¾	1.750	...	1.875	0.045	0.010	4.000	0.045	0.010	0.180	0.213	0.153
1⅞	1.875	...	2.000	0.045	0.010	4.250	0.045	0.010	0.180	0.213	0.153
2	2.000	...	2.125	0.045	0.010	4.500	0.045	0.010	0.180	0.213	0.153
2¼	2.250	...	2.375	0.045	0.010	4.750	0.045	0.010	0.220	0.248	0.193
2½	2.500	...	2.625	0.045	0.010	5.000	0.045	0.010	0.238	0.280	0.210
2¾	2.750	...	2.875	0.065	0.010	5.250	0.065	0.010	0.259	0.310	0.228
3	3.000	...	3.125	0.065	0.010	5.500	0.065	0.010	0.284	0.327	0.249

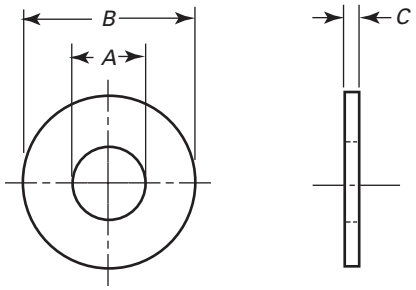
GENERAL NOTE: For general information pertaining to this table, see section 4.

NOTES:

(1) Preferred sizes are for the most part from series previously designated "Standard Plate" and "SAE." Where common slzes existed in the two series, the SAE site is designated "N" (narrow) and the Standard Plate "W" (wide). These sizes as well as all other sizes of Type A Plain Washers are to be ordered by I.D., O.D., and thickness dimensions.

(2) The 0.734 in., 1.156 in., and 1.469 in. outside diameters avoid washers which could be used in coin operated devices.

Table 12 Dimensions of Type B Plain Washers



Nominal Washer Size [Note (1)]		Series	Inside Diameter, *A*			Outside Diameter, *B*			Thickness, *C*		
				Tolerance			Tolerance				
			Basic	Plus	Minus	Basic	Plus	Minus	Basic	Max.	Min.
No. 0	0.060	Narrow	0.068	0.000	0.005	0.125	0.000	0.005	0.025	0.028	0.022
No. 0	0.060	Regular	0.068	0.000	0.005	0.188	0.000	0.005	0.025	0.028	0.022
No. 0	0.060	Wide	0.068	0.000	0.005	0.250	0.000	0.005	0.025	0.028	0.022
No. 1	0.073	Narrow	0.084	0.000	0.005	0.156	0.000	0.005	0.025	0.028	0.022
No. 1	0.073	Regular	0.084	0.000	0.005	0.219	0.000	0.005	0.025	0.028	0.022
No. 1	0.073	Wide	0.084	0.000	0.005	0.281	0.000	0.005	0.032	0.036	0.028
No. 2	0.086	Narrow	0.094	0.000	0.005	0.188	0.000	0.005	0.025	0.028	0.022
No. 2	0.086	Regular	0.094	0.000	0.005	0.250	0.000	0.005	0.032	0.036	0.028
No. 2	0.086	Wide	0.094	0.000	0.005	0.344	0.000	0.005	0.032	0.036	0.028
No. 3	0.099	Narrow	0.109	0.000	0.005	0.219	0.000	0.005	0.025	0.028	0.022
No. 3	0.099	Regular	0.109	0.000	0.005	0.312	0.000	0.005	0.032	0.036	0.028
No. 3	0.099	Wide	0.109	0.008	0.005	0.406	0.008	0.005	0.040	0.045	0.036
No. 4	0.112	Narrow	0.125	0.000	0.005	0.250	0.000	0.005	0.032	0.036	0.028
No. 4	0.112	Regular	0.125	0.008	0.005	0.375	0.008	0.005	0.040	0.045	0.036
No. 4	0.112	Wide	0.125	0.008	0.005	0.438	0.008	0.005	0.040	0.045	0.036
No. 5	0.125	Narrow	0.141	0.000	0.005	0.281	0.000	0.005	0.032	0.036	0.028
No. 5	0.125	Regular	0.141	0.008	0.005	0.406	0.008	0.005	0.040	0.045	0.036
No. 5	0.125	Wide	0.141	0.008	0.005	0.500	0.008	0.005	0.040	0.045	0.036
No. 6	0.138	Narrow	0.156	0.000	0.005	0.312	0.000	0.005	0.032	0.036	0.028
No. 6	0.138	Regular	0.156	0.008	0.005	0.438	0.008	0.005	0.040	0.045	0.036
No. 6	0.138	Wide	0.156	0.008	0.005	0.562	0.008	0.005	0.040	0.045	0.036
No. 8	0.164	Narrow	0.188	0.008	0.005	0.375	0.008	0.005	0.040	0.045	0.036
No. 8	0.164	Regular	0.188	0.008	0.005	0.500	0.008	0.005	0.040	0.045	0.036
No. 8	0.164	Wide	0.188	0.008	0.005	0.625	0.015	0.005	0.063	0.071	0.056
No. 10	0.190	Narrow	0.203	0.008	0.005	0.406	0.008	0.005	0.040	0.045	0.036
No. 10	0.190	Regular	0.203	0.008	0.005	0.562	0.008	0.005	0.040	0.045	0.036
No. 10	0.190	Wide	0.203	0.008	0.005	0.734 [Note (2)]	0.015	0.007	0.063	0.071	0.056
No. 12	0.216	Narrow	0.234	0.008	0.005	0.438	0.008	0.005	0.040	0.045	0.036
No. 12	0.216	Regular	0.234	0.008	0.005	0.625	0.015	0.005	0.063	0.071	0.056
No. 12	0.216	Wide	0.234	0.008	0.005	0.875	0.015	0.007	0.063	0.071	0.056
1/4	0.250	Narrow	0.281	0.015	0.005	0.500	0.015	0.005	0.063	0.071	0.056
1/4	0.250	Regular	0.281	0.015	0.005	0.734 [Note (2)]	0.015	0.007	0.063	0.071	0.056
1/4	0.250	Wide	0.281	0.015	0.005	1.000	0.015	0.007	0.063	0.071	0.056

Table 12 Dimensions of Type B Plain Washers (Cont'd)

Nominal Washer Size [Note (1)]		Series	Inside Diameter, *A*			Outside Diameter, *B*			Thickness, *C*		
				Tolerance			Tolerance				
			Basic	Plus	Minus	Basic	Plus	Minus	Basic	Max.	Min.
5/16	0.312	Narrow	0.344	0.015	0.005	0.625	0.015	0.005	0.063	0.071	0.056
5/16	0.312	Regular	0.344	0.015	0.005	0.875	0.015	0.007	0.063	0.071	0.056
5/16	0.312	Wide	0.344	0.015	0.005	1.125	0.015	0.007	0.063	0.071	0.056
3/8	0.375	Narrow	0.406	0.015	0.005	0.734 [Note (2)]	0.015	0.007	0.063	0.071	0.056
3/8	0.375	Regular	0.406	0.015	0.005	1.000	0.015	0.007	0.063	0.071	0.056
3/8	0.375	Wide	0.406	0.015	0.005	1.250	0.030	0.007	0.100	0.112	0.090
7/16	0.438	Narrow	0469	0.015	0.005	0.875	0.015	0.007	0.063	0.071	0.056
7/16	0.438	Regular	0.469	0.015	0.005	1.125	0.015	0.007	0.063	0.071	0.056
7/16	0.438	Wide	0.469	0.015	0.005	1.469 [Note (2)]	0.030	0.007	0.100	0.112	0.090
1/2	0.500	Narrow	0.531	0.015	0.005	1.000	0.015	0.007	0.063	0.071	0.056
1/2	0.500	Regular	0.531	0.015	0.005	1.250	0.030	0.007	0.100	0.112	0.090
1/2	0.500	Wide	0.531	0.015	0.005	1.750	0.030	0.007	0.100	0.112	0.090
9/16	0.562	Narrow	0.594	0.015	0.005	1.125	0.015	0.007	0.063	0.071	0.056
9/16	0.562	Regular	0.594	0.015	0.005	1.469 [Note (2)	0.030	0.007	0.100	0.112	0.090
9/16	0.562	Wide	0.594	0.015	0.005	2.000	0.030	0.007	0.100	0.112	0.090
5/8	0.625	Narrow	0.656	0.030	0.007	1.250	0.030	0.007	0.100	0.112	0.090
5/8	0.625	Regular	0.656	0.030	0.007	1.750	0.030	0.007	0.100	0.112	0.090
5/8	0.625	Wide	0.656	0.030	0.007	2.250	0.030	0.007	0.160	0.174	0.146
3/4	0.750	Narrow	0.812	0.030	0.007	1.375	0.030	0.007	0.100	0.112	0.090
3/4	0.750	Regular	0.812	0.030	0.007	2.000	0.030	0.007	0.100	0.112	0.090
3/4	0.750	Wide	0.812	0.030	0.007	2.500	0.030	0.007	0.160	0.174	0.146
7/8	0.875	Narrow	0.938	0.030	0.007	1.469 [Note (2)]	0.030	0.007	0.100	0.112	0.090
7/8	0.875	Regular	0.938	0.030	0.007	2.250	0.030	0.007	0.160	0.174	0.146
7/8	0.875	Wide	0.938	0.030	0.007	2.750	0.030	0.007	0.160	0.174	0.146
1	1.000	Narrow	1.062	0.030	0.007	1.750	0.030	0.007	0.100	0.112	0.090
1	1.000	Regular	1.062	0.030	0.007	2.500	0.030	0.007	0.160	0.174	0.146
1	1.000	Wide	1.062	0.030	0.007	3.000	0.030	0.007	0.160	0.174	0.146
1 1/8	1.125	Narrow	1.188	0.030	0.007	2.000	0.030	0.007	0.100	0.112	0.090
1 1/8	1.125	Regular	1.188	0.030	0.007	2.750	0.030	0.007	0.160	0.174	0.146
1 1/8	1.125	Wide	1.188	0.030	0.007	3.250	0.030	0.007	0.160	0.174	0.146
1 1/4	1.250	Narrow	1.312	0.030	0.007	2.250	0.030	0.007	0.160	0.174	0.146
1 1/4	1.250	Regular	1.312	0.030	0.007	3.000	0.030	0.007	0.160	0.174	0.146
1 1/4	1.250	Wide	1.312	0.045	0.010	3.500	0.045	0.010	0.250	0.266	0.234
1 3/8	1.375	Narrow	1.438	0.030	0.007	2.500	0.030	0.007	0.160	0.174	0.146
1 3/8	1.375	Regular	1.438	0.030	0.007	3.250	0.030	0.007	0.160	0.174	0.146
1 3/8	1.375	Wide	1.438	0.045	0.010	3.750	0.045	0.010	0.250	0.266	0.234
1 1/2	1.500	Narrow	1.562	0.030	0.007	2.750	0.030	0.007	0.160	0.174	0.146
1 1/2	1.500	Regular	1.562	0.045	0.010	3.500	0.045	0.010	0.250	0.266	0.234
1 1/2	1.500	Wide	1.562	0.045	0.010	4.000	0.045	0.010	0.250	0.266	0.234
1 5/8	1.625	Narrow	1.750	0.030	0.007	3.000	0.030	0.007	0.160	0.174	0.146
1 5/8	1.625	Regular	1.750	0.045	0.010	3.750	0.045	0.010	0.250	0.266	0.234
1 5/8	1.625	Wide	1.750	0.045	0.010	4.250	0.045	0.010	0.250	0.266	0.234

Table 12 Dimensions of Type B Plain Washers (Cont'd)

Nominal Washer Size [Note (1)]		Series	Inside Diameter, *A*			Outside Diameter, *B*			Thickness, *C*		
				Tolerance			Tolerance				
			Basic	Plus	Minus	Basic	Plus	Minus	Basic	Max.	Min.
1 3/4	1.750	Narrow	1.875	0.030	0.007	3.250	0.030	0.007	0.160	0.174	0.146
1 3/4	1.750	Regular	1.875	0.045	0.010	4.000	0.045	0.010	0.250	0.266	0.234
1 3/4	1.750	Wide	1.875	0.045	0.010	4.500	0.045	0.010	0.250	0.266	0.234
1 7/8	1.875	Narrow	2.000	0.045	0.010	3.500	0.045	0.010	0.250	0.266	0.234
1 7/8	1.875	Regular	2.000	0.045	0.010	4.250	0.045	0.010	0.250	0.266	0.234
1 7/8	1.875	Wide	2.000	0.045	0.010	4.750	0.045	0.010	0.250	0.266	0.234
2	2.000	Narrow	2.125	0.045	0.010	3.750	0.045	0.010	0.250	0.266	0.234
2	2.000	Regular	2.125	0.045	0.010	4.500	0.045	0.010	0.250	0.266	0.234
2	2.000	Wide	2.125	0.045	0.010	5.000	0.045	0.010	0.250	0.266	0.234
2 1/4	2.250	Narrow	2.375	0.045	0.010	4.000	0.045	0.010	0.250	0.266	0.234
2 1/4	2.250	Regular	2.375	0.045	0.010	5.000	0.045	0.010	0.250	0.266	0.234
2 1/4	2.250	Wide	2.375	0.065	0.010	5.500	0.065	0.010	0.375	0.393	0.357
2 1/2	2.500	Narrow	2.625	0.045	0.010	4.500	0.045	0.010	0.250	0.266	0.234
2 1/2	2.500	Regular	2.625	0.065	0.010	5.500	0.065	0.010	0.375	0.393	0.357
2 1/2	2.500	Wide	2.625	0.065	0.010	6.000	0.065	0.010	0.375	0.393	0.357
2 3/4	2.750	Narrow	2.875	0.045	0.010	5.000	0.045	0.010	0.250	0.266	0.234
2 3/4	2.750	Regular	2.875	0.065	0.010	6.000	0.065	0.010	0.375	0.393	0.357
2 3/4	2.750	Wide	2.875	0.065	0.010	6.500	0.065	0.010	0.375	0.393	0.357
3	3.000	Narrow	3.125	0.065	0.010	5.500	0.065	0.010	0.375	0.393	0.357
3	3.000	Regular	3.125	0.065	0.010	6.500	0.065	0.010	0.375	0.393	0.357
3	3.000	Wide	3.125	0.065	0.010	7.000	0.065	0.010	0.375	0.393	0.357

GENERAL NOTES:

(a) Inside and outside diameters shall be concentric within at least the inside diameter tolerance.

(b) Washers shall be flat within 0.005 in. for basic outside diameters up to and including 0.075 in. and within 0.010 in. for larger outside diameters.

(c) For the scope of this Standard see section 1, and for General Data see sections 1 and 3.

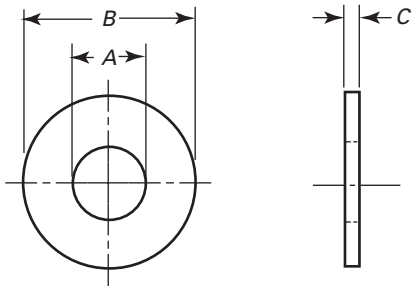
(d) For general information pertaining to this table, see section 4.

NOTES:

(1) Nominal washer sizes are intended for use with comparable nominal screw or bolt sizes.

(2) The 0.734 in. outside diameters avoids washers which could be used in coin operated devices.

Table 13 Fender Washers



Size	Inside Diameter, *A*			Outside Diameter, *B*			Thickness, *C*		
	Basic	Min.	Max.	Basic	Min.	Max.	Basic	Min.	Max.
1/8 × 5/8	0.160	0.150	0.170	0.625	0.617	0.654	0.065	0.047	0.080
1/8 × 3/4	0.160	0.150	0.170	0.750	0.742	0.779	0.065	0.047	0.080
5/32 × 7/8	0.190	0.182	0.201	0.875	0.867	0.904	0.065	0.047	0.080
3/16 × 3/4	0.190	0.213	0.233	0.750	0.742	0.779	0.065	0.047	0.080
3/16 × 1	0.190	0.213	0.233	1.000	0.992	1.018	0.065	0.047	0.080
3/16 × 1 1/4	0.190	0.213	0.233	1.250	1.242	1.279	0.065	0.047	0.080
3/16 × 1 1/2	0.190	0.213	0.233	1.500	1.492	1.529	0.065	0.047	0.080
1/4 × 1	0.285	0.275	0.295	1.000	0.992	1.029	0.065	0.047	0.080
1/4 × 1 1/4	0.285	0.275	0.295	1.250	1.242	1.279	0.065	0.047	0.080
1/4 × 1 1/2	0.285	0.275	0.295	1.500	1.492	1.529	0.065	0.047	0.080
1/4 × 1 3/4	0.285	0.275	0.295	1.761	1.742	1.779	0.065	0.047	0.080
1/4 × 2	0.285	0.275	0.295	2.000	1.992	2.029	0.065	0.047	0.080
5/16 × 7/8	0.348	0.338	0.358	0.875	0.867	0.904	0.065	0.047	0.080
5/16 × 1	0.348	0.338	0.358	1.000	0.992	1.029	0.065	0.047	0.080
5/16 × 1 1/4	0.348	0.338	0.358	1.250	1.242	1.279	0.065	0.047	0.080
5/16 × 1 1/2	0.348	0.338	0.358	1.500	1.492	1.529	0.065	0.047	0.080
5/16 × 1 3/4	0.348	0.338	0.358	1.750	1.742	1.779	0.065	0.047	0.080
5/16 × 1 5/8	0.348	0.338	0.358	1.625	1.617	1.654	0.065	0.047	0.080
5/16 × 2	0.348	0.338	0.358	2.000	1.992	2.029	0.065	0.047	0.080
3/8 × 1 1/4	0.410	0.400	0.420	1.250	1.242	1.279	0.065	0.047	0.080
3/8 × 1 1/2	0.410	0.400	0.420	1.500	1.492	1.529	0.065	0.047	0.080
3/8 × 1 3/4	0.410	0.400	0.420	1.750	1.742	1.779	0.065	0.047	0.080
3/8 × 1 5/8	0.410	0.400	0.420	1.625	1.617	1.654	0.065	0.047	0.080
3/8 × 2	0.410	0.400	0.420	2.000	1.992	2.029	0.065	0.047	0.080
1/2 × 1 1/4	0.535	0.525	0.545	1.250	1.242	1.279	0.065	0.047	0.080
1/2 × 1 1/2	0.535	0.525	0.545	1.500	1.492	1.529	0.065	0.047	0.080
1/2 × 1 3/4	0.535	0.525	0.545	1.750	1.742	1.779	0.065	0.047	0.080
1/2 × 2	0.535	0.525	0.545	2.000	1.992	2.029	0.065	0.047	0.080
1/2 × 2 1/2	0.535	0.525	0.545	2.500	2.492	2.529	0.065	0.047	0.080

GENERAL NOTE: For general information pertaining to this table, see section 4.

(a) product name and type
(b) ASME document number (ASME B18.21.1)
(c) nominal size (number, fraction, or decimal equivalent)
(d) basic washer inside diameter
(e) basic washer outside diameter
(f) basic washer thickness
(g) material (include alloy or UNS number if required)
(h) surface protective finish standard number and thickness, if applicable

EXAMPLES:
(1) Plain Washer, Type A, ASME B18.21.1, 3/8 N, 0.406 × 0.812 × 0.065, 302 Stainless Steel, Passivation per ASTM A 380.
(2) Plain Washer, Type B, ASME B18.21.1, 1/2 W, 0.531 × 1.750 × 0.100. Steel (UNS 105000), hardened per ASTM A 436.
(3) Fender Washer, ASME B18.21.1, 1/4 × 1 3/4 × 0.065, Low Carbon Steel, Zinc per ASTM F 1941, Fe/Zn 3A.

4.5 Workmanship: Plain Washers

Plain and Fender washers shall be free from burrs, loose scale, sharp edges, and all other defects that might affect their serviceability. Unhardened plain and fender washers shall meet the requirements for parallelism and flatness in ASTM F 844. The runout of the outside diameter to the inside diameter shall not exceed the inside diameter tolerance in Tables 11 through 13.