

1. Introductory Notes.

1.1 Scope.

1.1.1 This Standard covers the dimensions, physical properties and methods of testing of carbon steel metric tooth lock washers.

1.1.2 It should be noted that the word "lock" appearing in the names of the products in this Standard is a generic name historically

associated with their identification and is not intended to imply an indefinite permanence of fixity in attachments where they are used.

1.1.3 The inclusion of dimensional data in this Standard is not intended to imply that all of the products described herein are production items. Consumers are requested to consult with manufacturers concerning lists of stock production sizes.

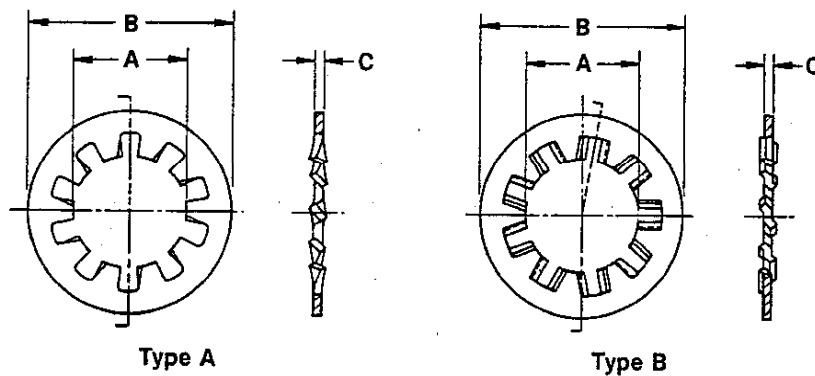


Table 1 Dimensions of Internal Tooth Lock Washers

Nom Washer Size (1)	A		B		C	
	Inside Dia		Outside Dia		Material Thickness	
	Max	Min	Max	Min	Max	Min
2.2♦	2.40	2.25	4.70	4.40	0.35	0.25
2.5	2.80	2.65	5.35	5.45	0.35	0.25
2.9♦	3.12	2.92	6.75	6.25	0.45	0.30
3	3.30	3.15	7.35	6.85	0.50	0.35
3.5	3.80	3.65	8.05	7.55	0.55	0.40
4	4.30	4.15	8.75	8.25	0.60	0.45
4.2♦	4.47	4.27	8.75	8.25	0.60	0.45
4.8♦	5.18	4.95	9.70	9.20	0.65	0.50
5	5.30	5.15	10.50	10.00	0.70	0.55
5.5♦	5.87	5.61	10.50	10.00	0.70	0.55
6	6.50	6.20	12.95	12.20	0.70	0.55
6.3♦	6.80	6.50	12.95	12.20	0.70	0.55
8	8.50	8.20	15.50	14.75	0.85	0.70
9.5♦	10.11	9.75	17.60	16.85	1.00	0.80
10	10.60	10.20	17.60	16.85	1.00	0.80
12	12.70	12.30	20.25	19.50	1.00	0.80
14	14.80	14.30	22.90	21.90	1.15	0.95
16	17.00	16.40	27.20	26.20	1.25	1.05
20	21.20	20.50	32.00	31.00	1.40	1.20
24	25.30	24.50	35.30	34.50	1.50	1.30
30	31.40	30.60	46.30	45.10	1.70	1.50

NOTE:

1. Nominal washer sizes are intended for use with comparable nominal screw, bolt or nut sizes. Washer sizes identified (♦) are suited for use with spaced thread tapping screw Types AB, B, BF and BT.

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Table 2 Dimensions of Heavy Internal Tooth Lock Washers

Nom Washer Size	A		B		C	
	Inside Dia		Outside Dia		Material Thickness	
	Max	Min	Max	Min	Max	Min
6	6.50	6.20	13.5	12.5	1.15	0.90
8	8.50	8.20	15.5	14.5	1.25	1.05
10	10.60	10.20	19.0	18.0	1.30	1.10
12	12.70	12.30	25.0	24.0	1.70	1.50
14	14.80	14.30	29.0	28.0	1.80	1.60
16	17.00	16.40	32.0	31.0	2.20	1.80
20	21.20	20.50	42.0	41.0	2.60	2.20

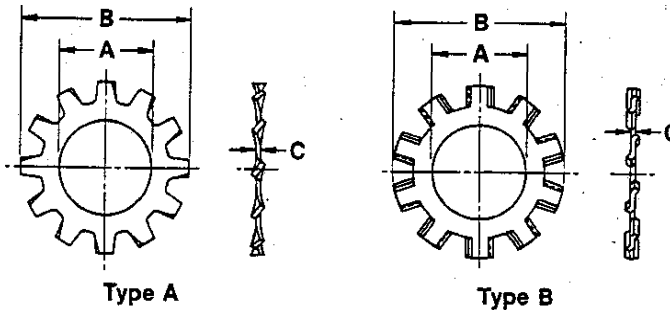


Table 3 Dimensions of External Tooth Lock Washers

Nom Washer Size (1)	A		B		C	
	Inside Dia		Outside Dia		Material Thickness	
	Max	Min	Max	Min	Max	Min
2.2♦	2.40	2.25	—	—	0.35	0.25
2.5	2.80	2.65	5.85	5.45	0.35	0.25
2.9♦	3.12	2.92	6.60	6.20	0.45	0.30
3	3.30	3.15	7.35	6.85	0.50	0.35
3.5	3.80	3.65	8.05	7.55	0.55	0.40
4	4.30	4.15	9.00	8.50	0.60	0.45
4.2♦	4.47	4.27	9.70	9.20	0.60	0.45
4.8♦	5.18	4.95	10.30	9.80	0.65	0.50
5	5.35	5.15	10.50	10.00	0.65	0.50
5.5♦	5.87	5.61	12.00	11.50	0.70	0.55
6	6.50	6.20	12.95	12.20	0.70	0.55
6.3♦	6.60	6.50	12.95	12.20	0.70	0.55
8	8.50	8.20	15.50	14.75	0.85	0.70
9.5♦	10.11	9.75	17.75	17.00	1.00	0.80
10	10.60	10.20	17.75	17.00	1.00	0.80
12	12.70	12.30	20.25	19.50	1.00	0.80
14	14.80	14.30	23.00	22.00	1.15	0.95
16	17.00	16.40	27.50	26.50	1.25	1.05
20	21.20	20.50	32.00	31.00	1.40	1.20
24	25.30	24.50	35.80	34.50	1.50	1.30
30	31.40	30.60	46.80	45.10	1.70	1.50

NOTE:

- Nominal washer sizes are intended for use with comparable nominal screw, bolt or nut sizes. Washer sizes identified (♦) are suited for use with spaced thread tapping screw Types AB, B, BF and BT.



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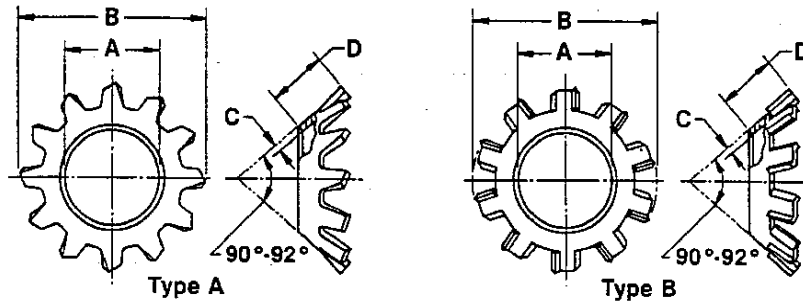


Table 4 Dimensions of Countersunk External Tooth Lock Washers

Nom Washer Size (1)	A		B	C		D	
	Inside Dia		Outside Dia	Material Thickness		Length	
	Max	Min	Nom	Max	Min	Max	Min
2 and 2.2♦	2.40	2.25	3.75	0.25	0.17	1.05	0.75
2.5	2.80	2.65	4.50	0.25	0.17	1.70	1.30
3 and 2.9♦	3.30	3.15	5.85	0.45	0.30	2.10	1.70
3.5	3.80	3.65	6.60	0.45	0.30	2.30	1.80
4 and 4.2♦	4.47	4.27	7.50	0.55	0.40	2.40	1.80
5 and 4.8♦	5.30	5.15	9.60	0.65	0.50	3.40	2.80
5.5♦	5.87	5.61	10.90	0.65	0.50	3.90	3.30
6	6.50	6.20	12.00	0.65	0.50	4.20	3.40
6.3♦	6.80	6.50	12.00	0.65	0.50	4.20	3.40
8	8.50	8.20	15.60	0.70	0.55	5.50	4.75
10 and 9.5♦	10.60	10.20	19.50	0.85	0.70	6.80	5.80
12	12.70	12.30	23.00	1.00	0.80	7.80	6.80

NOTE:

1. Nominal washer sizes are intended for use with comparable nominal screw, bolt or nut sizes. Washer sizes identified (♦) are suited for use with spaced thread tapping screw Types AB, B, BF and BT.

1.2 Types and Series.

1.2.1 Tooth Lock Washers. This Standard covers tooth lock washers of carbon steel having internal teeth (Tables 1 and 2), external teeth, (Tables 3 and 4), and both internal and external teeth, (Table 5). All washers are of two constructions, designated Type A and Type B.

1.3 Use and Application. The tooth lock washers in this Standard are intended for general industrial application. They serve to promote the retention of fasteners, such as bolts, screws and nuts, to the component parts of an assembly by increasing friction between the fasteners and the assembly and by providing spring takeup.

1.4 Dimensions. All dimensions in this Standard are given in millimeters unless otherwise stated.

1.5 Responsibility for Modifications. The

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

1.6 Terminology. For definitions of terms relating to washers or features thereof used in this Standard, refer to the American National Standard Glossary of Terms for Mechanical Fasteners, page J-5.

2. General Data.

2.1 Dimensions. Dimensions of internal tooth lock washers, heavy internal tooth lock washers, external tooth lock washers, countersunk external tooth lock washers, and internal-external tooth lock washers shall be as specified in Tables 1. thru 5 respectively.

2.2 Designation. Washers shall be specified or designated by the nominal size, description

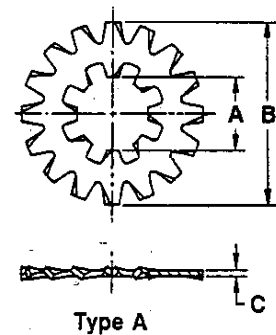
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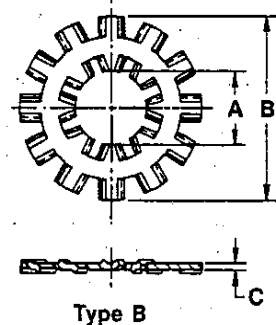
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Table 5 Dimensions of External-Internal Tooth Lock Washers

Nom Washer Size (1)	A		B		C	
	Inside Dia		Outside Dia		Material Thickness	
	Max	Min	Max	Min	Max	Min
2.9♦	3.12	2.92	12.10	11.35	0.50	0.35
			13.00	12.25	0.55	0.40
			15.50	14.75	0.55	0.40
3	3.30	3.15	12.10	11.35	0.50	0.35
			13.00	12.25	0.55	0.40
			15.50	14.75	0.55	0.40
3.5	3.80	3.65	12.90	12.15	0.70	0.55
			15.50	14.75	0.70	0.55
			17.55	16.80	0.70	0.55
4	4.30	4.15	15.25	14.50	0.85	0.70
			17.70	17.05	0.85	0.70
			19.30	18.55	0.85	0.70
4.2♦	4.47	4.27	15.25	14.50	0.85	0.70
			17.70	17.05	0.85	0.70
			19.30	18.55	0.85	0.70
4.8♦	5.18	4.95	15.25	14.50	0.85	0.70
			17.75	17.05	1.00	0.80
			19.30	18.55	1.00	0.80
5	5.35	5.15	15.25	14.50	0.85	0.70
			17.75	17.05	1.00	0.80
			19.30	18.55	1.00	0.80
5.5♦	5.87	5.61	17.75	17.00	1.00	0.80
			19.30	18.55	1.00	0.80
			22.90	21.90	1.00	0.80
6	6.50	6.20	19.30	18.55	1.00	0.80
			22.90	21.90	1.00	0.80
			25.00	24.00	1.15	0.95
6.3♦	6.80	6.50	19.30	18.55	1.00	0.80
			22.90	21.90	1.00	0.80
			25.00	24.00	1.15	0.95
8	8.50	8.20	22.90	21.90	1.00	0.80
			25.00	24.00	1.15	0.95
			27.20	26.20	1.15	0.95
9.5♦	10.11	9.75	22.90	21.90	1.00	0.80
			25.00	24.00	1.15	0.95
			27.20	26.20	1.25	1.05
10	10.60	10.20	22.90	21.90	1.00	0.80
			25.00	24.00	1.15	0.95
			27.20	26.20	1.25	1.05
12	12.70	12.30	25.00	24.00	1.15	0.95
			27.20	26.20	1.25	1.05
			29.35	28.35	1.25	1.05
14	14.80	14.30	32.00	30.70	1.40	1.20
			33.50	32.20	1.40	1.20
			36.00	34.30	1.50	1.30
16	17.00	16.40	36.00	34.30	1.50	1.30
			41.35	39.65	1.70	1.50
			46.50	45.30	1.70	1.50



Type A



Type B

NOTE:

1. Nominal washer sizes are intended for use with comparable nominal screw, bolt or nut sizes. Washer sizes identified (♦) are suited for use with spaced thread tapping screw Types AB, B, BF and BT.



and type. For example, 4 mm Internal Tooth, Type A; 20 mm External Tooth, Type B; or 5.5 mm Internal-External Tooth, Type A. Nominal washer sizes are intended for use with comparable nominal screw or bolt sizes.

2.3 Manufacturing Detail. 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, with the provision, however, that the projection of the teeth on both sides of the washer shall be uniform within a tolerance equal to one-half of the projection on one side. Washers shall be symmetrical in shape and free from defects that might affect their serviceability.

2.4 Material and Hardness. Washers shall be made from carbon steel, fabricated and heat treated to a hardness of Rockwell C 40-50, or equivalent. It is recommended, however, that the lighter, more sensitive depth reading Rockwell A scale be used when testing washers of thin section. Decarburization shall be removed before testing hardness.

Corrosion resistant steel washers, unless otherwise specified, shall be fabricated from AISI 410 and heat treated to a hardness of Rockwell C 40-50, or equivalent. When specified, corrosion resistant steel washers shall be fabricated from AISI 302 and shall have a hardness of Rockwell C 30-37 or equivalent.

2.5 Finishes. Unless otherwise specified, washers shall be supplied with a natural (as processed) finish, unplated or uncoated. Where corrosion preventative treatment is required, washers shall be plated or coated as agreed upon between the manufacturer and the purchaser.

The determinant of plating thickness shall be the thickness of plating or coating on the flat surface of the rim of the washers, approximately half way across the rim of the washer.

Carbon steel washers plated with metal or otherwise processed as to be subject to hydrogen embrittlement shall be suitably treated, subsequent to plating or coating operation, to obviate such embrittlement and shall be subjected to a clamping test.

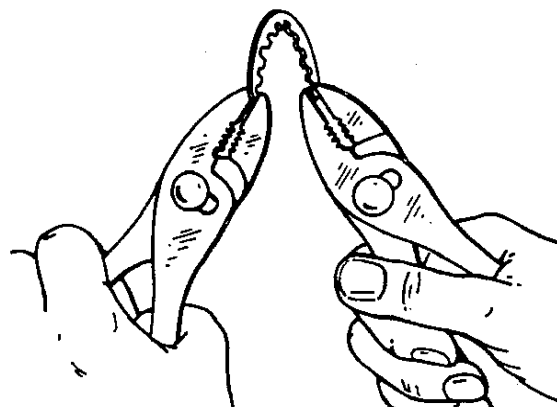


FIG. 1 TWIST TEST

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

2.7 Tests.

2.7.1 Temper Test. Washers after being compressed to a height equal to the actual material thickness plus 0.13 mm, 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.

2.7.2 Clamping Test. Plated washers shall be clamped to a height equal to the actual material thickness plus 0.13 mm for a period of 24 hours without breaking. The clamping shall be accomplished between parallel flat surfaces for flat varieties of tooth washers and between mating countersunk holes and cones for countersunk tooth washers.

2.7.3 Twist Test. The rim of the lock washer shall be cut or severed with a cold chisel or cutting pliers and the severed ends shall be gripped by pliers or vise and pliers (Fig. 1). Separation of the ends in the form of a helix, to a distance equal to the inside diameter of the washer, shall not result in fracture. When the ends are separated a greater distance and the washer does fracture, the structure at the point of fracture shall show a fine grain, and the washer up to the instant of fracture shall deliver a tough springy reaction.