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SURFACE VEHICLE STANDARD

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An American National Standard

CONICAL SPRING WASHERS

***Foreword*—**This Document has been changed only to comply with the new SAE Technical Standards Board Format.

1. ***Scope*—**This SAE Standard covers dimensional, material, and general specifications and methods of test for two types of general purpose conical spring washers, designated type L and type H, for use as loose washers over screws and bolts, and also for use as pre-assembled washers in screw and washer assemblies.

1.1 Both the type L and type H washers are available in three washer series (narrow, regular and wide), having varied proportions designed to fulfill specific application requirements for load distribution.

1.2 Where so specified by the user, washers shall be supplied with peripheral teeth.

1.3 All sizes and types of washers specified in this standard are not necessarily stock production items. Users should consult with manufacturers concerning availability.

2. ***References***

2.1 **Applicable Publication—**The following publication forms a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAEJ429—Mechanical and Material Requirements for Externally Threaded Fasteners

3. ***Designation*—**Washers shall be specified or designated as shown in the following example:

Washer, Conical, ½, SAE Type L, Wide

4. ***Use and Application*—**Type L washers are intended for use with screws and bolts equivalent to SAE Grade 1 and 2. Type H washers are intended for use with SAE Grade 5 or equivalent bolts or screws (SAE J429)

4.1 The desired installed position of this washer is as near flat as possible. The flattening will occur at a load equal to approximately 27 500 bolt psi for the Type L washer and 60 000 bolt psi for the Type H washer. The spring return will vary due to the compromises in washer diameter, thickness, and tolerances, which have been made to maintain this standard in a commercial category (see 8.1).

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4.2 The relatively high supporting load and spring return makes this washer very effective where bolt tension may be subject to loss due to such factors as compensating for wear, thermal expansion, or compression set.

4.3 When used to span over-size clearance holes, it is recommended that (1) if the full periphery is supported, at least 70% of the washer annular area be bearing or (2) if the periphery is partially supported, as over a slot, the slot should be no wider than 1½ times the I.D. Narrow series should always be fully supported. Insufficient bearing will reduce spring return.

4.4 Washers with peripheral teeth are used for non-slip or positive electrical grounding purposes.

5. ***Dimensions—***Dimensions of Type L and Type H conical spring washers are specified in Table 1.

TABLE 1—DIMENSIONS OF CONICAL SPRING WASHERS, in (see FIGURE 1)

Nominal Screw or Bolt Size	Washer Series	A(1) ID Min	A(1) ID Max	B OD Max	B OD Min	Type L C Thick-ness Nom	Type L C Thick-ness Max	Type L C Thick-ness Min	Type L D Crown Height Min	Type L D Crown Height Max	Type H C1 Thick-ness Nom	Type H C1 Thick-ness Max	Type H C1 Thick-ness Min	Type H D1 Crown Height Min	Type H D1 Crown Height Max
	Narrow			0.320	0.307	0.025	0.029	0.023	0.010	0.016	0.035	0.040	0.033	0.015	0.025
6	Regular	0.151	0.156	0.446	0.433	0.030	0.034	0.028	0.014	0.020	0.040	0.046	0.037	0.015	0.025
	Wide			0.570	0.557	0.030	0.034	0.028	0.021	0.031	0.040	0.046	0.037	0.019	0.029
	Narrow			0.383	0.370	0.035	0.040	0.033	0.010	0.016	0.040	0.046	0.037	0.015	0.025
8	Regular	0.183	0.188	0.508	0.495	0.035	0.040	0.033	0.020	0.030	0.045	0.050	0.042	0.016	0.026
	Wide			0.640	0.620	0.035	0.040	0.033	0.027	0.037	0.045	0.050	0.042	0.030	0.040
	Narrow			0.446	0.433	0.035	0.040	0.033	0.010	0.016	0.050	0.056	0.047	0.015	0.025
10	Regular	0.203	0.208	0.570	0.557	0.040	0.046	0.037	0.017	0.027	0.055	0.060	0.052	0.016	0.026
	Wide			0.765	0.743	0.040	0.046	0.037	0.026	0.036	0.055	0.060	0.052	0.024	0.034
	Narrow			0.446	0.433	0.040	0.046	0.037	0.011	0.017	0.055	0.060	0.052	0.015	0.025
12	Regular	0.230	0.240	0.640	0.620	0.040	0.046	0.037	0.023	0.033	0.055	0.060	0.052	0.016	0.026
	Wide			0.890	0.868	0.045	0.050	0.042	0.034	0.044	0.064	0.071	0.059	0.023	0.033
	Narrow			0.515	0.495	0.045	0.050	0.042	0.014	0.024	0.064	0.071	0.059	0.015	0.025
1/4	Regular	0.271	0.281	0.765	0.743	0.050	0.056	0.047	0.023	0.033	0.079	0.087	0.074	0.022	0.032
	Wide			1.015	0.993	0.055	0.060	0.052	0.030	0.040	0.079	0.087	0.074	0.029	0.039
	Narrow			0.640	0.620	0.055	0.060	0.052	0.016	0.026	0.079	0.087	0.074	0.016	0.026
5/16	Regular	0.334	0.344	0.890	0.868	0.064	0.071	0.059	0.031	0.041	0.095	0.103	0.090	0.019	0.029
	Wide			1.140	1.118	0.064	0.071	0.059	0.034	0.044	0.095	0.103	0.090	0.030	0.040
	Narrow			0.765	0.743	0.071	0.079	0.066	0.015	0.025	0.095	0.103	0.090	0.015	0.025
3/8	Regular	0.396	0.406	1.015	0.993	0.071	0.079	0.066	0.033	0.043	0.118	0.126	0.112	0.023	0.033
	Wide			1.265	1.243	0.079	0.087	0.074	0.037	0.047	0.118	0.126	0.112	0.035	0.045
	Narrow			0.890	0.868	0.079	0.087	0.074	0.018	0.028	0.128	0.136	0.122	0.016	0.026
7/16	Regular	0.470	0.480	1.140	1.118	0.095	0.103	0.090	0.031	0.041	0.128	0.136	0.122	0.028	0.038
	Wide			1.530	1.493	0.095	0.103	0.090	0.049	0.059	0.132	0.140	0.126	0.039	0.049
	Narrow			1.015	0.993	0.100	0.108	0.094	0.021	0.031	0.142	0.150	0.136	0.020	0.030
1/2	Regular	0.530	0.540	1.265	1.243	0.111	0.120	0.106	0.033	0.043	0.142	0.150	0.136	0.027	0.037
	Wide			1.780	1.743	0.111	0.120	0.106	0.052	0.062	0.152	0.160	0.146	0.042	0.052

1. Not applicable to washers assembled with screw blanks. See General Specifications.

5.1 Manufacturing Detail—Washers shall be symmetrical in shape. The radial section of the washer shall be flat to convex upward with flat preferred (see Figure 1). Unless otherwise specified by the user, the direction of blanking the outside diameter should permit the sharper edge to be on the underside of the washer. Washers shall be free from sharp edges, burrs, cracks, checks, embrittlement, loose scale, and all other defects that might affect their serviceability.

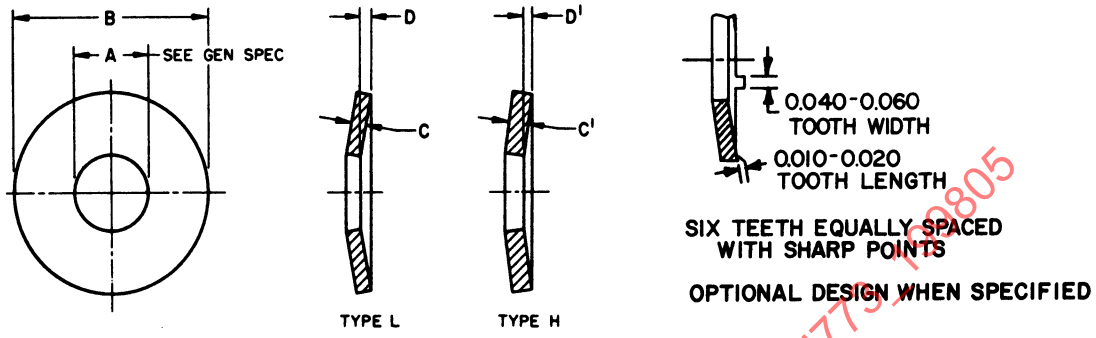

FIGURE 1—CONICAL SPRING WASHER DETAIL

5.2 Assembly Detail—The inside diameters of washers for pre-assembly on unthreaded screw blanks shall be optional, but shall be such that the washer will be retained on the screw after thread rolling, but shall not bind on the screw shank before and during tightening of the assembly.

6. Material and Hardness—Washers shall be made from SAE 1050 to 1065 carbon steel, fabricated and heat treated to a Rockwell hardness of 44-48 C scale (Rockwell hardness of C46-50 if austempering is used) or equivalent for loose washers, and 40-48 C scale or equivalent ibr pre-assembled washers, heat treated as an integral part of heat treated bolt or screw and washer assemblies. Washer hardness shall be checked by grinding or filing a flat spot on the top conical surface of the washer to rest on the anvil, with reading to be taken on the undisturbed inner face of the washer. If washer hardness, as obtained above, is not within specification, washers may be qualified by checking hardness on a cut-out section of the washer on which both sides have been ground. However, an excessive decarburized surface, especially on the lighter gage material, may be grounds for rejection if the performance of the washer is affected.

7. Finish—Electroplated washers or screw or bolt and washer assemblies shall be baked at 400 °F as soon as practicable after plating, in order to relieve hydrogen or acid embrittlement. If washers so treated fail to meet the prescribed tests, the baking time and/or the temperature shall be increased, but not to approach annealing temperature.

8. Tests

8.1 Recovery Test—The washers shall retain at least one-third their original crown height after flattening between two hardened plates and release. (Note: Conical washers which have a higher angle of elevation than covered by this standard are not expected to have the same percentage of recovery.)

8.2 Embrittlement Test—As a constant quality control check, a minimum of 12 pieces shall be taken from each batch after plating or final finishing operations and subjected to a load test sufficient to flatten washers for a minimum period of 24 h. Upon examination after testing, washers shall not exhibit cracks or fractures.

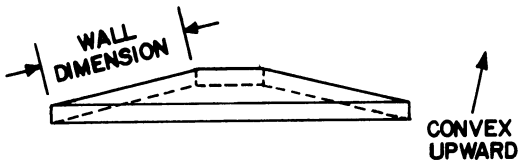

FIGURE 2—CONICAL SPRING WASHER ORIENTATION

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