

Serrated Shaft Ends

1. **Scope**—This SAE Recommended Practice is intended for service only. Use ANSI B92.1, 1a, and B92.2M. This document contains information on inch serrated shaft ends and hole dimensions. For metric information, see TSB 003.

2. References

2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

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

SAE TSB 003—Rules for SAE Use of SI (Metric) Units

2.1.2 ANSI PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI B92.1-1970—Involute Splines and Inspection, Inch Version

ANSI B92.1a-1976—Addendum to Involute Splines and Serrations

ANSI B92.2M-R-1989—Metric Module, Involute Splines

3. Straight Shafts—

N = Number of serrations.

b = Included angle of the space in the hole, and the tooth on the shaft.

The pitch diameter (PD) and hole are basic.

The pitch line is midway between the inner and outer sharp points.

The minimum hole with maximum shaft as measured across wires in Table 1, produce basic (no clearance) fit.

The wire diameter in Table 1 is the diameter that will bear on the pitch line. See Figure 1.

Tolerance for diameter across wires = -0.001 in on tooth thickness, for hole and shaft sizes from 1/8 to 1-3/4 in, and -0.0015 in on sizes from 2 to 3 in, inclusive.

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Tooth thickness on the shaft may be varied from the tolerance given, to secure desired fit.

W_c = Constant to be added to measurement across wires for shaft, subtracted for hole, for each 0.001-in increase in wire diameter used over wire size in Table 1.

When serrations are hobbled, the sides of teeth are involute. This departure from flat sides is slight and is ignored.

4. Formulas

4.1 Diameter over sharp points:

$$\begin{aligned}(\text{OD}) &= 1.0476479 \text{ PD for 36 serrations.} \\ &= 1.0349592 \text{ PD for 48 serrations.}\end{aligned}$$

4.2 Diameter under sharp points:

$$\begin{aligned}(\text{RD}) &= 0.9523521 \text{ PD for 36 serrations} \\ &= 0.9650408 \text{ PD for 48 serrations.}\end{aligned}$$

4.3 Diameter of wire that will bear on pitch line of hole:

$$\begin{aligned}(\text{Wh}) &= 0.05309792 \text{ PD for 36 serrations.} \\ &= 0.04133332 \text{ PD for 48 serrations.}\end{aligned}$$

Diameter of wire that will bear on pitch line of shaft:

$$\begin{aligned}(\text{Ws}) &= 0.06585005 \text{ PD for 36 serrations.} \\ &= 0.0485955 \text{ PD for 48 serrations.}\end{aligned}$$

4.4 Measurement across wires:

$$\begin{aligned}\text{for hole} &= 0.9119441 \text{ PD for 36 serrations.} \\ &= 0.9309375 \text{ PD for 48 serrations.}\end{aligned}$$

Measurement across wires:

$$\begin{aligned}\text{for shaft} &= 1.1113285 \text{ PD for 36 serrations.} \\ &= 1.0823601 \text{ PD for 48 serrations.}\end{aligned}$$

4.5 Tolerance constant for measurement across wires per 0.001-in tooth:

$$\text{thickness for hole} = 0.001 \frac{\sin 45}{\sin\left(45 - \frac{180}{N}\right)} \quad (\text{Eq. 1})$$

$$\text{for shaft} = 0.001 \frac{\sin\left(45 - \frac{180}{N}\right)}{\sin 45} \quad (\text{Eq. 2})$$

4.6 Wire diameter constant for use of other diameter wire than that which bears on pitch line, (Wc):

$$0.001 + \frac{0.001}{\sin\left(45 - \frac{180}{N}\right)} \text{ for hole} \quad (\text{Eq. 3})$$

$$= 0.001 + \frac{0.001}{\cos 45} \text{ for shaft} \quad (\text{Eq. 4})$$

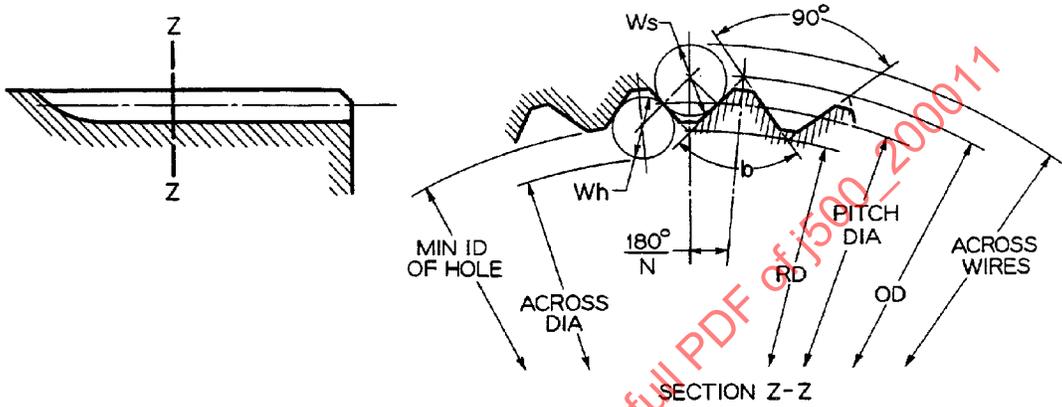


FIGURE 1—SERRATION TERMS

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TABLE 1—DIMENSIONS OF HOLES AND SHAFTS, IN ONLY

Hole and Shaft Nominal Dia	Hole and Shaft Pitch Dia	Hole and Shaft N	Hole and Shaft b, Deg	Hole and Shaft Theoretical Dig of Points OD	Hole and Shaft Theoretical Dig of Points RD	Hole Large Dia Min	Hole Small Dia Max	Hole Small Dia Min	Hole Dia Across Wires Min	Hole Dia Across Wires Max	Hole Wire Size, Wh	Hole Wc	Shaft Root Dia Max	Shaft Outside Dia Max	Outside Dia Min	Shaft Dia Across Wires Max	Shaft Dia Across Wires Min	Shaft Wire Size, Ws	Shaft Wc
1/8	0.122	36	80	0.1278	0.1162	0.125	0.118	0.117	0.1113	0.1124	0.0065	0.0026	0.116	0.124	0.123	0.1356	0.1347	0.0080	0.0024
3/16	0.182	36	80	0.1907	0.1733	0.187	0.176	0.175	0.1660	0.1671	0.0097	0.0026	0.174	0.186	0.185	0.2023	0.2014	0.0120	0.0024
1/4	0.243	36	80	0.2546	0.2314	0.250	0.235	0.234	0.2216	0.2227	0.0129	0.0026	0.233	0.249	0.248	0.2701	0.2692	0.0160	0.0024
5/16	0.303	36	80	0.3174	0.2886	0.312	0.293	0.292	0.2763	0.2774	0.0161	0.0026	0.291	0.311	0.310	0.3367	0.3358	0.0200	0.0024
3/8	0.363	36	80	0.3803	0.3457	0.375	0.352	0.351	0.3310	0.3321	0.0193	0.0026	0.350	0.374	0.373	0.4034	0.4025	0.0239	0.0024
1/2	0.485	36	80	0.5081	0.4619	0.500	0.469	0.468	0.4423	0.4434	0.0258	0.0026	0.467	0.499	0.498	0.5390	0.5381	0.0319	0.0024
5/8	0.605	36	80	0.6338	0.5762	0.625	0.584	0.583	0.5517	0.5528	0.0321	0.0026	0.582	0.624	0.623	0.6724	0.6715	0.0398	0.0024
3/4	0.733	48	82-1/2	0.7586	0.7074	0.750	0.716	0.714	0.6824	0.6835	0.0303	0.0025	0.713	0.749	0.747	0.7934	0.7925	0.0356	0.0024
7/8	0.855	48	82-1/2	0.8849	0.8251	0.875	0.835	0.833	0.7960	0.7971	0.0353	0.0025	0.832	0.874	0.872	0.9254	0.9245	0.0415	0.0024
1	0.977	48	82-1/2	1.0112	0.9428	1.000	0.954	0.952	0.9095	0.9106	0.0404	0.0025	0.951	0.999	0.997	1.0575	1.0566	0.0475	0.0024
1-1/8	1.098	48	82-1/2	1.1364	1.0596	1.125	1.071	1.069	1.0222	1.0233	0.0454	0.0025	1.068	1.124	1.122	1.1884	1.1875	0.0534	0.0024
1-1/4	1.220	48	82-1/2	1.2626	1.1773	1.250	1.190	1.188	1.1357	1.1368	0.0504	0.0025	1.187	1.249	1.247	1.3205	1.3196	0.0593	0.0024
1-3/8	1.342	48	82-1/2	1.3889	1.2951	1.375	1.309	1.307	1.2493	1.2504	0.0555	0.0025	1.306	1.374	1.372	1.4525	1.4516	0.0652	0.0024
1-1/2	1.464	48	82-1/2	1.5152	1.4128	1.500	1.428	1.426	1.3629	1.3640	0.0605	0.0025	1.425	1.499	1.497	1.5846	1.5837	0.0711	0.0024
1-3/4	1.708	48	82-1/2	1.7677	1.6483	1.750	1.666	1.664	1.5900	1.5911	0.0706	0.0025	1.663	1.749	1.747	1.8487	1.8478	0.0830	0.0024
2	1.952	48	82-1/2	2.0202	1.8838	2.000	1.904	1.902	1.8172	1.8188	0.0807	0.0025	1.901	1.999	1.997	2.1128	2.1114	0.0949	0.0024
2-1/4	2.196	48	82-1/2	2.2728	2.1192	2.250	2.142	2.140	2.0443	2.0459	0.0908	0.0025	2.139	2.249	2.247	2.3769	2.3755	0.1067	0.0024
2-1/2	2.440	48	82-1/2	2.5253	2.3547	2.500	2.380	2.378	2.2715	2.2731	0.1009	0.0025	2.377	2.499	2.497	2.6410	2.6396	0.1180	0.0024
2-3/4	2.684	48	82-1/2	2.7778	2.5902	2.750	2.618	2.616	2.4986	2.5002	0.1109	0.0025	2.615	2.749	2.747	2.9051	2.9037	0.1304	0.0024
3	2.928	48	82-1/2	3.0304	2.8256	3.000	2.856	2.854	2.7258	2.7274	0.1210	0.0025	2.853	2.999	2.997	3.1692	3.1678	0.1423	0.0024

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