

Piston Rings and Grooves

SAE Standard

Report of Miscellaneous Division approved AUGUST 1916
and last revised by Engineering Technical Committee June 1951.

These specifications for piston rings and grooves are in general use and have been adopted as an SAE Standard primarily for automotive engines. For pistons not of the conventional automotive type, it may be necessary to deviate from these specifications, but such deviations should be made in piston-groove specifications and not in ring specifications.

Groove-root diameters (Table 2) were calculated from the following formulas:

Compression-ring grooves

$$A = D (2T + 0.006D + 0.020)$$

Oil-ring grooves

$$A = D (2T + 0.006D + 0.060)$$

For all rings

$$B = A - 0.010$$

where A = high limit for groove-root diameter

B = low limit for groove-root diameter

D = nominal cylinder diameter

T = maximum ring wall

It is recommended that cylinder-diameter tolerance be specified as plus above the nominal diameter.

TABLE 1—Piston-Ring and Groove Widths, 2 In. to 8 In. in Diameter

NOMINAL RING WIDTH	RING WIDTHS, IN.			RING-GROOVE WIDTHS, IN.							
	All dia ^a	2 to 3 1/16 in. dia	4 to 8 in. dia	Compression-ring grooves				Oil-ring grooves			
				2 to 3 1/16 in. dia, ^b inclusive		4 to 8 in. dia, ^c inclusive		2 to 3 1/16 in. dia, inclusive		4 to 8 in. dia, inclusive	
				Max	Min	Max	Min	Max	Min	Max	Min
3/64	0.0470	0.0465	0.0460	0.0500	0.0490	—	—	—	—	—	—
1/16	0.0625	0.0620	0.0615	0.0655	0.0645	—	—	—	—	—	—
5/64	0.0780	0.0775	0.0770	0.0810	0.0800	—	—	—	—	—	—
3/32	0.0935	0.0930	0.0925	0.0965	0.0955	0.0970	0.0960	0.0960	0.0950	—	—
1/8	0.1240	0.1235	0.1230	0.1270	0.1260	0.1275	0.1265	0.1265	0.1255	—	—
5/32	0.1550	0.1545	0.1540	—	—	0.1585	0.1575	0.1575	0.1565	0.1580	0.1570
3/16	0.1865	0.1860	0.1855	—	—	0.1900	0.1890	0.1890	0.1880	0.1895	0.1885
1/4	0.2490	0.2485	0.2480	—	—	0.2525	0.2515	0.2515	0.2505	0.2520	0.2510

^a On side-coated rings 2 to 3 1/16 in., add 0.0005 to maximum ring width.

^b Add 0.0005 for torsional rings.

^c Add 0.001 for torsional rings.

TABLE 2—Piston-Ring Radial Wall Thickness* and Groove-Root Diameters

CYLINDER DIAMETER, IN.	MAXIMUM RING RADIAL WALL THICKNESS, IN.	MAXIMUM RING GROOVE-ROOT DIAMETER, IN.		CYLINDER DIAMETER, IN.	MAXIMUM RING RADIAL WALL THICKNESS, IN.	MAXIMUM RING GROOVE-ROOT DIAMETER, IN.	
		Compression rings	Oil rings			Compression rings	Oil rings
1	0.046	0.882	0.842	1 1/2	0.069	1.333	1.293
1 1/16	0.049	0.938	0.898	1 5/16	0.072	1.389	1.349
1 1/8	0.052	0.994	0.954	1 3/8	0.075	1.445	1.405
1 3/16	0.055	1.050	1.010	1 1/2	0.078	1.501	1.461
1 1/4	0.058	1.106	1.066	1 3/4	0.081	1.557	1.517
1 5/16	0.061	1.162	1.122	1 13/16	0.084	1.613	1.573
1 3/8	0.064	1.219	1.179	1 7/8	0.087	1.670	1.630
1 1/2	0.067	1.274	1.234	1 15/16	0.090	1.725	1.685

* Tolerance on ring thickness is not to exceed 0.010 up to 5 in. in diameter and not to exceed 0.025 over 5 in. in diameter.

(Table 2 continued on next page.)

PISTON RINGS AND GROOVES

TABLE 2—Piston-Ring Radial Wall Thickness* and Groove-Root Diameters (Concluded)

CYLINDER DIAMETER, IN.	MAXIMUM RING RADIAL WALL THICKNESS, IN.	MAXIMUM RING GROOVE-ROOT DIAMETER, IN.		CYLINDER DIAMETER, IN.	MAXIMUM RING RADIAL WALL THICKNESS, IN.	MAXIMUM RING GROOVE-ROOT DIAMETER, IN.	
		Compression rings	Oil rings			Compression rings	Oil rings
2	0.093	1.782	1.742	5	0.205	4.540	4.500
2 $\frac{1}{16}$	0.096	1.838	1.798	5 $\frac{1}{16}$	0.207	4.598	4.558
2 $\frac{1}{8}$	0.098	1.896	1.856	5 $\frac{1}{8}$	0.209	4.656	4.616
2 $\frac{3}{16}$	0.101	1.952	1.912	5 $\frac{3}{16}$	0.211	4.714	4.674
2 $\frac{1}{4}$	0.104	2.008	1.968	5 $\frac{1}{4}$	0.214	4.770	4.730
2 $\frac{5}{16}$	0.107	2.064	2.024	5 $\frac{5}{16}$	0.216	4.828	4.788
2 $\frac{3}{8}$	0.110	2.120	2.080	5 $\frac{3}{8}$	0.218	4.886	4.846
2 $\frac{7}{16}$	0.113	2.176	2.136	5 $\frac{7}{16}$	0.220	4.944	4.904
2 $\frac{1}{2}$	0.116	2.233	2.193	5 $\frac{1}{2}$	0.222	5.002	4.962
2 $\frac{9}{16}$	0.119	2.289	2.249	5 $\frac{9}{16}$	0.224	5.061	5.021
2 $\frac{5}{8}$	0.122	2.345	2.305	5 $\frac{5}{8}$	0.226	5.119	5.079
2 $\frac{11}{16}$	0.125	2.401	2.361	5 $\frac{11}{16}$	0.228	5.177	5.137
2 $\frac{3}{4}$	0.127	2.459	2.419	5 $\frac{3}{4}$	0.230	5.235	5.195
2 $\frac{13}{16}$	0.130	2.515	2.475	5 $\frac{13}{16}$	0.232	5.293	5.253
2 $\frac{7}{8}$	0.133	2.572	2.532	5 $\frac{7}{8}$	0.234	5.351	5.311
2 $\frac{15}{16}$	0.136	2.627	2.587	5 $\frac{15}{16}$	0.236	5.409	5.369
3	0.139	2.684	2.644	6	0.238	5.468	5.428
3 $\frac{1}{16}$	0.141	2.742	2.702	6 $\frac{1}{16}$	0.240	5.526	5.486
3 $\frac{1}{8}$	0.143	2.800	2.760	6 $\frac{1}{8}$	0.243	5.582	5.542
3 $\frac{3}{16}$	0.145	2.858	2.818	6 $\frac{3}{16}$	0.245	5.640	5.600
3 $\frac{1}{4}$	0.147	2.916	2.876	6 $\frac{1}{4}$	0.247	5.698	5.658
3 $\frac{5}{16}$	0.149	2.974	2.934	6 $\frac{5}{16}$	0.249	5.756	5.716
3 $\frac{3}{8}$	0.151	3.032	2.992	6 $\frac{3}{8}$	0.251	5.816	5.776
3 $\frac{7}{16}$	0.153	3.090	3.050	6 $\frac{7}{16}$	0.253	5.872	5.832
3 $\frac{1}{2}$	0.155	3.149	3.109	6 $\frac{1}{2}$	0.255	5.931	5.891
3 $\frac{9}{16}$	0.157	3.207	3.167	6 $\frac{9}{16}$	0.257	5.989	5.949
3 $\frac{5}{8}$	0.159	3.265	3.225	6 $\frac{5}{8}$	0.259	6.047	6.007
3 $\frac{11}{16}$	0.162	3.321	3.281	6 $\frac{11}{16}$	0.261	6.105	6.065
3 $\frac{3}{4}$	0.164	3.379	3.339	6 $\frac{3}{4}$	0.263	6.163	6.123
3 $\frac{13}{16}$	0.166	3.437	3.397	6 $\frac{13}{16}$	0.265	6.221	6.181
3 $\frac{7}{8}$	0.168	3.496	3.456	6 $\frac{7}{8}$	0.267	6.279	6.239
3 $\frac{15}{16}$	0.170	3.555	3.515	6 $\frac{15}{16}$	0.269	6.337	6.297
4	0.172	3.612	3.572	7	0.271	6.396	6.356
4 $\frac{1}{16}$	0.174	3.670	3.630	7 $\frac{1}{16}$	0.273	6.454	6.414
4 $\frac{1}{8}$	0.176	3.728	3.688	7 $\frac{1}{8}$	0.275	6.512	6.472
4 $\frac{3}{16}$	0.178	3.786	3.746	7 $\frac{3}{16}$	0.277	6.570	6.530
4 $\frac{1}{4}$	0.180	3.844	3.804	7 $\frac{1}{4}$	0.280	6.626	6.586
4 $\frac{5}{16}$	0.182	3.902	3.862	7 $\frac{5}{16}$	0.282	6.684	6.644
4 $\frac{3}{8}$	0.184	3.960	3.920	7 $\frac{3}{8}$	0.284	6.742	6.702
4 $\frac{7}{16}$	0.186	4.018	3.978	7 $\frac{7}{16}$	0.286	6.800	6.760
4 $\frac{1}{2}$	0.189	4.075	4.035	7 $\frac{1}{2}$	0.288	6.859	6.819
4 $\frac{9}{16}$	0.191	4.133	4.093	7 $\frac{9}{16}$	0.290	6.917	6.877
4 $\frac{5}{8}$	0.193	4.191	4.151	7 $\frac{5}{8}$	0.292	6.975	6.935
4 $\frac{11}{16}$	0.195	4.249	4.209	7 $\frac{11}{16}$	0.294	7.033	6.993
4 $\frac{3}{4}$	0.197	4.307	4.267	7 $\frac{3}{4}$	0.296	7.091	7.051
4 $\frac{13}{16}$	0.199	4.365	4.325	7 $\frac{13}{16}$	0.299	7.147	7.107
4 $\frac{7}{8}$	0.201	4.423	4.383	7 $\frac{7}{8}$	0.301	7.205	7.165
4 $\frac{15}{16}$	0.203	4.481	4.441	7 $\frac{15}{16}$	0.303	7.263	7.223
				8	0.305	7.322	7.282

* Tolerance on ring thickness is not to exceed 0.010 up to 5 in. in diameter and not to exceed 0.025 over 5 in. in diameter.

PISTON RINGS AND GROOVES

TABLE 3—Piston-Ring Radial Wall Thickness and Groove-Root Diameters for Thick-Wall Compression Rings^a 1/8 In. or Less in Width

CYLINDER DIAMETER, IN.	MAXIMUM RING RADIAL WALL THICKNESS, IN. 0.000-0.010	MAXIMUM RING GROOVE-ROOT DIAMETER, IN. (COMPRESSION RINGS ONLY)	CYLINDER DIAMETER, IN.	MAXIMUM RING RADIAL WALL THICKNESS, IN. 0.000-0.010	MAXIMUM RING GROOVE-ROOT DIAMETER, IN. (COMPRESSION RINGS ONLY)
3	0.150	2.662	4	0.200	3.556
3 1/16	0.153	2.718	4 1/16	0.203	3.612
3 1/8	0.156	2.774	4 1/8	0.206	3.668
3 3/16	0.159	2.830	4 3/16	0.209	3.724
3 1/4	0.162	2.886	4 1/4	0.212	3.780
3 5/16	0.166	2.940	4 5/16	0.216	3.834
3 3/8	0.169	2.997	4 3/8	0.219	3.891
3 7/16	0.172	3.052	4 7/16	0.222	3.946
3 1/2	0.175	3.109	4 1/2	0.225	4.003
3 5/8	0.178	3.165	4 5/8	0.228	4.059
3 3/4	0.181	3.221	4 3/4	0.231	4.115
3 11/16	0.184	3.277	4 11/16	0.234	4.171
3 1/2	0.187	3.333	4 1/2	0.237	4.227
3 13/16	0.191	3.387	4 13/16	0.241	4.281
3 7/8	0.194	3.444	4 7/8	0.244	4.338
3 15/16	0.197	3.499	4 15/16	0.247	4.393
			5	0.250	4.450

^a Thick-wall specifications are applicable to compression-ring type only. Thick-wall rings are for use in high-output applications, in top compression-ring grooves. Thick-wall are recommended from 3 to 5 in. diameter and 3/32 in. width or less. Rings 1/8 in. wide may be used from 4 to 5 in. diameter inclusive.

TABLE 4—Minimum Width of Piston Lands Between Rings

CYLINDER DIAMETER, IN.	LAND WIDTH, IN.
2 to 2 1/32 inclusive	3/32
3 to 3 1/32 inclusive	1/8
4 to 4 1/32 inclusive	5/32
5 to 5 1/32 inclusive	3/16
6 to 8 inclusive	1/4

Piston-ring end clearance must be determined from the minimum cylinder diameter. It is recommended that end clearance for rings in automotive engines be as given in table 5.

TABLE 5—Ring End Clearances

CYLINDER DIAMETER, IN.	END CLEARANCE, IN.
1 to 1 1/32 inclusive	0.005 to 0.013
2 to 2 1/32 inclusive	0.007 to 0.017
3 to 3 1/32 inclusive	0.010 to 0.020
4 to 4 1/32 inclusive	0.013 to 0.025
5 to 5 1/32 inclusive	0.017 to 0.032
7 to 8 inclusive	0.023 to 0.040

TABLE 6—Size of Oil-Ring-Groove Drain Holes

NOMINAL RING WIDTH, IN.	DRILL-HOLE DIAMETER, IN.
1/8	3/32
5/32	1/8
3/16	5/32
1/4	7/32

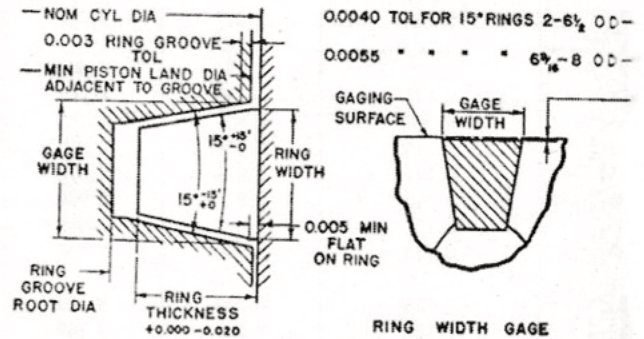


FIG. 1—KEYSTONE-RING DIMENSIONS AND TOLERANCES

TABLE 7—Dimensions of Keystone Rings^a (Fig. 1)

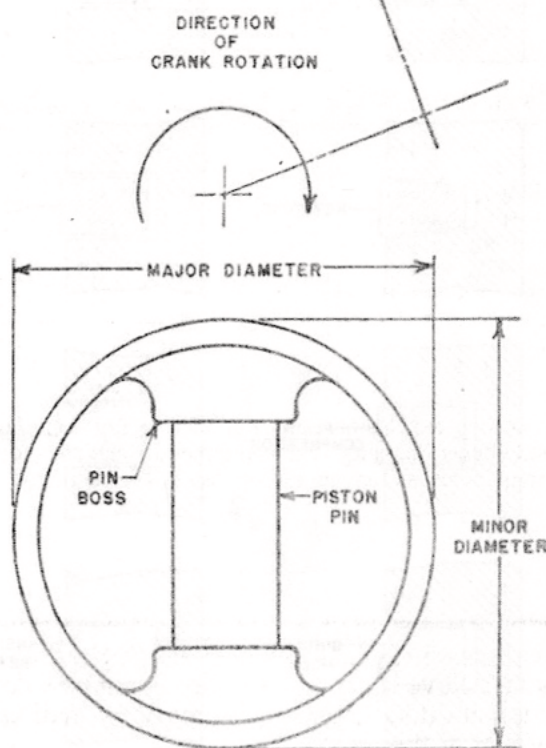
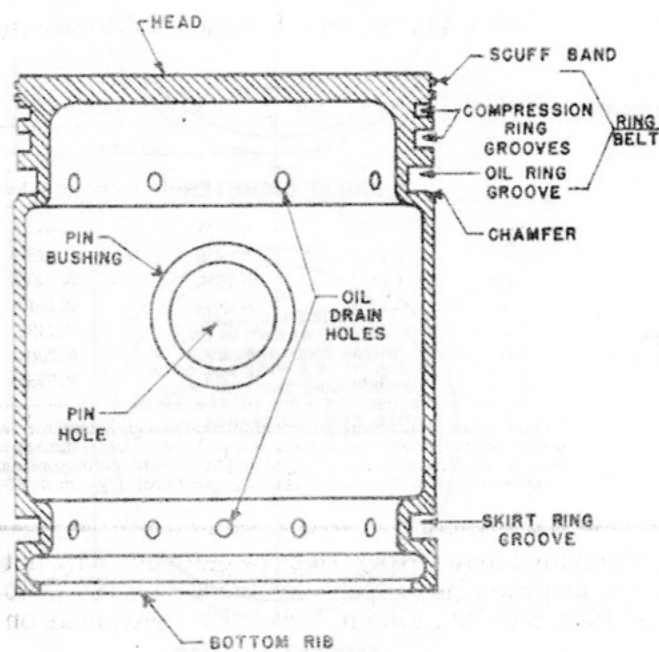
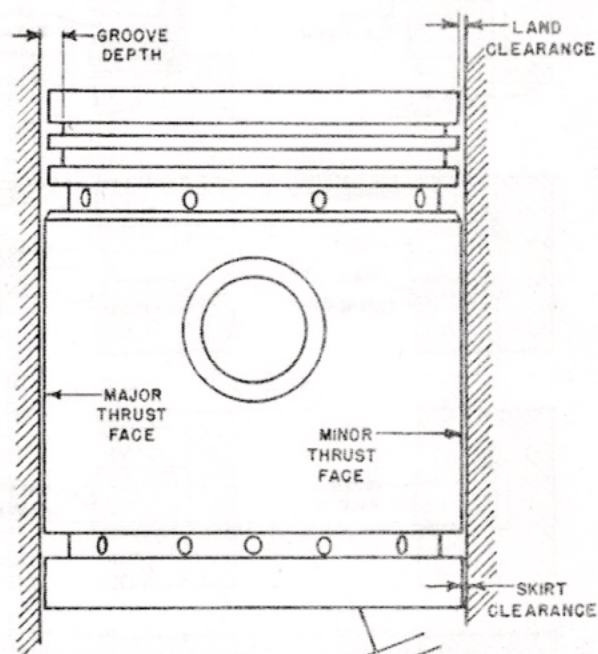
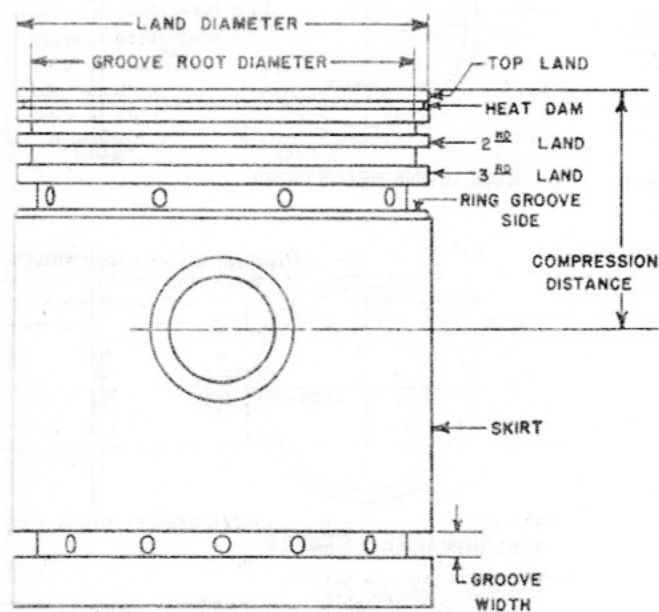
NOMINAL RING SIZE	GAGE WIDTH	RING WIDTH	
		2 to 6 1/2 in. diameter	6 1/2 to 8 in. diameter
3/32	0.0935	0.0890	—
1/8	0.1240	0.1195	0.1185
5/32	0.1550	0.1505	0.1495
3/16	0.1865	0.1820	0.1810
1/4	0.2490	0.2445	0.2435
5/16	0.3115	0.3070	0.3060
3/8	0.3740	0.3696	0.3685

^a The keystone type of ring is commonly used in high-output internal-combustion engines where ring sticking is a problem. These standards are recommended where this ring is considered but should not be construed as a recommendation for this type of ring if conventional rings are satisfactory.

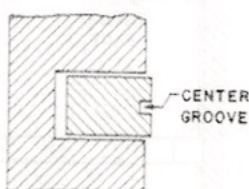
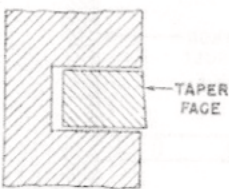
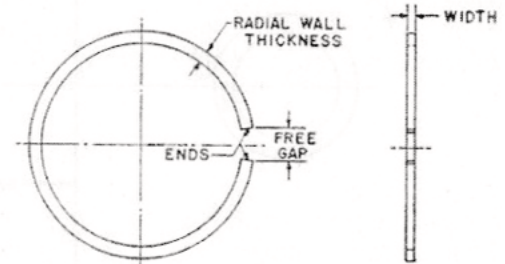
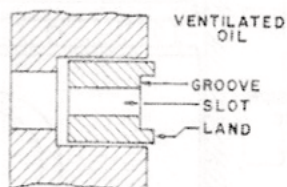
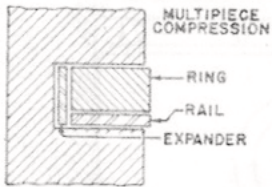
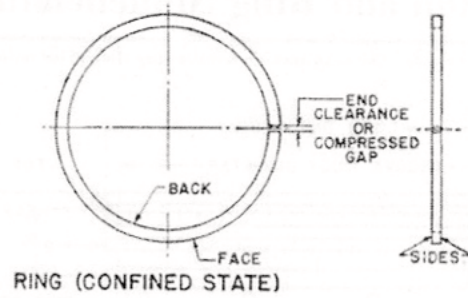
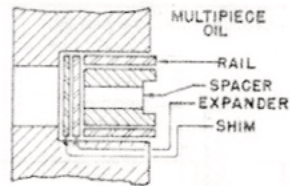
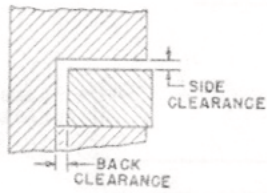
Need piston rings? Have questions? Need more information about piston rings or grooves? Why not contact Dave Reed at Otto Gas Engine Works. He is the piston ring expert! By phone 410-398-7340, by e-mail at otto@ringspacers.com or by mail at 2167 Blue Ball Rd., Elkton, MD 21921. See his ad on page 49 of this issue.

Piston and Ring Nomenclature SAE Recommended Practice

Report of Gasoline Engine Division approved January 1944 and last revised by Engine Technical Committee June 1951.



COMMON TYPES OF RINGS IN GENERAL USE:



RING (FREE STATE)

