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CAST IRON SEALING RINGS—SAE J281 SEP80

SAE R c mm nded Practice

Report of the Transmission and Drivetrain Technical Committee, approved February 1972, editorial change September 1980. For information on Sealing Rings—Cast Iron, having metric dimensions, refer to SAE J1236 (August, 1977)

1. Purpose—The purpose of this SAE Recommended Practice is to establish specifications for use as a guide to the automatic transmission and hydraulic systems designer, helping him to select cast iron sealing ring width, thickness, coatings, and other accepted design details.

2. Materials—Cast iron sealing rings are generally made from gray cast iron piston ring material. As stated in SAE J929a (September, 1976), "Gray cast iron piston ring material is used for general automotive applications. Gray cast iron piston rings are made with a high carbon equivalent iron and with casting techniques that promote, in the small section castings, the most desirable graphite and matrix microstructural conditions for wear resistance and adequate mechanical and physical properties. The chemical element ranges shown represent typical chemical compositions for gray cast iron piston rings."

2.1 Composition

Elements	%
Total carbon	3.50–3 95
Silicon	2 20–3 10
Manganese	0.40–0.80
Phosphorus	0.30–0 80
Sulfur	0.13 max

Alloying elements such as chromium, copper, molybdenum, vanadium, tin, etc., may be added to enhance the material properties or improve the material for special applications.

2.2 Hardness—Rockwell B 95–107

2.3 Microstructure—Gray cast iron piston rings are made to present an abrasion resistant matrix combined with the best graphite attainable in gray iron for mechanical and physical properties.

The matrix is essentially completely pearlitic or sorbitic with a minimum of free ferrite and massive cementite. The phosphorus constituent, steadite, is uniformly distributed in nonmassive particles.

The graphite will consist principally of randomly oriented flakes that are described as AFS-ASTM Type A or A-B combination The graphite particles will normally be of AFS-ASTM sizes 4-8.

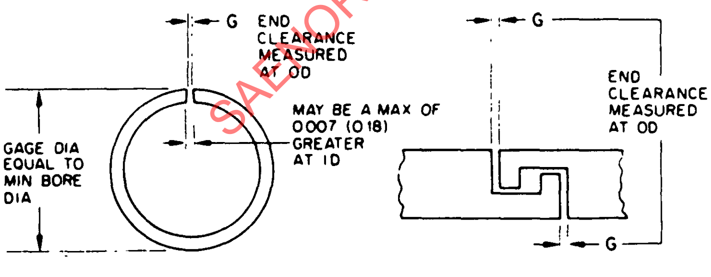
3. Application Design Data

3.1 Surface Finish and Coatings—Sealing rings are usually phosphate or oxide coated. Occasionally, they are used uncoated or covered with a flash of tin or other metallic plating. Ring side finish to be 10-35 MK before coating. OD and ID are to be smooth-turned before coating.

3.2 Axial Width—The widths shown in Table 1 apply to finished rings.

TABLE 1

Nominal Width		Seal Ring Width	
in	mm	in	mm
Under 5 in (127 mm) in diameter			
3 32	2 4	0 0925–0.0935	2.350–2.375
1 8	3 2	0 123–0 124	3.124–3 150
3 16	4 8	0 1855–0.1865	4.712–4.737
1 4	6 4	0 248–0.249	6.299–6 325
5 in (127 mm) in diameter and up			
1 8	3 2	0.1225–0.124	3 112–3 150
3 16	4 8	0.185–0 1865	4.699–4 737
1 4	6.4	0 2475–0 249	6 287–6 325



Nominal Bore Diameter		G, End Clearance or Compressed Gap			
		Butt Joint Rings		Hook Joint Rings	
in	mm	in	mm	in	mm
Under 3.000	Under 76.20	0.002–0.007	0.05–0.18	0.002–0.012	0.05–0.30
3.000–5.999	76.20–152.37	0.002–0.010	0.05–0.25	0.002–0.012	0.05–0.30
6.000 and up	152.40 and up	0.002–0.012	0.05–0.30	0.002–0.017	0.05–0.43

FIG. 1

This includes uncoated rings, rings that are surface treated, and rings that are flash-coated to a maximum depth of 0.0004 in (0.01 mm).

Rings with more than 0.0004 in (0.01 mm) coating will have the same maximum finished width, but the low limit will be determined by the coating thickness tolerance.

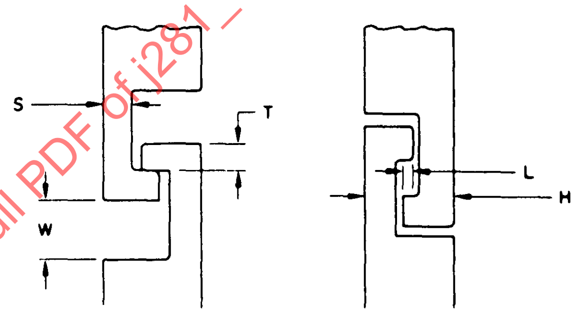
Other widths may be necessary for special applications.

3.3 Radial Wall Thickness—It is recommended that sealing ring radial wall thicknesses do not exceed the SAE regular radial wall thicknesses as shown in SAE J929a (September, 1976), Table 2. If a somewhat thinner section is desired to minimize groove depths and shaft diameters, a ring manufacturer should be consulted so that a radial wall thickness can be recommended which will still give good sealing characteristics along with the reduced thickness.

3.4 End Clearance or Compressed Gap—This recommended practice applies to butt joint and hook joint rings. The tolerance required for manufacture increases as the ring diameters get larger. The smallest recommended clearance is 0.002 in (0.05 mm), which should be measured at the OD of the ring in a gage of minimum bore diameter as illustrated in Fig. 1.

3.5 Hook Joint Details—Hook joint rings are used when assistance is needed in blind assembly operations. The direction of the hooks is optional as shown in Fig 2. Also shown are the other necessary hook dimensions.

3.6 Groove Root Diameter and Side Clearance—The ring groove must



H = WIDTH OVER HOOKS IN HOOKED POSITION (MUST BE LESS THAN RING WIDTH AT ANY OTHER POINT)
L = 0.010 IN (0.25 MM), MIN
T = 0.015 IN (0.38 MM), MIN
W = 0.030 IN (0.76 MM), MIN*
S = 0.028 IN (0.71 MM), MIN, FOR 3/32 IN (2.4 MM) RINGS
= 0.043 IN (1.09 MM), MIN, FOR 1/8 IN (3.2 MM) RINGS
= 0.073 IN (1.85 MM), MIN, FOR 3/16 IN (4.8 MM) RING WIDTH
= 0.098 IN (2.49 MM), MIN, FOR 1/4 IN (6.4 MM) RING WIDTH

*LONGER HOOKS WITH A WEAR LENGTH, W, OF 0.050 IN (1.27 MM) MINIMUM ARE AVAILABLE ON LARGER DIAMETER RINGS. IT IS RECOMMENDED THAT THE 0.050 IN (1.27 MM) DIMENSION NOT BE USED ON RINGS UNDER 3.0 IN (76.2 MM) IN DIAMETER.

FIG. 2

in	mm
Given: $B = 1.989–1\ 990$	Given: $B = 50.52–50.54$
$C = 1\ 980–1\ 985$	$C = 50.29–50.42$
$e = 0.0025$ max	$e = 0.06?$ max
$f = 0\ 010$ max	$f = 0.25$ max
$t = 0\ 080–0.090$	$t = 2.03–2.29$
$Z = 2.125$ max	$Z = 53.98$ max
Check: $B_{min} - C_{max} \geq 0\ 004$	Check: $B_{min} - C_{max} \geq 0.10$
$1.989 - 1.985 = 0\ 004$	$50.52 - 50.42 = 0.10$
$GRD_{max} = C_{min} - 2(t_{max} + e + f)$	$GRD_{max} = C_{min} - 2(t_{max} + e + f)$
$= 1\ 980 - 2(0.090 + 0.0025 + 0.010)$	$= 50.29 - 2(2.29 + 0.065 + 0.25)$
$= 1.980 - 0.2050$	$= 50.29 - 5.21$
$GRD_{max} = 1\ 775$	$GRD_{max} = 45.08$
$GRD_{min} = GRD_{max} - 0\ 010$	$GRD_{min} = GRD_{max} - 0.25$
$= 1\ 775 - 0\ 010 = 1.765$	$= 45.08 - 0.25 = 44.83$
$x_{max} = Z_{max} - \left(\frac{GRD_{min} + C_{min}}{2} + t_{min} - e_{max}\right)$	$x_{max} = Z_{max} - \left(\frac{GRD_{min} + C_{min}}{2} + t_{min} - e_{max}\right)$
$x_{max} = 2.125 - \left(\frac{1.765 + 1.980}{2} + 0.080 - 0.0025\right)$	$x_{max} = 53.98 - \left(\frac{44.83 + 50.29}{2} + 2.03 - 0.065\right)$
$x_{max} = 2\ 125 - 1.950$	$x_{max} = 53.98 - 49.525$
$x_{max} = 0.175$	$x_{max} = 4.46$
$X_{min} = B_{max} + 2x_{max}$	$X_{min} = B_{max} + 2x_{max}$
$= 1.990 + 0.350$	$= 50.54 + 8.92$
$X_{min} = 2.340$	$X_{min} = 59.46$