

Static and Reciprocating Elastomeric Transmission Seals

1. **Scope**—This SAE Recommended Practice is intended as a guide to the design and use of static and reciprocating elastomeric transmission seals. It has been prepared from existing literature, which includes standards, specifications, and catalog data of both producers and users and includes generally-accepted information and data. The main reason for the preparation of the document is to make standard information available in one document to the users of static and reciprocating elastomeric transmission seals.
2. **References**—There are no referenced publications specified herein.
3. **Seals—Rectangular**—Rectangular seals (Reference Figures 1 to 4) are elastomeric seals confined to their sealing location by part of the application hardware. Rectangular seals are used where bi-directional sealing is required. Some caution should be exercised when using rectangular seals for low dynamic friction applications since excessive displacement of the seal may cause undesirable high seal drag. These seals are produced by lathe cutting either molded or extruded tubing.

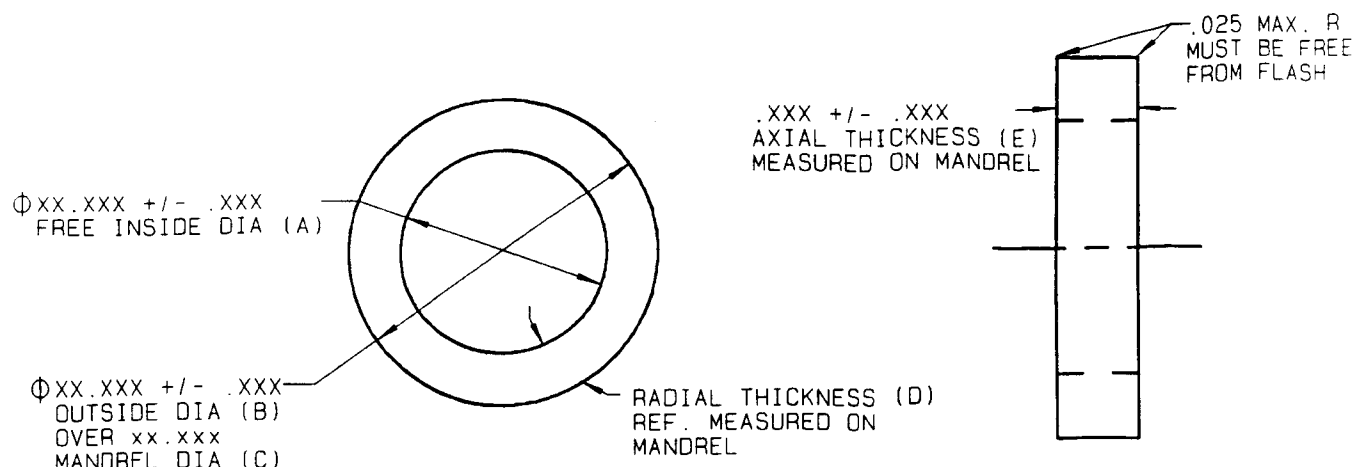


FIGURE 1—TYPICAL RECTANGULAR SEAL DESIGN

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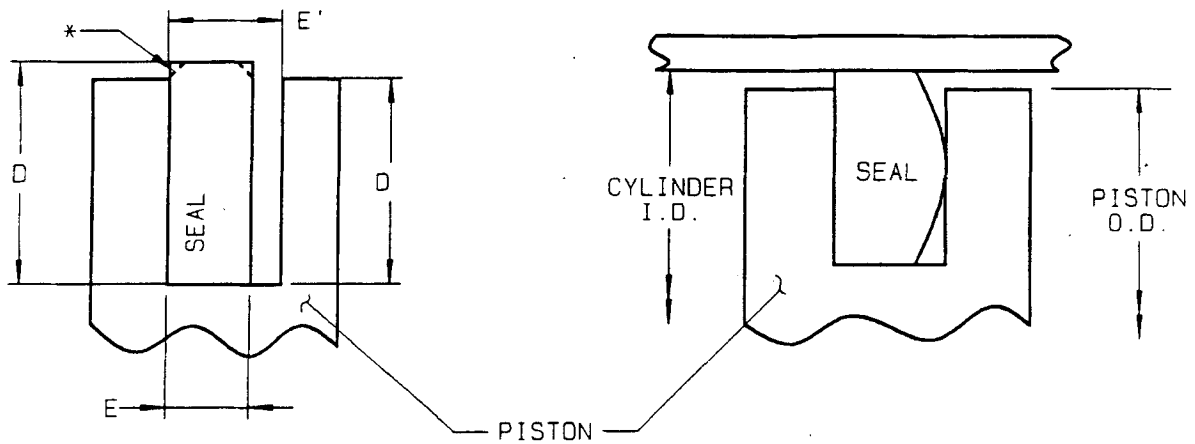
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* OPTIONAL .75mm X 45° CHAM. TO AID ASSEMBLY OR REDUCE DYNAMIC FRICTION

FIGURE 2—RECTANGULAR SEAL—DYNAMIC SEAL APPLICATION

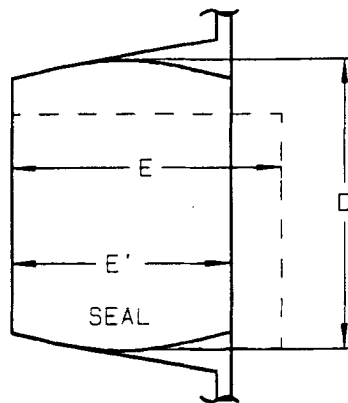


FIGURE 3—RECTANGULAR SEAL STATIC APPLICATION

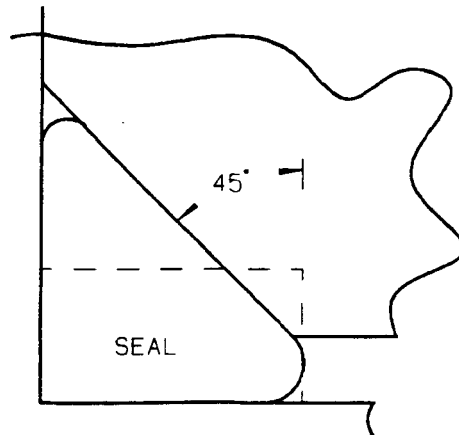


FIGURE 4—RECTANGULAR SEAL STATIC APPLICATION

3.1 Suggested Tolerances and Dimensioning Practices—A typical design of a rectangular seal is shown in Figure 1. Table 1 lists the actual tolerances for different size ranges. The design parameters are:

- 3.1.1 Inspection mandrel diameter (C) should be equal to the external groove diameter and should be approximately 4% greater than the free inside diameter (A).
- 3.1.2 Outside diameter (B) is equal to mandrel diameter (C) plus twice the stretched radial thickness of the seal.
- 3.1.3 Variation of the total radial thickness tolerance shall not occur in less than 90 degrees of circumference and rate of change shall be uniform over this distance.
- 3.1.4 The tolerances in Table 1 apply to all nitrile rubber.
- 3.1.5 For post cured compounds, the tolerances in Table 1 also apply except for free inside diameter which has $\pm 0.6\%$ applied with a minimum tolerance of ± 0.2 mm under 25 mm and a minimum tolerance of ± 0.25 mm over 25 mm.

TABLE 1—RECTANGULAR SEAL TOLERANCES—mm

A, ID or B, OD Size	A, Free ID	C, OD Over Mandrel	D, Radial Thickness	E, Axial Thickness
Up to 25 mm	± 0.20	± 0.20	± 0.10	± 0.13
25 mm to 75 mm	± 0.25	± 0.20	± 0.10	± 0.13
75 mm and Up	$\pm 0.4\%$	± 0.20	± 0.10	± 0.13

3.2 Application Design Data

- 3.2.1 **DYNAMIC**—The rectangular seal shown in Figure 2 represents a dynamic seal application. The design parameters are:
 - 3.2.1.1 The cross-sectional area of the seal ($E \times D$) shall be approximately 20% less than the cross-sectional area of the groove ($E' \times D'$).
 - 3.2.1.2 The radial thickness (D) of the seal shall be approximately 10% greater than the groove depth (D') to place the seal under 10% radial displacement. In some applications, frictional drag may dictate reduction of the 10% radial displacement value.
 - 3.2.1.3 The axial thickness of the seal (E) must be at least two times the maximum possible clearance between the piston outside diameter and cylinder inside diameter.
 - 3.2.1.4 The radial thickness (D) of the seal typically is at least twice as great as the width (E).
 - 3.2.1.5 The maximum diametrical clearance between cylinder and piston must not exceed 0.5 mm.
 - 3.2.1.6 The seal shall have approximately 4% stretch when installed into an OD groove and 4% displacement when installed into an ID groove.
- 3.2.2 **STATIC**—The rectangular seals shown in Figures 3 and 4 represent static seal designs. The design parameters are:
 - 3.2.2.1 The maximum cross-sectional area of a rubber seal shall not exceed 95% of the minimum cross-sectional area of the groove for a completely constrained seal (Figure 3).