Custom Groove Dimensions

Contents

There are times when using standard seal groove dimensions is not an option. Whether it is for cylinders that have been refinished or off sized metal, there are some simple calculations to use to determine what the appropriate groove dimensions should be. The formulas for calculating custom groove dimensions are included below.

Piston Gland Custom Groove Calculation

Subtract the standard bore diameter from the next smallest standard bore diameter to determine the Offset Factor. Apply the Offset Factor to the Groove Diameter, ***X***, and the Shoulder Diameter, ***Y***, as shown below. Groove Width, ***Z***, will remain unchanged.

Offset Factor Diameter:

$$\left(\begin{matrix}Offset\\Factor\end{matrix}\right) = \left(\begin{matrix}Required\\Bore\ Diameter\end{matrix}\right) - \left(\begin{matrix}Standard\\Bore\ Diameter\end{matrix}\right)$$

New Groove Diameter, ***X***:

$$X = \left(\begin{matrix}Standard\\Groove\ Diameter\end{matrix}\right) + \left(\begin{matrix}Offset\\Factor\end{matrix}\right)$$

New Piston Diameter, ***Y***:

$$Y = \left(\begin{matrix}Standard\\Piston\ Diameter\end{matrix}\right) + \left(\begin{matrix}Offset\\Factor\end{matrix}\right)$$

If the required diameter is smaller than the standard diameter, a negative Offset Factor will be calculated, and the piston seal will be compressed. In most circumstances, Parker advises against compressing smaller sizes of piston seals to fit oversized bores. Please contact your local Parker representative for assistance in these cases.

IMPORTANT: It is necessary to calculate the additional stretch that the piston seal will be subjected to. Do this by using the equation below:

$$\left(\begin{matrix}Additional\\Stretch\ \%\end{matrix}\right) = \left(\frac{Offset\ Factor}{Standard\ Bore\ Diameter}\right) X\ 100$$

Parker recommends that the Additional Stretch Percentage not exceed 5%. If this percentage does exceed 5%, please contact your local Parker representative for assistance.

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Rod Seal and Rod Wiper Custom Groove Calculation

Subtract the required rod diameter from the next largest standard rod diameter to determine the Offset Factor. Apply the Offset Factor to the Groove Diameter, ***X***, and the Throat Diameter, ***Y***, as shown below. Groove Width, ***Z***, will remain unchanged.

Offset Factor Diameter

$$\left(\begin{matrix}\text{Offset}\\ \text{Factor}\end{matrix}\right) = \left(\begin{matrix}\text{Standard}\\ \text{Rod Diameter}\end{matrix}\right) - \left(\begin{matrix}\text{Required}\\ \text{Rod Diameter}\end{matrix}\right)$$

New Groove Diameter, ***X***:

$$X = \left(\begin{matrix}\text{Standard}\\ \text{Groove Diameter}\end{matrix}\right) - \left(\begin{matrix}\text{Offset}\\ \text{Factor}\end{matrix}\right)$$

New Shoulder Diameter, ***Y***:

$$Y = \left(\begin{matrix}\text{Standard}\\ \text{Shoulder Diameter}\end{matrix}\right) - \left(\begin{matrix}\text{Offset}\\ \text{Factor}\end{matrix}\right)$$

If the required diameter is larger than the standard diameter, a negative Offset Factor will be calculated, and the rod seal will be stretched. In most circumstances, Parker advises against stretching smaller sizes of rod seals to fit oversized rods. Please contact your local Parker representative for assistance in these cases.

IMPORTANT: It is necessary to calculate the additional compression that the rod seal will be subjected to. Do this by using the equation below:

$$\left(\begin{matrix}\text{Additional}\\ \text{Compression \%}\end{matrix}\right) = \left(\frac{\text{Offset Factor}}{\text{Standard Bore Diameter}}\right) \text{X } 100$$

Parker recommends that the Additional Compression Percentage not exceed 2%. If this percentage does exceed 2%, please contact your local Parker representative for assistance.

Piston Wear Ring / Bearing Groove Calculation

The formula for calculating piston wear ring grooves using alternative extrusion gaps, metal-to-metal clearances and machining tolerances:

1. Maximum Groove Diameter, ***B***:

$$B = \left(\begin{matrix}\text{Minimum Bore}\\ \text{Diameter, A}\end{matrix}\right) - .001" = 2 \text{ X } \left(\begin{matrix}\text{Max. Cross}\\ \text{Section}\end{matrix}\right)$$

2. Minimum Groove Diameter:

$$\left(\begin{matrix}\text{Minimum}\\ \text{Groove Diameter}\end{matrix}\right) = B - \left(\begin{matrix}\text{Machining}\\ \text{Tolerances}\end{matrix}\right)$$

3. Maximum Piston Diameter, ***C***:

$$C = \left(\begin{matrix}\text{Min. Groove}\\ \text{Diameter}\end{matrix}\right) + 2 \text{ X} \left(\begin{matrix}\text{Min. Cross}\\ \text{Section}\end{matrix}\right) - 2 \text{ X} \left(\begin{matrix}\text{Desired Min. Radial}\\ \text{Metal-to-Metal Clearance}\end{matrix}\right)$$

4. ***D*** = (Nominal Width, ***W***) + .010"

$$D = \left(\text{Nominal Width, } W\right) + \left(.010"\right)$$

Notes:
1. Tolerance for dimension D is +.010" / -.000"
2. Groove radii must not exceed .015" max.
3. Parker recommends a minimum .005" radial metal-to-metal clearance. Using the above equations may result in metal-to-metal contact if the material's compressive properties are not considered, contact your local Parker representative for assistance.

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Rod Wear Ring Groove Calculation

The formula for calculating rod wear ring grooves using alternative extrusion gaps metal-to-metal clearances and machining tolerances:

5. Maximum Groove Diameter, ***B1***:

$$B1 = \left(\begin{matrix}\text{Minimum Rod}\\ \text{Diameter, A1}\end{matrix}\right) + .001" = 2 \times \left(\begin{matrix}\text{Max. Cross}\\ \text{Section}\end{matrix}\right)$$

6. Maximum Groove Diameter:

$$\left(\begin{matrix}\text{Minimum}\\ \text{Groove Diameter}\end{matrix}\right) = B1 + \left(\begin{matrix}\text{Machining}\\ \text{Tolerances}\end{matrix}\right)$$

7. Miniimum Throat Diameter, ***C1***:

$$C1 = \left(\begin{matrix}\text{Max. Groove}\\ \text{Diameter}\end{matrix}\right) - 2 \times \left(\begin{matrix}\text{Min. Cross}\\ \text{Section}\end{matrix}\right) + 2 \times \left(\begin{matrix}\text{Desired Min. Radial}\\ \text{Metal-to-Metal Clearance}\end{matrix}\right)$$

8. ***D*** = (Nominal Width, ***W***) + .010"

$$D = \left(\text{Nominal Width, } W\right) + \left(.010"\right)$$

Notes:

5. Tolerance for dimension ***D*** is +.010" / -.000"
6. Groove radii must not exceed .015" max.
3. Parker recommends a minimum .005" radial metal-to-metal clearance. Using the above equations may result in metal-to-metal contact if the material's compressive properties are not considered, contact your local Parker representative for assistance.

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