



Beveled Retaining Rings

Beveled rings are designed to function in the groove when positioned within a range of seating depths from the bottom of the groove (maximum insertion) to a recommended position of half way up the groove depth (minimum insertion). The complementary groove and ring bevel allow the ring to function like a wedge when it makes contact with the retained part. The ring exerts an axial force against the retained part, taking up the play and, consequently, reducing the clearance between parts to zero.

If the sum of the assembly tolerances consisting of the retained part width (B), the groove location (A) and the ring beveled edge (U) exceed the end play take-up capacity of the ring, two conditions may potentially occur:

1. The ring will be seated less than half way down the groove depth, compromising the thrust load capacity of the assembly.
2. The ring will be seated at the groove bottom and play will be present.

Groove Location—(Refer to the above drawings)

The outer groove wall with the beveled edge locates the groove. The distance from a fixed shoulder to the outer beveled groove wall is A. The machining tolerance associated with locating the groove is ΔA . The width of the retained part/parts is B. U is the beveled thickness at the base of the bevel and is specified in our VHO and VSH specification tables.

Determining Ring Feasibility

The feasibility of a beveled ring should be evaluated first. The built-up tolerances of the system must be less than or equal to the take-up capacity of the ring. For example: A bearing must be retained on a 3" shaft using a VSH-300 Rotor Clip retaining ring. The bearing width is 1.000/0.995. Before the location can be determined, we would need to know the acceptable machining tolerance (ΔA), which we will designate as +.003/-.000 for the sake of this example. Compute the sum of the tolerances:

ΔB (Bearing Width Tolerance Range) = $B_{max} - B_{min}$.005
ΔA (Acceptable Machining Tolerance Range) = $A_{max} - A_{min}$.003
ΔU (Beveled End Thickness Tolerance Range from catalog spec) = $U_{max} - U_{min}$.004
$\Sigma \Delta =$.012

The sum of the tolerances is less than the take-up capacity of the ring (.0135), confirming the fact that the ring will in all assemblies seat within the acceptable limits of half way down to all of the way down the groove.

Computing Groove Location

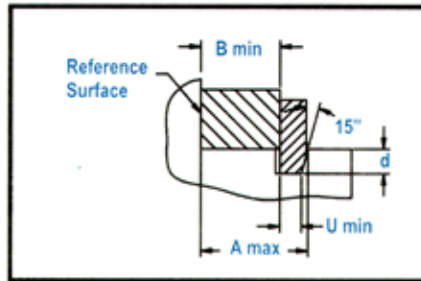
The following equations determine the distance from the defined shoulder (plane of reference) to the top of the far groove wall (A):

$$A_{min} \geq B_{max} + U_{max} + d/2 \tan 15$$

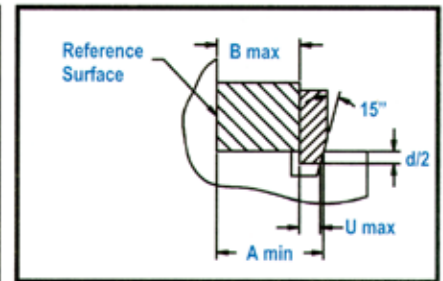
(Corresponding to minimum groove engagement)

$$A_{max} \leq B_{min} + U_{min} + d \tan 15$$

(Corresponding to maximum groove engagement)



Maximum insertion of a beveled retaining ring.



Minimum insertion of a beveled retaining ring.

Using the values from the above example, we compute A_{min} and A_{max} as follows:

$$A_{min} \geq 1.000 + .073 + .102/2 \tan 15$$

(Note: .073 U value and .102 d value, per catalog spec)

$$A_{min} \geq 1.087$$

$$A_{max} \leq .995 + .069 + .102 \tan 15$$

$$A_{max} \leq 1.091$$

$$A_{nom} = (A_{max} + A_{min})/2 \quad - \quad (A_{max} - A_{min})/2$$

$$A \Leftrightarrow 1.089 - .002$$

Reviewing our stack up of tolerances, we assumed .003" for machining. Our calculated groove location allows for more leniency (.004") in the tolerance. Checking the $\Sigma \Delta$ again, we find the assembly is still within the .0135 limit for end play take-up.

From known ring dimensions, retained part dimension(s), required groove depth and designated machining tolerance, the groove can be easily located for assemblies meeting the primary requirement $\Sigma \Delta \leq d/2 \tan 15$.

If assembly tolerances exceed the capacity of the ring, contact Rotor Clip Technical Sales for further assistance.

1-800-55-ROTOR