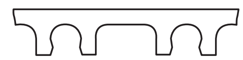
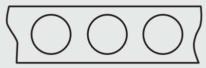
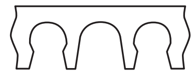
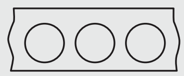
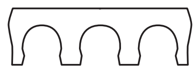
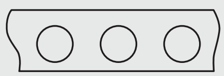
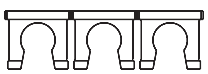
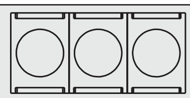
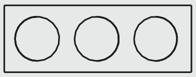
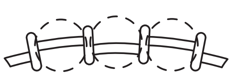
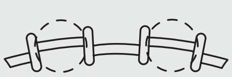
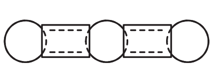
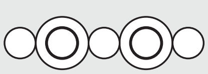
Overview of Separator Types Used in REALI-SLIM® Bearings

Code Letter*	Description	Design Features	Precautions	Material	Design
P	One piece formed ring with “snapover” pockets.	Standard ball complement. Used in Type C and X bearings for “KA” through “KG” cross-section bearings.	Commercial type cage, not recommended for low torque applications. Consult factory for temperatures below -65°F and above 250°F.	Brass or non-metallic composite.	
R	One piece formed ring with circular pockets.	Standard ball complement. Used in Type A bearings for “KA” through “KG” cross-section bearings.	Commercial type cage, not recommended for low torque applications. Consult factory for temperatures below -65°F and above 250°F.	Brass or non-metallic composite.	
L	One piece molded ring with “snapover” pockets.	Standard ball complement. Used in Type C and X KAA cross-section bearings.	Consult factory for temperatures below -65°F and above 250°F.	Nylon. Fiberglass reinforced.	
G	One piece molded ring with circular pockets.	Standard ball complement. Used in Type A KAA cross-section bearings.	Consult factory for temperatures below -65°F and above 250°F.	Nylon. Fiberglass reinforced.	
D	One piece machined ring with “snapover” pockets.	Standard ball complement. Used in Type C and X bearing when low torque, lightweight or vacuum impregnation is required.	Not recommended above 250°F. Longer lead time and higher cost than “P” type separators.	Phenolic laminate.	
H	One piece machined ring with circular pockets.	Standard ball complement. Used in Type A bearing when low torque, lightweight or vacuum impregnation is required.	Not recommended above 250°F. Longer lead time and higher cost than “R” type separators. Use toroid ball spacer when possible.	Phenolic laminate.	
N	Molded strip with “snap over” pockets	Slightly higher ball count, used in Type C and X bearings. Available for all diameters over 4 inches.	Shaft or housing protrusions can grab separator and remove from bearing. 180°F max suggested operating temp.	Nylon 12	
J	Molded strip with circular pockets	Slightly higher ball count, used in Type A bearings. Available for all diameters over 4 inches.	180°F max suggested operating temp.	Nylon 12	
X	One piece molded ring with “snap over” pockets	Excellent for vacuums	Limited availability	PEEK	
Q	One piece molded ring with circular pockets	Excellent for vacuums	Limited availability	PEEK	
M	Formed wire strip or segmental cage with “snapover” pockets.	Increased ball complement. Used in Type A, C, and X bearings for greater capacity (approx. 150%) and higher temperature.	Higher torque and lower speed capability than “R” type separators. Comparatively high wear rate. Requires loading notch for “C” and “X” bearings.	17-7 PH stainless steel	
W	Formed wire strip or segmental cage with “snapover” pockets.	Used in Type C and X bearings for high temperature applications. Standard ball complement.	Higher torque and lower speed capability than “R” type separators. Comparatively high wear rate.	17-7 PH stainless steel	
F	Full complement bearing.	Max. ball complement. Used in Type C, X, and A bearings for maximum capacity and stiffness.	High torque and low limiting speed due to ball rubbing. Not recommended for dynamic applications. Loading notches are required for “C” and “X” bearings.	Steel (Per ABMA Standard 10).	
S	Helical coil spring.	Reduced ball complement. Used in Type C and X bearings for low torque and high temperature.	Increased assembly cost. Should only be considered when PTFE spacer slugs cannot be used. Slow speed and light load only.	300 Series stainless steel.	
Z	Spacer slugs.	Standard ball complement. Used in Type C or X bearings for low torque. Prevents separator wind-up.	Not recommended for temperatures greater than 250°F or speeds in excess of 500 ft/min pitch line velocity. (Example: KA040CZ0 max speed = 450 rpm).	PTFE tubing	
Z	Toroid ball spacers.	Increased ball complement. Used in Type A bearings for low torque. Prevents separator wind-up.	Not recommended for speeds greater than 500 ft/min pitch line velocity. PTFE is limited to 250°F. Vespel® is limited to 500°F.	PTFE or Vespel® SP-1 polyamide plastic.	
Z	Spacer ball.	Requires a loading notch for C and X assembly. Low speed capability. Relatively high torque.	Increased ball complement. Used in Type A bearings for low torque. Prevents separator wind-up.	Steel per ABMA Standard 10. (Spacer balls are smaller than load carrying balls.)	

*Code descriptions are Position 7 of bearing identification number - see page 3.

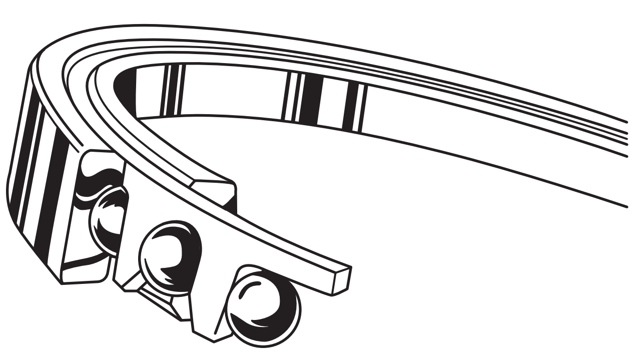
Separator Types

The principal function of a bearing separator is to space the rolling elements uniformly, thereby preventing contact between them. Minute differentials in rolling element motion result from differences in individual rolling element loads and the inherent elasticity of bearing and mounting components. Without a separator some rolling elements will eventually contact each other. Due to the shape of the rolling elements and the opposite direction of motion of the contacting surfaces, a combination of relatively high contact stress and rapid motion is possible. Consequent abrasion of the rolling elements and residue of wear in the raceways affect life and torque characteristics, limiting the use of full complement bearings to slow speed applications where relatively large torque variations can be tolerated.

KAYDON separators for REALI-SLIM® bearings are designated by a single letter character in coded part numbers (page 3), standard P, R, L, and G separators have proved to be suitable for a wide range of operating conditions. Requirements, however, may dictate the use of different materials. This may affect capacities. For assistance in selecting REALI-SLIM® bearings, contact KAYDON Engineering. Operating temperatures for various separator materials are shown on page 93.

Continuous Ring "Snapover Pocket" Separator

Figure 4-1 - Snapover Pocket



Designed for use in bearing types C and X, this style is installed after Conrad assembly of the races and balls. The tangs of the alternate "snap" pockets deform elastically to snap over the balls for retention of the separator. Centered on the balls at room temperature, the separator becomes outer race land riding or inner race land riding when temperatures cause differential thermal expansion or contraction.

Close control of roundness and wall thickness insures effective piloting in either case, limiting separator "whip" and friction between the separator and race lands for smooth operation.

Different materials are available for unusual operating conditions including stainless steel and non-metallics such as phenolic laminate, PTFE, and PEEK.

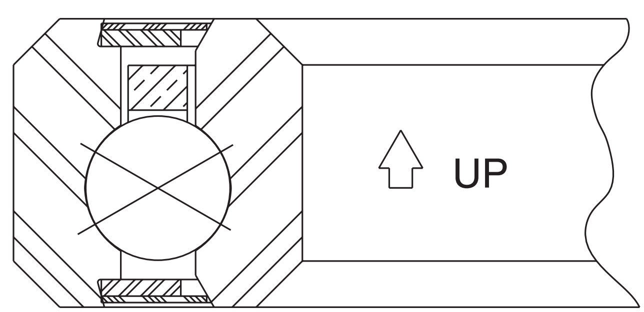
- Stainless steel separators are used in stainless steel bearings or high temperature applications for corrosion resistance.
- Phenolic laminate is used where light weight and/or lubricant absorption is desired.
- The "snap-over" non-metallic separator is ideal for high-speed applications of bearings too small in cross section for the two-piece riveted design (bearing Series C and lighter sections). It is also desirable in low speed, minimum torque applications.

For more information on how to use our bearings, contact KAYDON Engineering.

Orientation

It is suggested that in an application where the bearing axis will be within 45° of vertical, the bearing be positioned with separator pocket openings down or that a shoulder of the shaft or housing be extended as added assurance of retention. Sealed and shielded bearings have this orientation instruction etched on the O.D. by an arrow and the word "up" as shown below.

Figure 4-2



Correct bearing orientation is shown.

Continuous Ring Circular Separators

Figure 4-3 - Continuous Ring Pocket

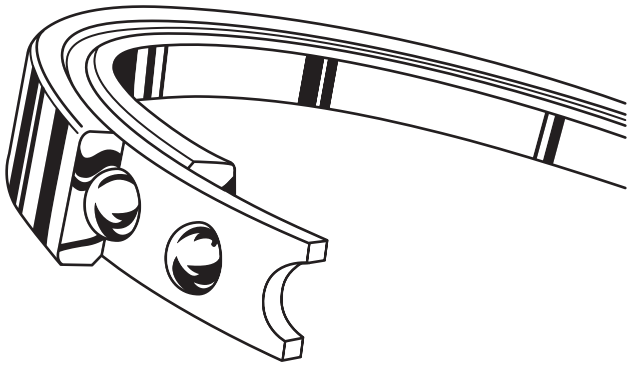
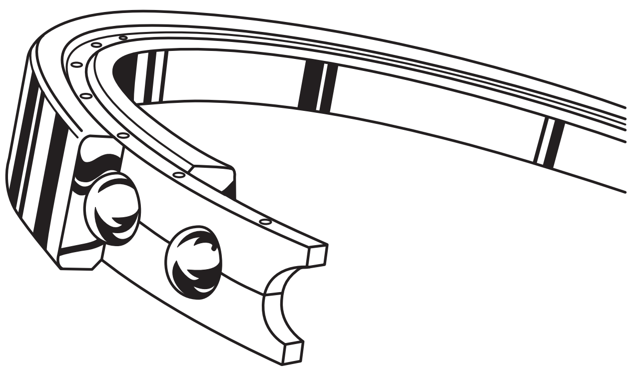


Figure 4-4 - Riveted Ring Circular Pocket



Designed for use in Type A bearings, the one-piece separator shown in Figure 4-3 is positioned around the inner race with the balls placed in pockets before the outer race is expanded thermally and dropped over the balls. This method of assembly permits the use of more balls than in the Conrad bearing Types C and X. In addition to the standard separators of brass, non-metallic composite and reinforced nylon, this style can be furnished in phenolic laminate, stainless steel, and aluminum.

Designed for use in non-standard bearings of Type C or Type X, the separator shown in Figure 4-4 is installed after Conrad assembly of the races and bearing and riveted together. Because of the space required for rivets, use is limited to Series D and heavier sections. Usually machined all over, this style is recommended in phenolic laminate for very high speeds. Where very high strength is required, it is furnished in bronze, aluminum, or stainless steel.

As in the case of the continuous ring "snapover" pocket separator, both of these styles are centered on the balls at room temperature, becoming either outer race land riding or inner race land riding as the temperature changes.

Segmental Separators

Segmental separators of either the ring or "snapover" design offer advantages for certain applications.

1. When larger diameter bearings are subjected to high temperatures, expansion differentials between the separator and the races may exceed the normal clearances provided.
2. When oscillatory motion, variable loading and a vertical axis combine to cause differential ball travel with no "vacation zone," torque may become objectionably high or erratic.

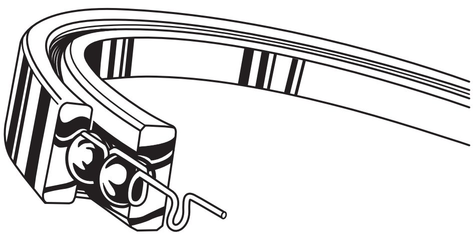
A segmental separator may consist of a one-piece open ring or it may be composed of two or more segments. Where differential expansion creates a problem, sufficient clearance is provided between the ends of the open ring or between the several segments to allow for this expansion. Where torque is of concern, the selection of the number of segments is made based upon experience. In all other respects, segmental separators satisfy the above descriptions for **Continuous Ring "Snapover Pocket" Separators or Continuous Ring "Circular Pocket" Separators.**

Segmenting the separator imposes somewhat greater restrictions on the bearings. Maximum allowable speed of rotation is reduced due to the centrifugal force ("brake banding") energized by the segments against the outer race lands. Also, in the case of the "snapover pocket" style, a shaft or housing shoulder should be extended to assure retention of the separator irrespective of the operating position of the bearing. See next page.

SEPARATOR TYPES (continued)

Formed Wire Separator

Figure 4-5



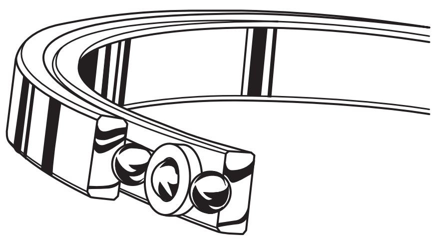
When the need exists for maximum capacity and thus the greatest possible number of balls, a formed wire separator may be used to avoid the disadvantages of a full complement bearing. It has been most successfully employed in Type A bearings, where the greater number of balls can be installed without resorting to use of a loading slot. Use in bearing Types C and X should be restricted to very low speed applications.

Comparatively high wear rate coupled with relatively light section can cause the wear life of the wire separator to be a limiting factor in the life a bearing, especially if the loads are high. However, where weight or space are at a premium and the added capacity is an important consideration, this separator may be considered a good compromise.

A bearing with a wire separator and maximum allowable ball complement has a static load capacity of 180% of the catalog static rating.

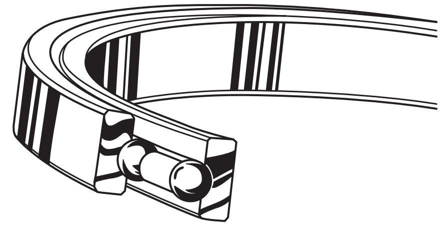
Toroid Separators

Figure 4-6A



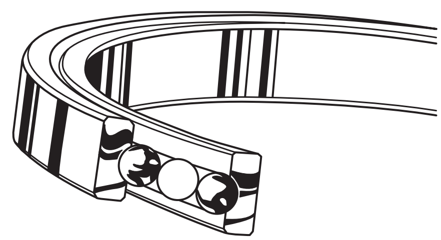
PTFE Spacer Slugs

Figure 4-6B



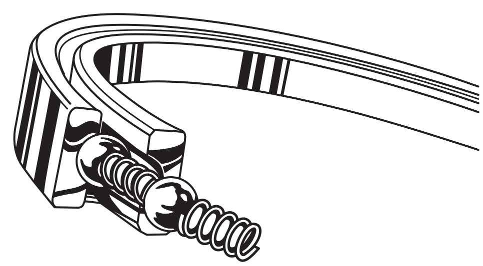
Spacer Balls

Figure 4-6C



Helical Spring Separators

Figure 4-6D



In some critical positioning applications, uniformity of torque is more important than the actual mean torque level. Specially designed toroids (Figure 4-6A), PTFE spacer slugs (Figure 4-6B), spacer balls (Figure 4-6C) or helical compression springs (Figure 4-6D) have proved in a number of such instances to be satisfactory for ball separation—by their nature they give a large amount of individual and cumulative circumferential freedom to the balls. To prevent this freedom from being abused, however, speeds must be low and loads comparatively light.

Applications involving use of these separators should be referred to KAYDON for review and recommendation.