

Reduce Costs by Choosing the Right Retaining Ring for Your Application

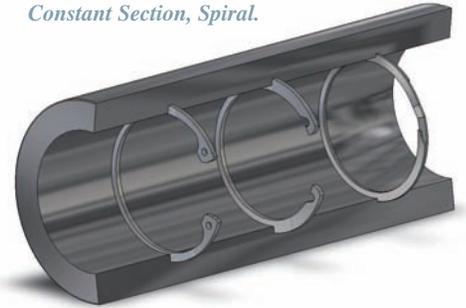
by Joe Cappello

Retaining rings are non-threaded fasteners that hold components in place once installed in a groove. It is a simple concept and one that appears to need no additional explanation. But end users should know that there are three basic types of retaining rings available to them to meet their fastener requirements. This is not to say that one retaining ring style is “better” than another. Rather, the parameters of an application determine which retaining ring is best to use, and this can vary from assembly to assembly.

Helping your customers select the correct type of retaining ring based on variables such as installation/removal requirements, anticipated thrust load, and taking up end play can result in a retaining ring that functions reliably, at a reasonable cost.

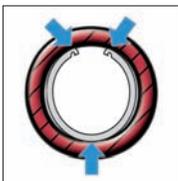
There are three main types of retaining rings available to the designer: tapered, constant section and spiral. These are typically made from carbon steel, stainless steel or beryllium copper and feature a variety of finishes for corrosion protection (see accompanying table). Again, the final selection of a type and size retaining rings depends upon these and the previously mentioned parameters.

Three types of Retaining Rings (L to R): Tapered, Constant Section, Spiral.



Tapered Section Ring

TAPERED SECTION RETAINING RINGS make uniform contact with the groove with a gap between the lugs. The lugs and lug holes are not meant to interfere with the application, but provide a convenient means to install/remove the ring using manual or automated equipment.



Constant Section Ring

CONSTANT SECTION RETAINING RINGS are elliptical when installed in the groove, making only 3-point contact. As a result, they accommodate less force than a tapered section ring, making them an economic alternative to this type of ring, depending on the application. They also offer more clearance than a tapered ring, but are more difficult to install/remove. Automotive transmissions are typical applications for constant section rings.



Spiral Retaining Ring

SPIRAL RETAINING RINGS make 360° contact with the groove, unlike the other two types. However, they are difficult to install and remove and accommodate less force (on a ring to ring comparison). Typical applications include sprinkler valves, clutch drives and quick connect devices.

The following application illustrates how the particular requirements of an application will dictate what type of retaining ring to specify.

A customer selected a constant section retaining ring to retain a transmission cooling valve located in radiators found in some automobiles. This valve, which regulates the oil temperature, is installed in the radiator after an oven brazing operation. A constant section ring was found to be the most economical and effective choice for the application (See **Photo A**).

However, if a leak is detected in testing, the radiator must go through the brazing operation a second time. Since the valve might melt during this process, it must be removed. The customer would pry the constant section ring off, but this often ruined the groove causing many valves to be scrapped.

In this case, the customer switched to a tapered retaining ring, since the lug holes could be used to easily remove the ring, if necessary. Also, this particular ring featured lugs that are reversed, ensuring there would be enough clearance so the lugs would not interfere with the operation of the valve(See **Photo B**).

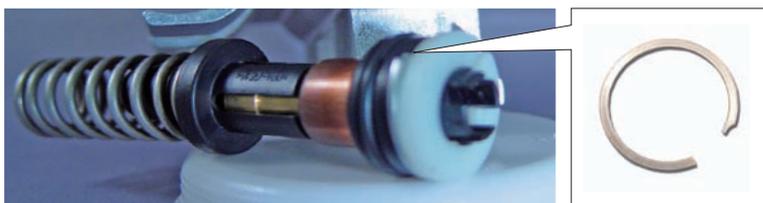
In contrast to the above, a ring that will provide uninterrupted, 360 degree

contact is preferred to withstand the rotational speeds of this gear/axle assembly (See **Photo C**). Removal of the ring is also not a significant consideration. In this instance, a spiral retaining ring is the most cost effective and logical choice.

To meet today’s stringent standards for cost reduction and value added design; the designer must consider all options. This includes retaining rings and the flexibility afforded by the different styles when searching for an appropriate fastener to accomplish a given task. Matching this task to the appropriate ring can help your customers meet their cost reduction targets without sacrificing quality or performance.

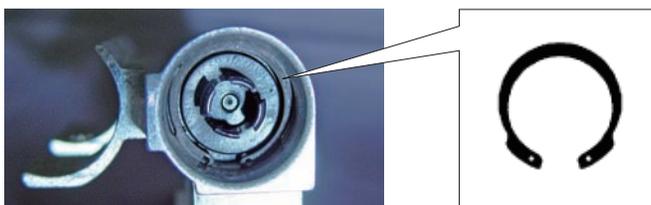
Material/Finishes Chart—Retaining Rings		
Retaining Ring Type	Material	Finishes
Tapered Section	• Carbon Steel (SAE 1060-1090)	• Phosphate
	• Stainless Steel (PH15-7 Mo)	• Phosphate and Oil
	• Beryllium Copper	• Zinc Dichromate
	• Phosphor Bronze	• Trivalent
Constant Section	• Carbon Steel (SAE 1060-1090)	• Phosphate
	• Stainless Steel (PH15-7 Mo)	• Phosphate and Oil
	• Beryllium Copper	• Zinc Dichromate
	• Phosphor Bronze	• Trivalent
Spiral	• Carbon Steel /Oil Tempered (1070-1090)	• Oil Dip
	• Carbon Steel/Hard Drawn (1060-1075)	• Black Oxide
	• AISI 302/316 Stainless Steel	• Cadmium Plating
	• 17-7 PH/C Stainless Steel (Condition CH900)	• Passivation
	• Beryllium Copper (Temper TH02)	• Zinc Phosphate

Photo A—Transmission Cooling Valve w/ Constant Section Ring



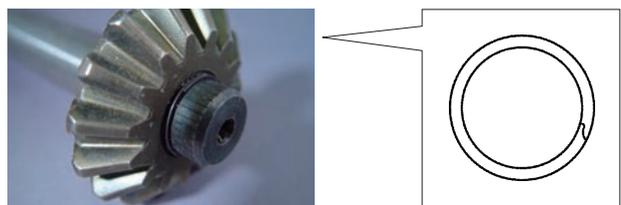
The ring originally used was a constant section type. The absence of lug holes makes it nearly impossible to remove from the assembly without damaging the groove.

Photo-B—Transmission Cooling Valve (Front View) w/ Tapered, Internal Retaining Ring with Lugs and Lug Holes



The lug holes allow the ring to be removed without damaging the groove.

Photo C Gear/Axle Assembly w/External Spiral Retaining Ring



This spiral retaining ring is ideal for this application, which requires 360 degree contact with the shaft.