



## ABOUT BACK-UP RINGS

We mostly think of back up rings as being used with o-rings. But they also are used with T-seals (an o-ring substitute) as well as various styles of piston seals and occasionally with u-seals. The primary purpose of the back up ring is to reduce the extrusion gap between metal surfaces of two cylinder components to enable the seal to operate at higher pressures without extruding and being damaged.

In cylinders where there are metal parts moving in a linear motion, there must be a suitable space between the metal parts so that metal to metal contact does not cause damage to either or both of the metal parts and damage to the softer seal material. This gap – called extrusion gap – varies depending on metals, temperatures, speed, size and pressure. This “gap” may be too large to allow for satisfactory performance of elastomeric (soft elastic) seals at the pressure required, so a “non-metallic” material is used to reduce the gap. In the case of a 70A durometer o-ring, a back up ring should be used at pressures exceeding 1500 PSI – depending on extrusion gap, temperature, speed and other factors.

Back up rings used with o-rings are of two different shapes. One style has two flat sides (Hercules style 575-) and the other style has one side concave in shape (to fit the curvature of the o-ring, Hercules style 574-) while the opposite side is flat to provide support against the metal surface. This concave style was made popular by Parker Seal Co. and is commonly called a Parback.

The theory behind the concave style is that the curvature of the back up deflects the o-ring away from the extrusion gap as system pressure deforms the o-ring against the back up ring.

The flat sided back up ring also performs satisfactorily in most applications to keep the softer seal material from “squeezing into” the extrusion gap. There is no clear performance advantage to either style.

Back up rings are available in a variety of materials. The material from which the back up ring is made has the most impact on the performance of the back up ring. The key is to use a material which is hard enough to resist extrusion but with enough elastic “memory” to make installation easy – i.e.: the back up ring will stretch for installation but return to its original size and shape. If a very hard material is used, the back up ring must be “split” to allow for installation. If the seal being used is made of a soft elastic material (i.e.: a 70A durometer o-ring) the seal may “extrude” into the split of the back up ring at higher pressures, especially under shock loads.

The two most common back up ring materials are urethane and Nitrile.

Urethane in a 95A durometer hardness (Hercules style 575-) has a good “memory” allowing it to be stretched and readily returning to the original shape. In addition, the physical properties of the urethane material make it slightly more resistant to extrusion than a Nitrile material. These are available in most o-ring sizes.

Nitrile back up rings (Hercules style 574-) in a 90A durometer hardness (commonly found in the contour shaped back ups) is easily installed and is also a highly effective back up ring to reduce extrusion of o-rings under most circumstances. These are available in most o-ring sizes.

High Performance Urethane (Hercules style 590) back up rings in 53D hardness are harder than the standard urethane compound and also has a higher temperature rating making them suitable for use in extreme conditions. These back up rings are mostly used to back up u-seals but may also be used with o-rings.

Hytrex material (Hercules style 573-) may be used in extreme applications – mining equipment, etc. – and is available in many common o-ring sizes. This material is harder (55D) and not quite as easy to install due to its hardness and physical properties as it does not readily return to original shape after being stretched on installation. However, it resists extrusion more than the urethane and Nitrile materials.

PTFE (Hercules style 575- and 595- suffix T) is a filled teflon material. It is commonly used in applications of heat and / or where the fluid is not compatible with elastomeric materials. PTFE back up rings are also used in valve applications due to their lower sliding resistance. Due to installation problems (PTFE has a very poor “memory” and does not readily recover its original shape), these back up rings may be provided “split” for ease of installation. But due to the problems of o-rings extruding into the split, they are also provided in a “spiral” configuration. The 575T product is primarily for o-ring applications while the 595T fits many u-seals.

Nylon (Hercules style 576) back ups are provided in a few o-ring sizes but many are sized to provide back up for rubber u-seals allowing these seals to be used at higher pressures. Due to the hardness of this material, these back up rings are almost universally supplied in a “split” configuration.

If you should have seal questions, please contact our engineering department at [engineering\\_group@herculesus.com](mailto:engineering_group@herculesus.com) and we will do our best to provide answers.