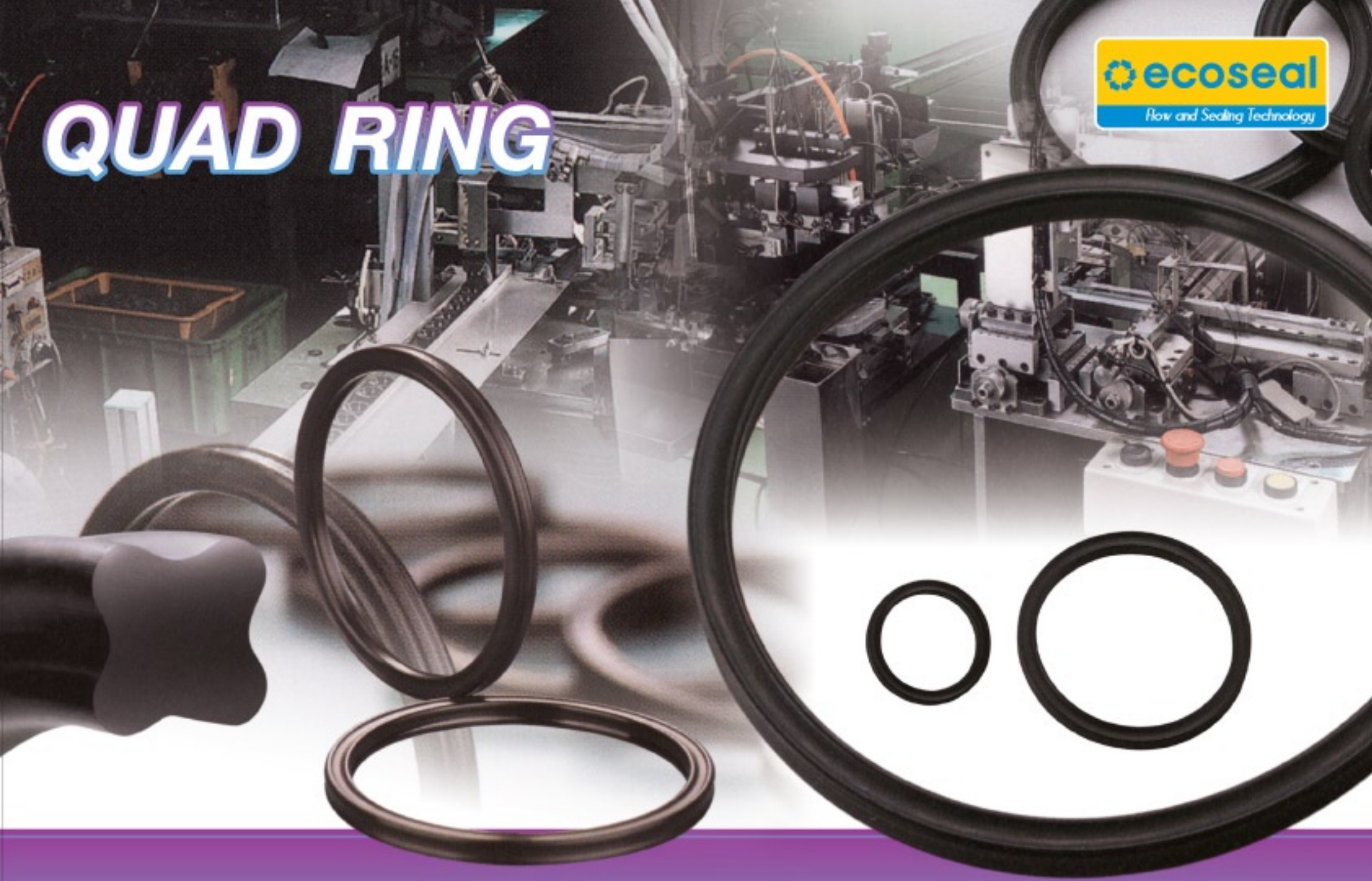
QUAD RING

ecoseal
Flow and Sealing Technology



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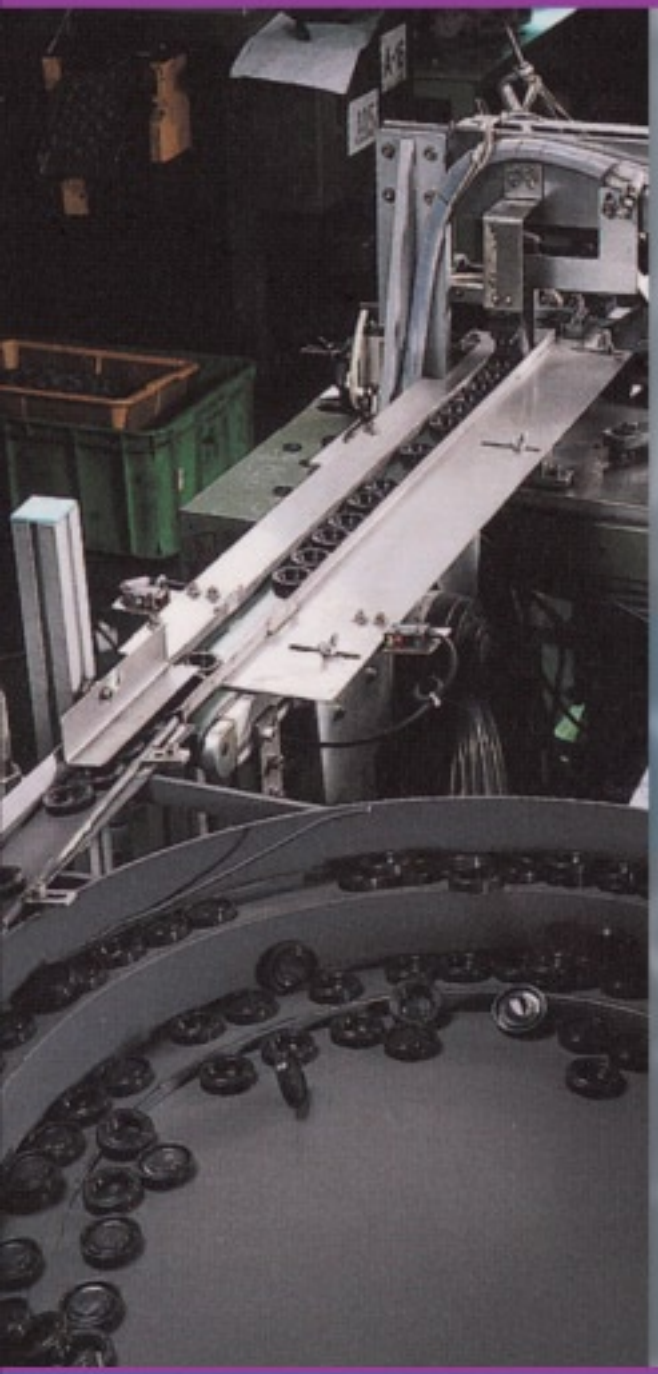


Custom Geometry Rings

There are a number of obstacles to overcome in toroidal sealing including temperature, speed, pressure, motion and groove space. By creating custom geometric shapes and materials, we at AFM can solve even the most difficult applications and overcome extreme operating conditions. Please allow us an opportunity to help solve your demanding problems.

Configure your Application and submit your configuration to AFM for a prompt response.

Contact AFM and speak with one of our technical sales specialists right now about your application.

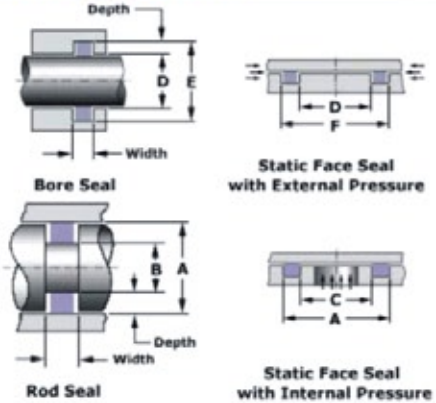
Lathe-Cut Rings

Originally, square and rectangular cut rings were used in static applications as a direct replacement for O-Rings. They were considered a inexpensive, loose-tolerance alternative to molded O-Rings. Because they are fabricated from a cylindrical tube of rubber which is extruded, the inside and outside diameters are defined and the part is specified by dimensioning the inside diameter and wall thickness. The tube is then machined into various cross-sectional configurations by using a precision grinder or lathe-type cutting machine. By using the process of extruding material, expensive molds are not required giving designers flexibility in sizing to their exact requirements.

Today, lathe-cut rings are considered an econimcal alternative to O-Rings, particularly in static applications. Lathe-cut rings (rectangular cut rings) are manufactured using the same processes as Square Rings, the only difference being that lathe-cut rings do not have a square cross-section. See Square Rings for more information about square rings.

Lathe-cut Ring Design Considerations
Lathe-cut Ring Dimensional Tolerances

Lathe-cut Ring Applications



Typical applications for lathe-cut rings fall into four categories:
- Rod Seal
- Bore Seal
- Face Seal with Internal Pressure
- Face Seal with External Pressure

Square Rings

Why a Square Ring?

Square and lathe-cut rings are considered an econimcal alternative to O-Rings, particularly in static applications.

- They seal in a superior manner, at a lower cost than any other comparable device.
- They use the same groove as O-ring
- They can be used for radial seals
- They are made of homogenous material without joints or laminations
- The edges are accurately formed
- Extreme close tolerances can be held on cross-section, ID and OD
- Surface smoothness, hardness, elasticity, toxicity and texture can be controlled
- The modern, economical option for static applications
- Available in many compounds

Square and Lathe-cut rings (rectangular cut rings) are manufactured using the same processes, the only difference being that lathe-cut rings do not have a square cross-section. See Lathe-Cut Rings for more information about rectangular lathe-cut rings.

Square Ring Design

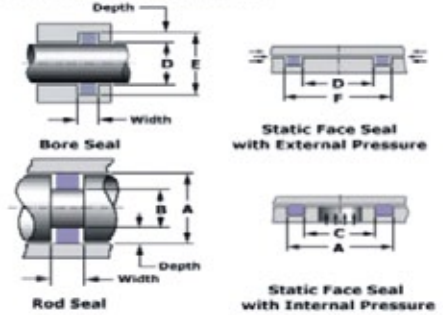
- Square Ring Design Considerations
- Dimensional Standards
- Gland Dimensions - Rod Seal
- Gland Dimensions - Bore Seal

What is a Square Ring?

Originally, square and rectangular cut rings were used in static applications as a direct replacement for O-Rings. They were considered a inexpensive, loose-tolerance alternative to molded O-Rings. Because they are fabricated from a cylindrical tube of rubber which is extruded, the inside and outside diameters are defined and the part is specified by dimensioning the inside diameter and wall thickness. The tube is then machined into various cross-sectional configurations by using a precision grinder or lathe-type cutting machine. By using the process of extruding material, expensive molds are not required giving designers flexibility in sizing to their exact requirements.

Square Ring Applications

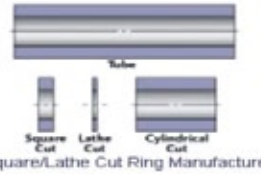
Typical applications for square-cut rings fall into four categories:
- Rod Seal
- Bore Seal
- Face Seal with Internal Pressure
- Face Seal with External Pressure



Square Ring Manufacture

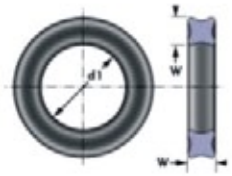
A square/lathe cut ring is simply a ring-shaped seal, or torus, with a square- or rectangular-shaped cross section. A square ring is a lathe cut ring with equal cross-section and axial height. A lathe cut ring is anything that does not have a square cross-section. Direct replacement of an O-ring with a square seal is normally feasible in static applications and is usually reduces costs. Typically, a square seal will perform a high-pressure sealing function as well as, or better than, an O-ring. In addition, lathe cut gaskets and seals do not require costly tooling and can provide quick prototyping. A square cut seal functioning as a drive belt is very easy to install, resilient and often does not require a tensioning device. Lathe cut rings are used in automobiles, appliances, office equipment, industrial machinery, plumbing and many other applications.

A square seal is a section of a cylindrical tube machined into a cross-sectional configuration by a precision automatic grinder and lathe. The most common configurations are square and rectangular defined by ID, cross-sectional wall and thickness dimensions. Square cut seals are available in a variety of elastomeric and thermoplastic materials.



Square/Lathe Cut Ring Manufacture

Introduction to Quad-Rings®



- Quad-Ring Dimensional Specifications
- Quad-Ring Gland & Groove Design & Specifications
- Search for Inch Quad-Rings
- Search for Metric Quad-Rings

Quad-Ring® Seals

Quad-Ring® Seals are four-lipped seals with a specially developed sealing profile that actually provides twice the number of sealing surfaces as an O-ring. The four-lobed design not only provides lower fiction than an O-ring, but also, due to its square cross section, it resists spiral twist. Quad-Ring® Seals are available in a wide range of elastomer materials for both standard and special applications. Quad-Ring ® Seals are vulcanized as a continuous ring. Their dimensions are specified with the inside diameter "d1" and the cross-section "W." Quad-Ring® Seals are supplied to the American Standard AS-568A and are completely interchangeable with O-rings in these sizes. Quad-Rings® Seals are available in all standard O-Ring sizes from 1/32" to 26", as well as custom seals for unique applications.

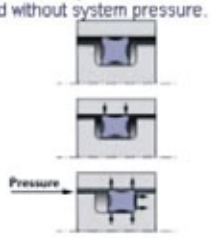
The Advantages of Quad-Ring® Seals

- There are two sealing surfaces to give a positive seal with less friction. Due to an improved pressure profile over Quad-Ring® Seal cross-section, a high sealing effect is achieved.
- The recessed mold parting line provides no flash or parting line on the surface of the seal and ensures "zero leakage." What's more, a lubricant reservoir formed between the sealing lips improves performance at start-up.
- The quad cross-section resists spiral twisting and extrusion. Due to its special profile, the seal does not tend to twist in the groove during reciprocating movement.
- Twice the sealing surface means less radial squeeze is needed to create an effective seal resulting in less friction, less wear and longer service life.

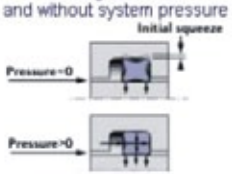
How Quad-Ring® Seals Work

Quad-Ring ® Seals are self-energizing, double acting seals. Radial or axial forces, depending on the installation, give these seals an initial leak-tightness similar to a built-in squeeze. The sealing force then increases with increasing system pressure. Under pressure, the Quad-Ring® Seal acts like a fluid with high surface tension, transmitting the pressure uniformly to all sides.

Seal squeeze with
and without system pressure.



Sealing force with
and without system pressure



Typical Applications for Quad-Ring® Seals

Quad-Ring® Seals are primarily used in dynamic sealing applications limited only by the pressure to be sealed and the velocity. They do have use in some static seal applications as well.

- As a dynamic seal for sealing of reciprocating pistons, rods, plungers, etc.
- As a dynamic seal for sealing oscillating, rotating, or spiral movements on shafts, spindles, rotary transmission leadthroughs,etc.
- As a radial-static seal for bushings, covers, pipes, etc.
- As an axial-static seal, e.g. for flanges, plates, caps, etc.
- As an energizer element for elastomer-energized hydraulic seals where the risk of the twisting exists.

Technical Data for Quad-Ring® Seals

Working pressure - Reciprocating Dynamic application:
up to 5 MPa (50 bar) without back-up ring
up to 30 MPa (300 bar) with back-up ring

Working pressure - Rotating Dynamic application:
up to 15 MPa (150 bar) with back-up ring

Working pressure - Static application:
up to 10 MPa (100 bar) without back-up ring
up to 40 MPa (400 bar) with back-up ring

Speed:
Reciprocating - up to 0.5 m/s
Rotating: - briefly - up to 2.0 m/s

Temperature (depending on material and media resistance):
General applications: -30°C to +110°C
Special compounds: -60°C to +200°C
Rotating applications: -30°C to +80°C

Note that transient peak and continuous operating temperature, cyclic duration and frictional heat are all factors bearing on the use of the seal.

Media:
Given the variety of materials available, it is possible to select the appropriate Quad-Ring® Seal for virtually every liquid, gas, and chemical application.

Design Criteria for Quad-Ring® Seals

- **Size** - Cross section (W) should be in an appropriate ratio to the inside diameter (d1). In static applications, Quad-Ring® Seals with smaller cross-sections may be used.
- **Elongation-Compression / Internal Groove / External Sealing** - Stretch over the root of the groove with maximum elongation is 6% installed.
- **Elongation-Compression / External Groove / Internal Sealing** - Seal is installed compressed and maximum compression is 3% installed.
- **Elongation-Compression / Cross Section** - 1% increase in the ID corresponds to a 0.5% reduction in cord diameter.
- **Initial Squeeze** - This is critical to the function of the Quad-Ring® Seal allowing it to achieve the initial seal, bridge production-dependent tolerances, assure defined frictional forces, and compensate for compression set and wear.
- **Initial Squeeze / Dynamic Applications** - 6 to 18%
- **Initial Squeeze / Static Applications** - 8 to 25%