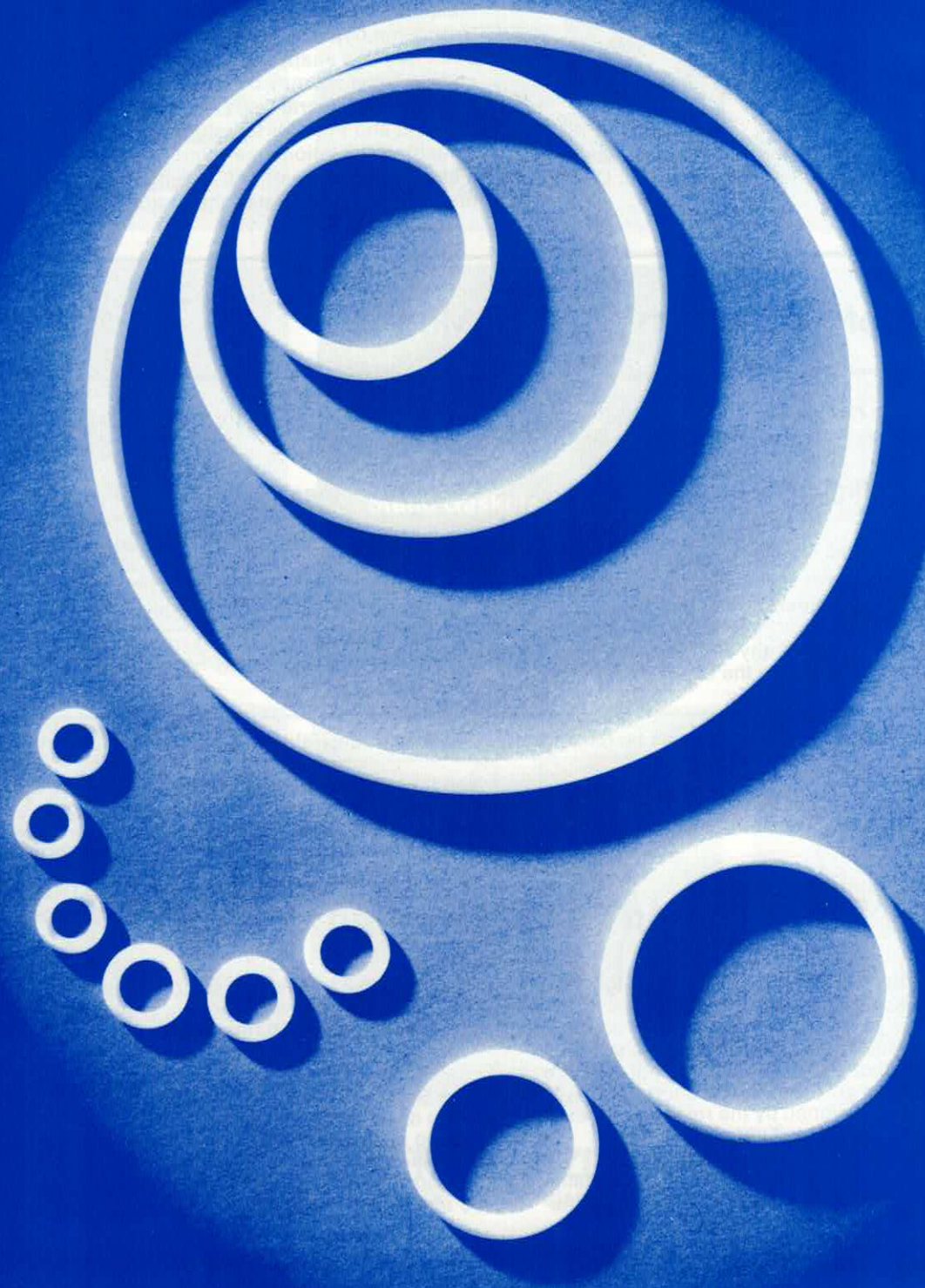
BULLETIN 0-3

Chicago Gasket Company

"Mirror Finish"™ TFE O-Rings



Best for heat and chemical resistance

"Mirror Finish" TFE O-Rings

Why "Mirror Finish" O-Rings Are Better

"Mirror-Finish" TFE O-Rings are shiny-smooth without surface chips, threads or marks which might cause serious leakage.

This highest quality finish is designed to give a better initial seal with less break-in time and is offered for the first time at no extra cost. Observe a sample—you can see the difference!

TFE as an O-Ring

TFE has made such an outstanding record as a packing and gasket material that it is often considered for O-Ring applications.

The major handicap to the use of TFE as an O-Ring has been its inelasticity in comparison to rubber. This often creates a problem in switching from rubber or other elastomer to TFE O-Rings on equipment not designed to accommodate TFE, especially where the ring must be stretched and snapped into a groove or where compression set may be a problem.

There are several ways to simplify or eliminate this problem and in order to help the O-Ring user, a number of valuable suggestions are offered in this brochure for making proper use of TFE O-Rings in both dynamic (moving) and static (stationary) applications.

Superiority of TFE as an O-Ring Material

Though rubber O-Rings have been highly successful as a sealing means, TFE O-Rings are superior in several ways and in many applications involving heat or chemicals.

Virgin TFE	Rubber or other elastomer
Completely unaffected by all common fluids.	May be attacked and swelled by many oils, solvents and chemicals.
Softens but not burned at temperatures up to 500° F.	May harden or burn from excessive heat.
Friction is much lower. Lowest of any solid material. Static and dynamic coefficients are the same so there is no 'breakaway'.	Relatively high friction and "breakaway" particularly when dry.
Lubrication is less critical and may sometimes be omitted.	Lubrication desirable in dynamic applications.
No twisting or 'snaking' is encountered. Wear is uniform.	Tendency to twist, extrude, abrade or cut in dynamic application.

TFE O-Ring Squeeze and Groove Design

SEE ILLUSTRATION AT RIGHT FOR TYPICAL GROOVE DESIGN

Any "O" Ring handbook will give more detailed information on standard O-Ring squeeze and groove design.

Groove Design The grooves for TFE O-Rings are similar to those used for rubber, though the cross-sectional squeeze on the ring is less and the groove length is shorter.

These changes are occasioned by the relative stiffness of TFE and the fact that the rings roll very little.

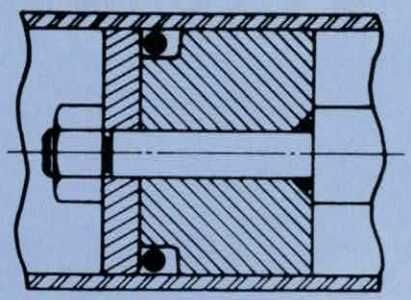
Grooves with 5-degree sloping sides are easier to machine than grooves with straight sides and are usually satisfactory. The grooves should have a smooth machine finish—25 to 32 rms—and be free of imperfections. For the best seal and lowest friction, running and sealing surfaces should be 16 rms or less.

Ring Sizes Fluorocarbon O-Rings are made in a wider range of sizes than rubber O-Rings. The ARP 568* uniform O-Ring numbering system of the SAE is used by most manufacturers. However, because TFE O-Rings are ordinarily machined, O-Rings of special dimensions can be readily obtained.

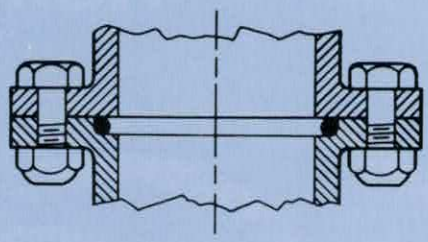
ARP 568* DASH NUMBERS	NOMINAL ID RANGES IN INCHES	"W" DIMENSION CROSS SECTION DIAMETER (IN)	MINIMUM CROSS-SECT. SQUEEZE	GROOVE LENGTH
006 to 050	1/8 to 5-1/4	.070 ± .003	.005	.080
105 to 178	5/32 to 9-3/4	.103 ± .003	.006	.110
201 to 281	3/16 to 15	.139 ± .004	.007	.160
309 to 349	7/16 to 4-1/2	.210 ± .005	.008	.240
425 to 472	4-1/2 to 23	.275 ± .006	.010	.315

*Uniform Dash Numbering System for O-Rings. Aeronautical Recommended Practice, Society of Automotive Engineers Inc.

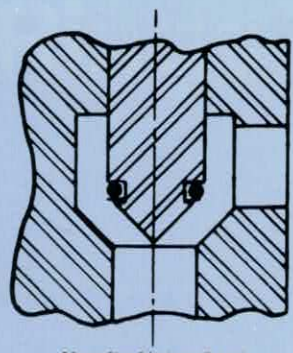
Typical Applications of "Mirror Finish" TFE O-Rings



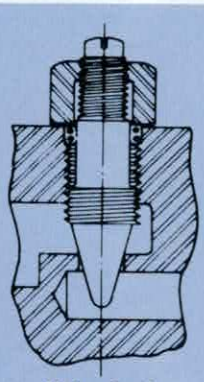
2-Piece Piston Seal



Flange Gasket
Open Groove



Needle Valve Seal



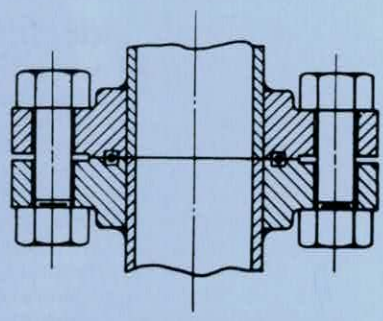
Valve Seal

Dynamic Seals

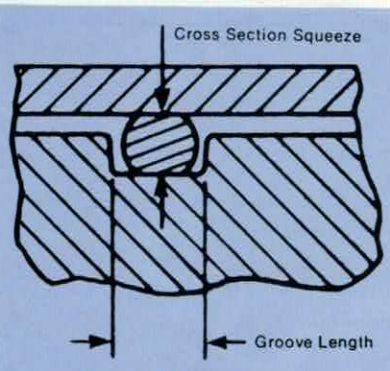
Where there is movement of one or both mating parts to be sealed, the sealing means is generally characterized as a "seal".

Static Gaskets

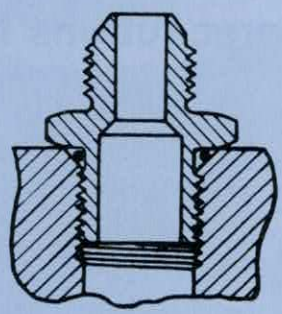
Where there is no movement of mating parts to be sealed, the sealing means is generally characterized as a "gasket".



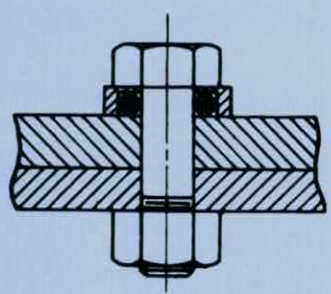
Flange Gasket
Confined Groove



Typical Groove Design



Tube Fitting Gasket



Bolt Head Gasket
With Spacer

ALL MILITARY AND INDUSTRIAL SIZES AND PRICES AVAILABLE

Refer to our size chart and SC-1 and phone or FAX for prices".

Chicago Gasket Company uses the new AS 568A standardized O'Ring numbering system of the Society of Automotive Engineers. These sizes have been adopted by Industry and the Military.

These specifications and their military procurement specifications were written to cover materials other than TFE. Therefore, certification to these specifications can be made only to dimensions and tolerance on TFE.

The following Military Specifications use these same dimension and dash numbers.

MS-9020 MS-9021	MS-29512 MS-29513	MS-29561 MS-28775	MS-28784 AN-6227 (Superseded)	AN-6230 (Superseded) AN-6290 (Superseded)

Note: Special Sizes—Many intermediate and larger diameters available which are not listed in the above standard size charts.

Installing TFE O-Rings

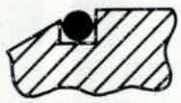
Stretchability

If an O-Ring is to be installed over a retaining shoulder not more than ten per cent larger in diameter than the O-Ring groove, the ring can be stretched. TFE O-Rings are easier to stretch if they are heated (in boiling water, for example) to about 210° F.

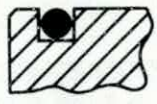
In some cases, the relationship between O-Ring cross section and diameter will permit the ring to be stretched over a shoulder having a diameter much greater than the O-Ring groove. For such installations, however, complete heat treatment of the fluorocarbon O-Ring is necessary. An undersize ring is heated to 575° F, stretched over a sizing mandrel, then allowed to cool. After the ring is installed in the equipment, the complete part or component is heated to 575° F and allowed to cool at a rate of approximately 50 deg. per hr. During cooling, the ring shrinks to a tight fit in the groove.

If the assembled component cannot be heated to 575° F, TFE O-Rings in removable metal inserts can be used. Or, the design can be modified to provide separate shoulders, retained with threads or snap rings, to serve as the second wall of the O-Ring groove.

Inclined entry to groove



Groove for "Cold Stretch"



Groove for "Hot Stretch"

Cold Stretch Method

Ring stretches 5 to 10% of diameter. Method used where pressure is on one side such as a faucet or valve application.

Hot Stretch Method

Ring stretches 10 to 20% of diameter. Heated in boiling water or controlled oven at 200° F. Method used where more positive retention in groove is required.

Deformation under load

Because TFE O-Rings do not extrude until they are subjected to much higher pressures than those at which rubber extrudes, allowance for backup rings is rarely necessary.

Another characteristic of TFE O-Rings which must be considered in a design is cold flow or creep. When fluorocarbon material is subjected to a continuous load, even at room temperature, deformation or cold flow occurs. Although the largest amount occurs during the first 24 hr. after loading, cold flow may continue, but at a much slower rate.

Creep depends upon several variables—intensity of the load, time under load, temperature—and may be expected particularly where extreme temperature cycling occurs. The result of creep is that clearances may appear between O-Ring and containing piece unless sufficient compression is maintained. Any of several means for maintaining compression can be used, including heavy initial loading, spring loading, or use of adjustable glands. Also, creep can be minimized by using a filled TFE O-Ring.

Unfilled TFE plastics can be used in dynamic applications but should be confined to those situations where the wear is light. Filled TFE compositions offer superior qualities; however, they are less flexible and compressible than ordinary TFE plastics.

TFE O-Rings are suitable for either static or dynamic application (pumps, valves, cylinders). However, because of their wear characteristics, the dynamic type of application is frequently less satisfactory.

Testing

In the process of deciding to use TFE O-Ring in a particular application, the prospective user would find a test and evaluation to be of benefit.

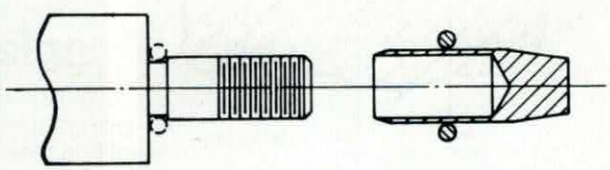
Surface protection and precautions for installing over threads

Equipment incorporating TFE O-Rings must be designed so that the rings can be installed without damage to any ring surface. TFE plastic is damaged more easily than, for instance, rubber, and surface imperfections do not squeeze closed as easily as in rubber. Any sharp scratch or indentation on the O-Ring is likely to cause leakage despite considerable squeeze. Conversely, the smoother the surface finish of the O-Ring, the better the seal.

The design should, of course, allow for easy replacement of rings and maintenance of the equipment.

When possible, leave clearance between the threads and the O-Ring to avoid scratching the TFE when it is slipped over the threads. Clearance may be enhanced by heating the O-Ring in boiling water or controlled oven at 200° F.

In some cases to prevent scratching of the TFE it may be desirable to slip a thin-walled tube or ferrule over the threads so the O-Ring may be installed by the "hot-stretch" method without touching the threads.



Ferrule for installing O-Rings over threads

Important: Considerable care should be used to be sure the sealing surfaces of the O-Ring are not scratched or marred in either handling or installation.

Note: Chicago Gasket assumes no responsibility or liability for the selection or design of TFE O-Rings for specific applications; this remains solely with the designer or buyer. Chicago Gasket warrants only the quality, workmanship and dimensional specifications as published.

CHICAGO GASKET COMPANY

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