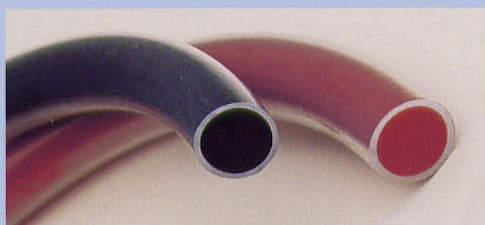


DICHTOMATIK SEALS

DICHTOMATIK USA offers one of the widest ranges of sealing elastomers available. In our ongoing effort to provide a full range of elastomeric seal alternatives for our customers, DICHTOMATIK is proud to include this line of TEFLON encapsulated O-rings for our customers.

TEFLON ENCAPSULATED O-RINGS

A TEFLON Encapsulated O-ring consists of a seamless TEFLON jacket over an elastomer core. Several options are possible for the core material and shape. This combination of a chemically resistant polymer jacket over a low-compression set elastomer provides unique properties for a range of demanding applications.



- Chemically resistant
- Thermal stability from -60 to 260°C (-76 to 500°F)
- Low extractable contaminants
- Low surface coefficient of friction (0.1 to 0.2)
- Low permeability

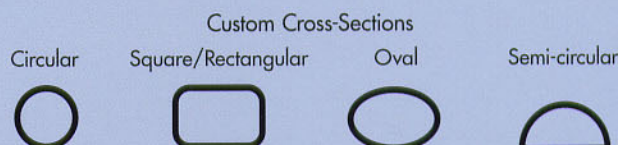
STANDARD MATERIALS



	VITON® CORE		SILICONE CORE		
Coating Material: TEFLON	FEP	PFA	FEP	PFA	FEP
Compound Designation	Z788	Z790	Z787	Z789	Z793
Color	Black	Black	Red	Red	Red
TEFLON PROPERTIES					
Hardness, Shore D	56	55	56	55	56
Tensile Strength (MPa)	28	28	28	28	28
Elongation, %	300	300	300	300	300
CORE ELASTOMER PROPERTIES					
Hardness, Shore A	79	79	73	73	73
Tensile Strength (MPa)	10.7	10.7	9.2	9.2	9.2
Elongation, %	213	213	279	279	279
Compression Set 22 hrs.@100°C	4.6	4.6	10	10	10
Miscellaneous Properties:					
Coefficient of friction; 0.1–0.2	Linear coefficient of thermal expansion; $5.6 \times 10^{-5} \text{ cm/cm}^{\circ}\text{C}$				

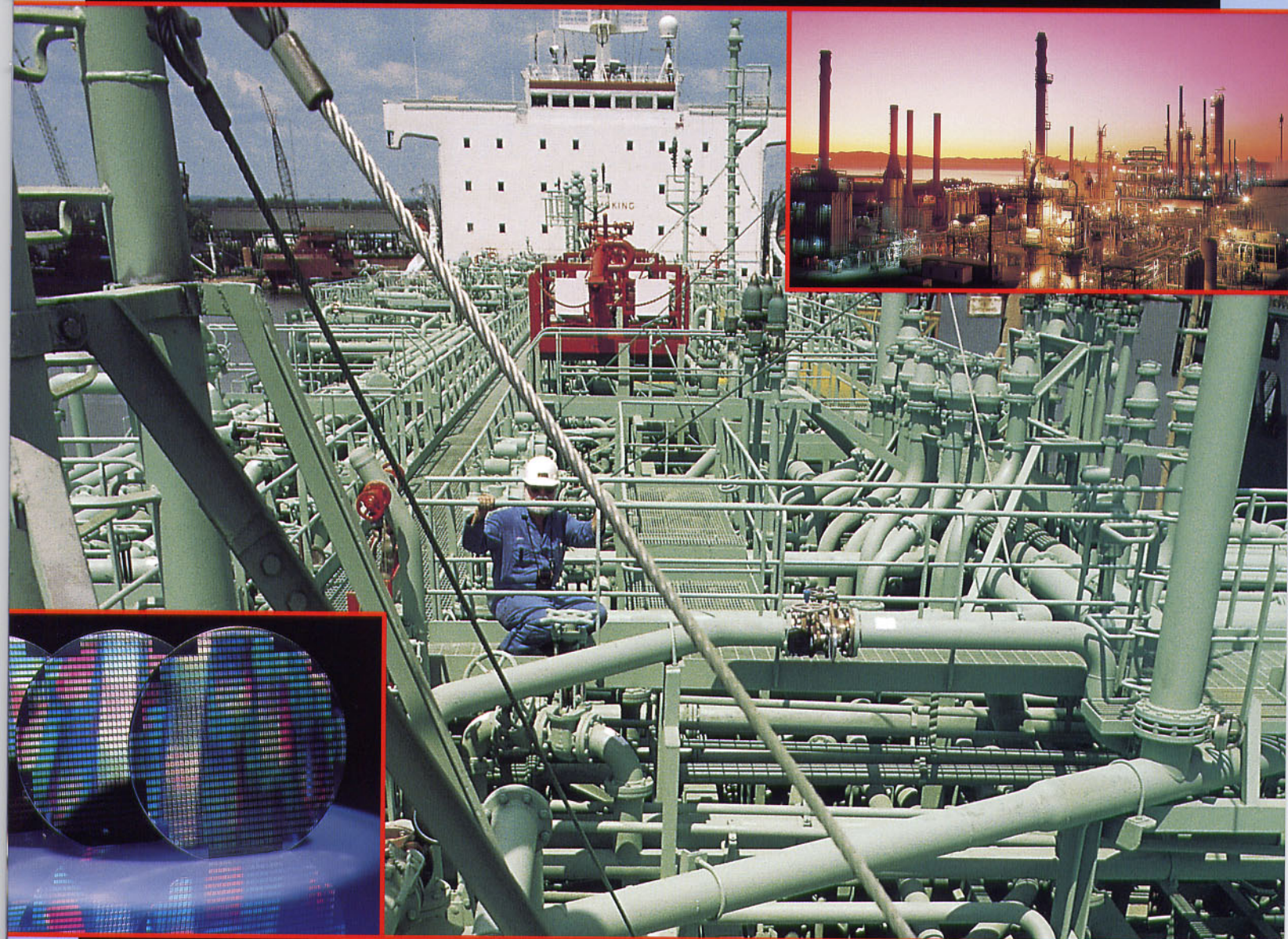
NON-STANDARD MATERIALS

Encapsulated O-rings are manufactured in a variety of shapes and cross-sections to meet various applications. In addition, custom cross-sections such as solid VITON or Silicone square or rectangular cores have been available. These are often used as gaskets in cam-action type couplings or as an alternative to PTFE or Envelope gaskets in flange sealing applications.

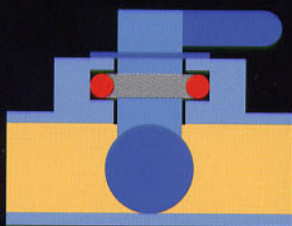


MARKETS AND APPLICATIONS

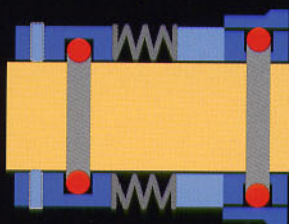
Excellent chemical resistance has been noted in several key markets including semiconductor fabrication, the chemical processing industry, and chemical transportation. The relative low cost of encapsulated O-rings used in chemical environments is driving their adoption in these industries.



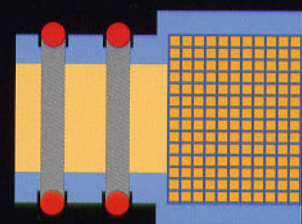
Encapsulated O-rings are used in a variety of situations, typically requiring chemically resistant seal materials. An added advantage of these O-ring seals is the low contamination potential. This is particularly effective in the semiconductor industry for those applications demanding clean seals.



Valves



Mechanical Seals



Filters

THERMAL STABILITY

This table shows the actual working temperature limits for core/jacket TEFLON encapsulated O-ring materials.

WORKING TEMPERATURE LIMITS (°C)	
FEP/VITON	—
FEP/Silicone	—
PFA/VITON	—
PFA/Silicone	—
	-60 -20 100 200 260

CHEMICAL RESISTANCE

TEFLON encapsulation is the primary source of the chemical compatibility of these O-rings. In general, TEFLON resins are compatible with a broad range of chemical environments, including those in the following chart.

CHEMICAL RESISTANCE	Z700 Series
ACIDS	
Acetic Acid, Glacial	A
Hydrochloric Acid	A
Hydrofluoric Acid	A
Nitric Acid	A
Trichloroacetic Acid	A
INORGANIC BASES	
Potassium Hydroxide	A
Sodium Hydroxide	A
ALCOHOLS/ETHERS	
Isopropyl Alcohol	A
Methyl Alcohol	A
AROMATIC HYDROCARBONS	
Benzene	A
Toluene	A
ALIPHATIC HYDROCARBONS	
ASTM Oil #3	A
ESTERS	
Dimethylphthalate	A
ALDEHYDES/KETONES	
Acetone	A
Methyl Ethyl Ketone (MEK)	A
Tetrahydrofuran	A
AMINES	
Aniline	A
Ethylenediamine	B
CHLOROCARBON SOLVENTS	
Carbon Tetrachloride	A
Methylene Chloride	A
Trichloroethane	A



RATING SYSTEM

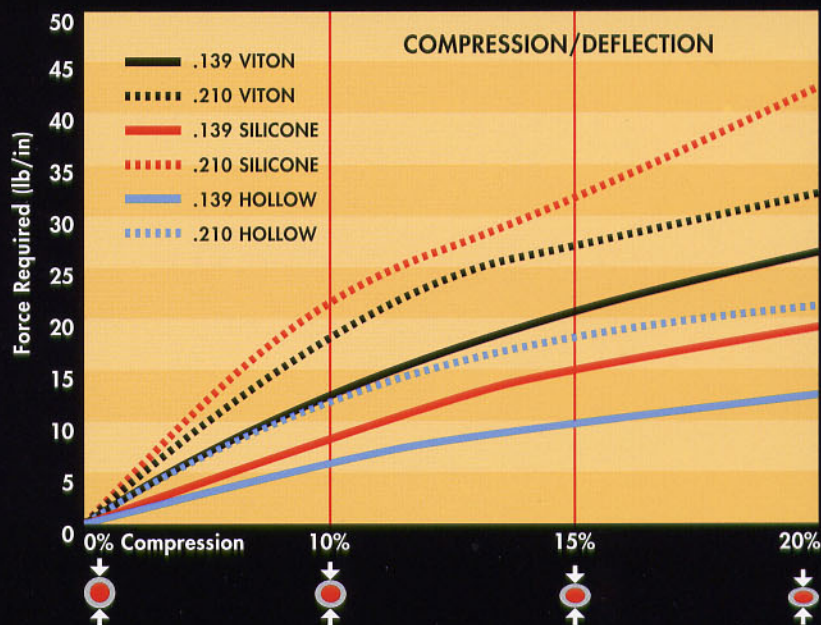
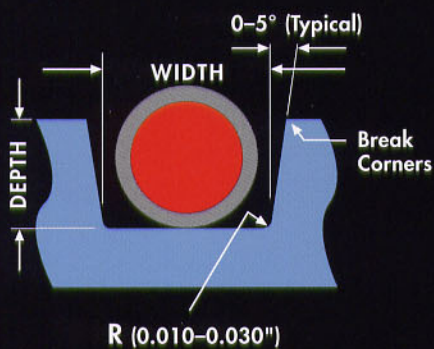
- | | |
|--|---|
| A Little or no effect
(volume swell <10%) | C Noticeable change
(volume swell 20-40%) |
| B Possible loss of physical properties
(volume swell 10-20%) | U Not suitable for service |
| | — Insufficient Information |

Molten alkali metals, fluorine and several complex halogen compounds are incompatible with TEFLON resins and should be avoided.

SEAL DESIGN

To ensure optimum performance of DICHTOMATIK encapsulated O-rings, care and attention must be paid to the design and application of the seal. Gland dimensions, surface finishes, installation procedures as well as chemical and thermal environment play key roles in determining seal performance.

O-ring CSD				Gland dimensions							
				DEPTH				WIDTH			
mm	+/-	in	+/-	mm	+/-	in	+/-	mm	+/-	in	+/-
1.60	0.10	0.063	0.004	1.20	0.05	0.047	0.002	2.10	0.20	0.083	0.008
1.78	0.10	0.070	0.004	1.30	0.05	0.051	0.002	2.30	0.20	0.091	0.008
2.00	0.10	0.079	0.004	1.50	0.05	0.059	0.002	2.60	0.20	0.102	0.008
2.50	0.12	0.098	0.005	1.90	0.05	0.075	0.002	3.20	0.20	0.126	0.008
2.62	0.12	0.103	0.005	2.00	0.05	0.079	0.002	3.40	0.20	0.134	0.008
3.00	0.15	0.118	0.006	2.30	0.05	0.091	0.002	3.90	0.20	0.154	0.008
3.53	0.15	0.139	0.006	2.75	0.05	0.108	0.002	4.50	0.20	0.177	0.008
4.00	0.25	0.157	0.010	3.15	0.05	0.124	0.002	5.20	0.20	0.205	0.008
4.50	0.25	0.177	0.010	3.60	0.05	0.142	0.002	5.80	0.20	0.228	0.008
5.00	0.25	0.197	0.010	4.00	0.05	0.157	0.002	6.50	0.20	0.256	0.008
5.33	0.25	0.210	0.010	4.30	0.05	0.169	0.002	6.90	0.20	0.272	0.008
5.50	0.25	0.217	0.010	4.50	0.05	0.177	0.002	7.10	0.20	0.280	0.008
5.70	0.25	0.224	0.010	4.65	0.05	0.183	0.002	7.40	0.20	0.291	0.008
6.00	0.30	0.236	0.012	4.95	0.05	0.195	0.002	7.80	0.20	0.307	0.008
6.35	0.30	0.250	0.012	5.25	0.05	0.207	0.002	8.20	0.20	0.323	0.008
6.99	0.30	0.275	0.012	5.85	0.05	0.230	0.002	9.10	0.20	0.358	0.008
8.00	0.40	0.315	0.016	6.75	0.10	0.266	0.004	10.40	0.20	0.409	0.008
8.40	0.40	0.331	0.016	7.15	0.10	0.281	0.004	10.90	0.20	0.429	0.008
9.00	0.40	0.354	0.016	7.70	0.10	0.303	0.004	11.70	0.20	0.461	0.008
9.52	0.40	0.375	0.016	8.20	0.10	0.323	0.004	12.30	0.20	0.484	0.008
10.00	0.50	0.394	0.020	8.65	0.10	0.341	0.004	13.00	0.20	0.512	0.008
11.10	0.50	0.437	0.020	9.70	0.10	0.382	0.004	14.30	0.20	0.563	0.008
12.00	0.50	0.472	0.020	10.60	0.10	0.417	0.004	15.60	0.20	0.614	0.008
12.70	0.50	0.500	0.020	11.40	0.10	0.449	0.004	16.70	0.20	0.657	0.008

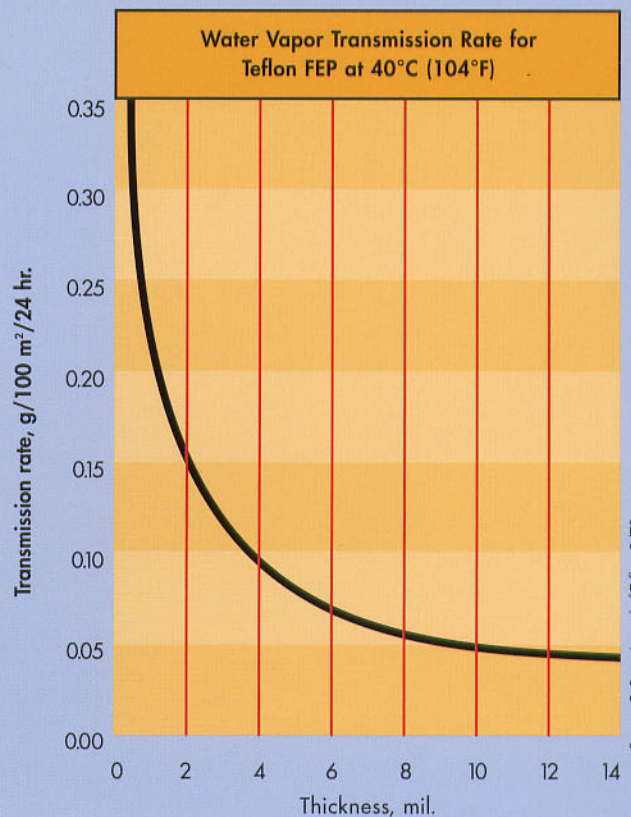


TEFLON PROPERTIES

TEFLON FEP has low gas and vapor permeability. The actual permeation rate is the product of the diffusion coefficient and the solubility coefficient and is dependent on several factors.

- Increasing temperature not only increases the solubility of the permeant, but also diffusion is increased due to the change in polymer chain movement.
- Increasing partial pressure, for many gases, can increase the permeation rate.
- Increasing the concentration gradients for liquids can increase the permeation rate.
- Increasing the permeated area, or decreasing the thickness will increase the permeation rate.

This chart illustrates the typical water vapor transmission rate for TEFLON FEP at 40°C.



INSTALLATION

A large percentage of seal problems with encapsulated O-rings are the result of incorrect installation. Adherence to the following recommendations will reduce installation-related failures.

- **For all seals.** It is important that the gland is chamfered and free from burrs or the TEFLON jacket may be degraded. Also, immersing the seal in hot water (60–70°C) will provide greater flexibility prior to installation.
- **For internal bore seals (figs. 1 & 2).** Slide the seal into the bore at an angle, allowing the leading edge to pass over and beyond the gland. After the trailing edge enters the gland, taking care to apply even pressure around the circumference of the seal to avoid kinking the jacket, the leading edge can be pulled back into the gland.
- **For external piston seals (fig. 3).** A sizing cone or similar device should be used to provide uniform stretch around the circumference. Ensure that the pressure is applied evenly around the circumference of the ring to avoid kinking. By applying external pressure to a split resizing ring, it is possible to speed up the recovery of the TEFLON jacket material.

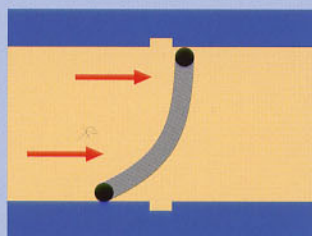


Figure 1

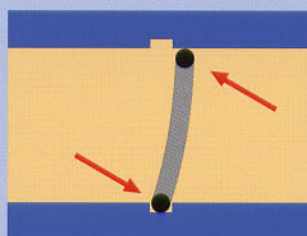


Figure 2

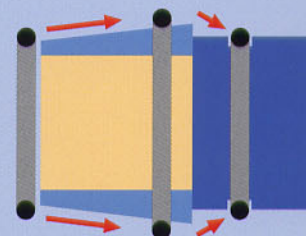


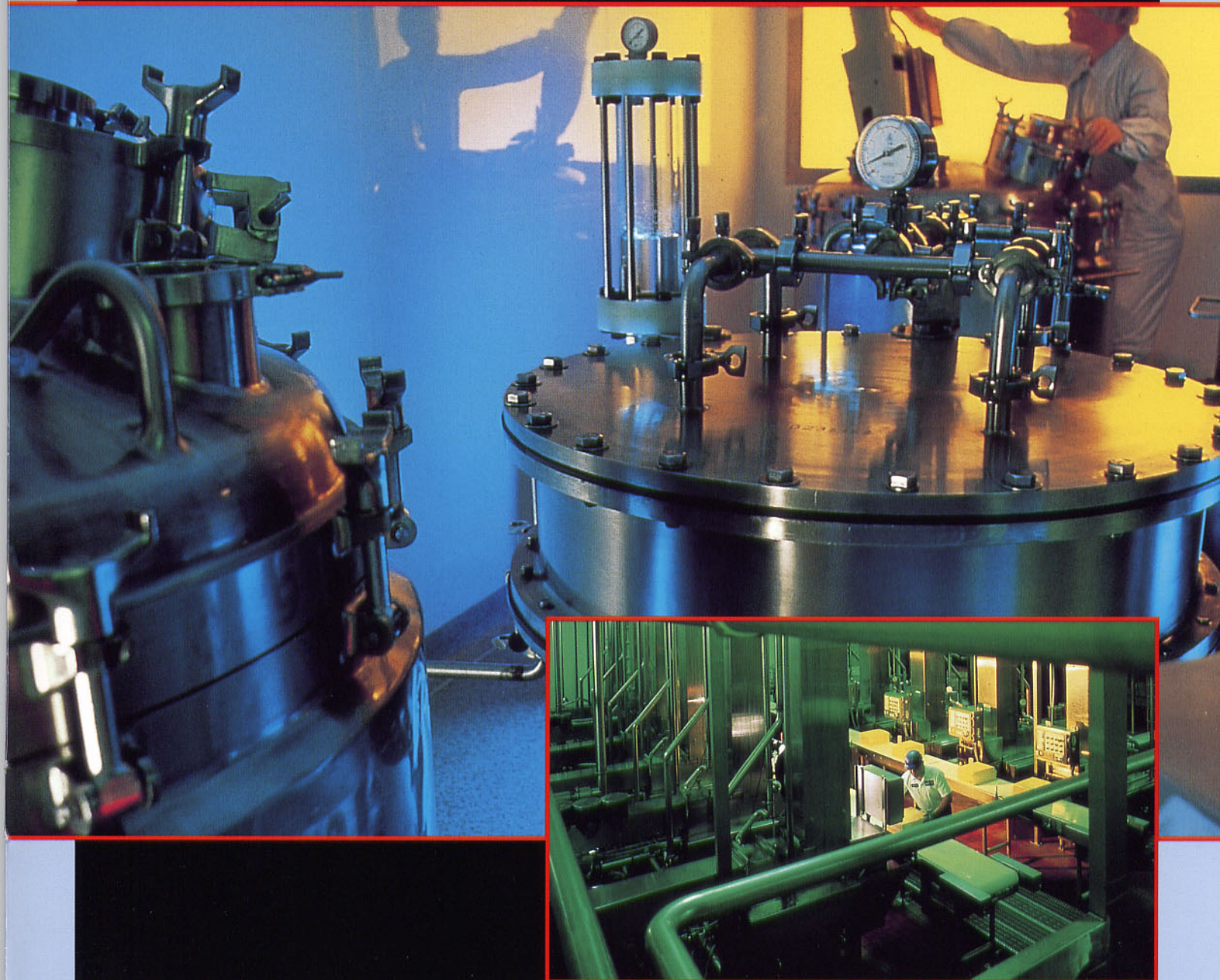
Figure 3

AVAILABILITY

DICHTOMATIK encapsulated O-rings are available in AS-568 standard sizes from -109 to -475. In addition, many standard metric sizes are in stock. Production lead times for standard parts not in inventory are 4–6 weeks. Non-standard or custom shape encapsulated O-ring lead times are 8–10 weeks. Please consult your local DICHTOMATIK distributor for price and availability information.

APPROVALS

The TEFLON FEP and PFA resins used to produce our encapsulated O-rings may be used as articles or components of articles intended to contact food in compliance with FDA Regulations 21 CFR 177.1550. The specification includes acceptance from the USDA for direct use in contact with meat or poultry, the Dairy & Food Industries Association, Inc. for dairy equipment, and for pharmaceutical processing (USP Class VI).



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