JIS O-RING SIZES

NOMINAL SIZE	DIMENSIONS OF O-RINGS		
	THICKNESS (W)	INNER DIAMETER (I.D.)	
S3	1.5 ± 0.1	2.5	± 0.15
S4		3.5	
S5		4.5	
S6		5.5	
S7		6.5	
S8		7.5	
S9		8.5	
S10		9.5	
S11.2		10.7	
S12		11.5	
S12.5		12.0	
S14		13.5	
S15		14.5	
S16		15.5	
S18		17.5	
S20		19.5	
S22		21.5	
S22.4	2.0 ± 0.1	21.9	
S24		23.5	
S25		24.5	
S26		25.5	
S28		27.5	
S29		28.5	
S30		29.5	
S31.5		31.0	
S32		31.5	
S34		33.5	
S35		34.5	
S35.5		35.0	
S36		35.5	
S38		37.5	
S39		38.5	
S40		39.5	
S42		41.5	± 0.25
S44		43.5	
S45		44.5	
S46		45.5	
S48		47.5	
S50		49.5	
S53		52.5	
S55		54.5	
S56		55.5	
S60		59.5	
S63		62.5	
S65		64.5	
S67		66.5	
S70		69.5	
S71		70.5	±0.4
S75		74.5	
S80		79.5	
S85		84.5	
S90		89.5	
S95		94.5	
S100		99.5	
S105		104.5	

NOMINAL SIZE	DIMENSIONS OF O-RINGS		
	THICKNESS (W)	INNER DIAMETER (I.D.)	
S110	2.0 ± 0.1	109.5	± 0.4
S112		111.5	
S115		114.5	
S120		119.5	
S125		124.5	
S130		129.5	± 0.6
S132		131.5	
S135		134.5	
S140		139.5	
S145		144.5	
S150		149.5	

BASIC ELASTOMERS

Nitrile (or Buna)

Standard color: Black
Trade Names: Chemigum, Paracril
Cost estimate: Low
Temperature range: -30° to +250° F

Nitrile is the most commonly used elastomer in the seal industry. The popularity of nitrile is due to its excellent resistance to petroleum products; balanced temperature range; and relatively low cost.

NBR's polymer content can be compounded for customized applications – (roughly 18% ACN content improves cold weather resistance whereas up to 40% ACN content increases oil resistance).

Nitrile has excellent compression set, tear and abrasion resistance.

Pluses: good property balance; excellent oil and fuel resistance; good water resistance.

Minuses: requires compounding for ozone resistance; avoid use in acids, ketones and amines.

Ethylene-Propylene

Standard color: Black
Trade Names: Nordel, Vistalon
Cost estimate: Low to Medium
Temperature range: -50° to 300° F

Ethylene-propylene has good mechanical properties combined with excellent ozone, UV and weathering resistance. EP is also commonly used in applications involving water, steam and automotive brake fluids. Not recommended for petroleum oils and greases.

Ethylene-Propylene can be cured with either sulfur or peroxide. Sulfur cured EP's are less expensive, whereas peroxide curing provides better heat and compression set resistance.

Pluses: weather; water/steam; chemical resistance; good temperature range.

Minuses: poor petroleum and solvent resistance.

Chloroprene

Standard color: Black
Trade Names: Neoprene, Bayprene
Cost estimate: Low to Medium
Temperature range: -40° to +250° F

Although one of the first commercially available elastomers, chloroprene has been replaced in some applications by EP. CR's still maintain an unusual advantage having good chemical resistance to oily air environments and a broad temperature range.

CR is also used extensively for sealing refrigeration fluids.

Pluses: both *moderate* oil & weather resistance; Freons

Minuses: high swell petroleum oils and fuels; steam and acids.

Fluorocarbon

Standard color: Black & Brown
Trade Names: Viton, Dai-El
Cost estimate: High
Temperature range: -15° to +400° F

FKM is the closest available selection to the universal o-ring, providing a broader range of chemical resistance than any other common elastomer.

Pluses: chemical & heat resistance; good mechanical and compression set properties.

Minuses: fair low temperature resistance; avoid steam, ketones and strong bases.

Silicone

Standard color: Red
Trade Names: Silastic, Silplus
Cost estimate: Medium to High
Typical temperature range: -65°F to +450° F

Silicone has excellent resistance to temperature extremes and is thereby a preferred material in seal applications requiring retention of initial shape and physical properties in both high and sub-zero temperature ranges.

Low physical strength and abrasion resistance limit silicone to static seals.

Pluses: dry heat; ozone

Minuses: Petroleum oils; ketones and concentrated acids; steam

Fluorosilicone

Standard color: Blue
Trade Names: FE, Silastic LS
Cost estimate: High
Temperature range: -70 to +350° F

Fluorosilicones combine most of the attributes of silicone with the resistance to petroleum oils and hydrocarbon fuels. Also like silicone, this elastomer is limited to static seals.

Pluses: dry heat; ozone; some hydrocarbons

Minuses: ketones; brake fluids

The above listing is a general guideline. For additional information and other elastomer selections (such as XNBR, Aflas, and perflouro-elastomers), please contact customer service.

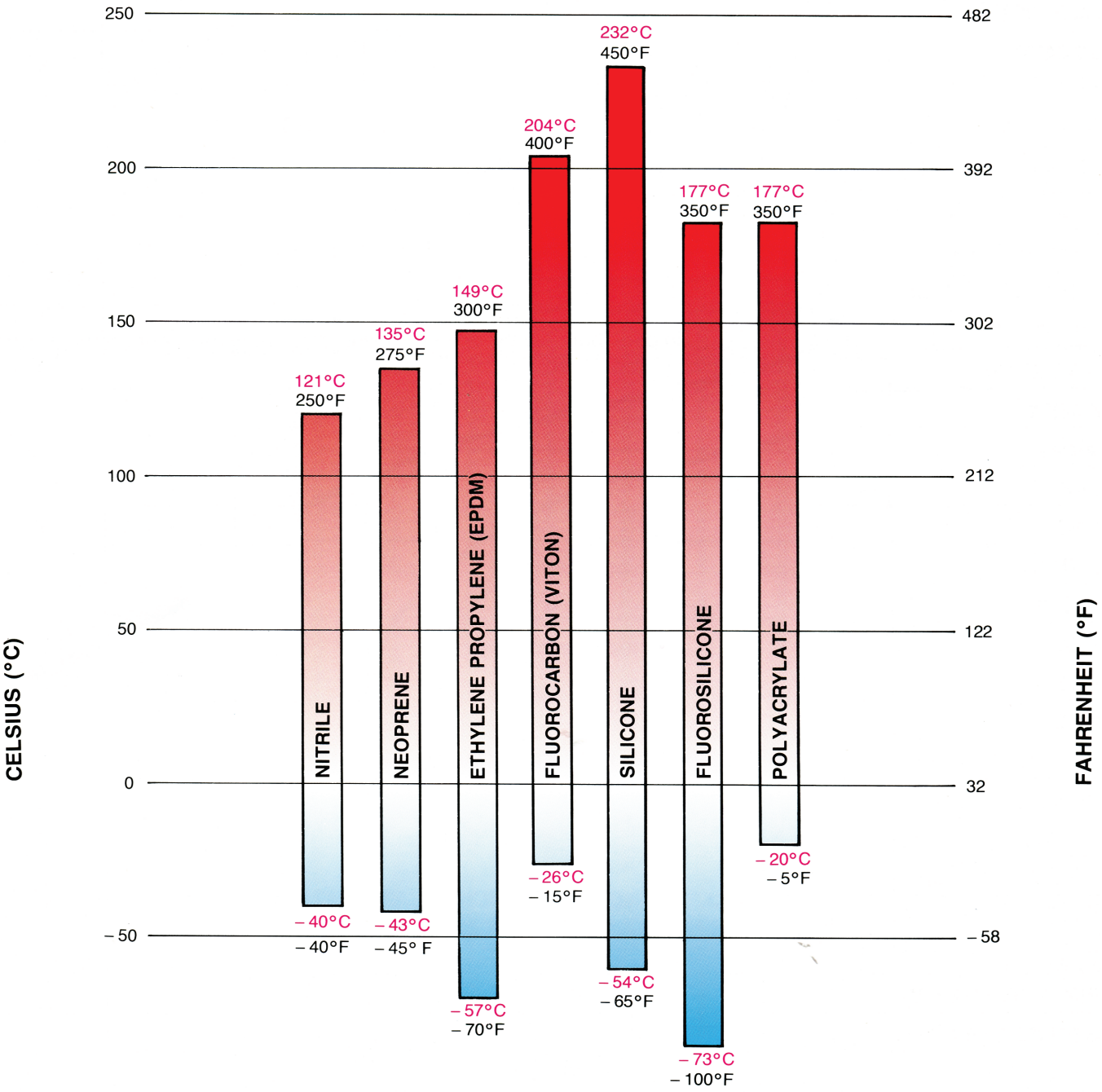
GENERAL PROPERTIES OF MOST USED ELASTOMERS

	NITRILE (HIGH NITRILE)	NEOPRENE	ETHYLENE PROPYLENE TERPOLYMER	POLYACRYLATE	SILICONE	FLUORO-SILICONE	FLUORO-CARBON
ASTM D1418 DESIGNATION	NBR	CR	EPDM	ACM	MQ. PMQ	FVMQ	FKM
ASTM D2000 /SAE J200 TYPE CLASS	BF. BG BK. CH	BC. BE	AA.BA.CA	DF.DH	VMQ.PVMQ FC.FE.GE	FK	HK
HARDNESS, SHORE A	40-90	30-90	30-90	40-85	30-85	60-80	60-95
TENSILE STRENGTH MAX, REINF (PSI)	4000	4000	3000	2500	1200	1200	2500
ELONGATION MAX, REINF (%)	600	600	600	400	700	400	300
SPECIFIC GRAVITY	1.00	1.24	0.86	1.09	0.98	0.98	1.85
BRITTLE POINT (F)	−40	−80	−90	−40	−90 TO −180	−85	−40
COMPRESSION SET	G-E	G-E	G-E	G	F-E	G	G-E
RESILIENCE AT 73°F	G	G-E	G	F	P-E	F	F
ELECTRICAL PROPERTIES	P-F	E	E	F	G-E	E	G
ADHESION TO METAL	G-E	G-E	F-G	G	G	F	F
RESISTANCE TO							
ABRASION	E	E	G	F	P-F	P	G
TEARING	G	F-G	F	P-F	P-F	P	F-G
FLAME	P	G-E	P	P	F-E	E	E
OZONE	P-F	E	E	E	E	E	E
WEATHER	P	E	E	E	E	E	E
OXIDATION	G	E	E	G	E	E	E
WATER	E	G	E	P	G-E	E	E
STEAM	F-G	F	G-E	VP	F-G	F-G	G
ACID (DILUTED)	G	E	E	P-F	G	E	E
ACID (CONCENTRATED)	G	E	E	P-F	F	G	E
ALKALIES (DILUTED)	G	E	E	P-F	E	E	E
ALKALIES (CONCENTRATED)	G	E	E	P-F	E	G	E
SYNTHETIC LUBRICANTS	G-E	P	VP	P	VP	E	E
LUBRICATING OILS (HIGH ANILINE)	E	E	VP	E	G	E	E
LUBRICATING OILS (LOW ANILINE)	E	G	VP	E	F	E	E
ANIMAL, VEGETABLE OILS	G	G	G-E	G	E	E	E
GAS PERMEABILITY	G-E	G	F	G	P	P	E

E = EXCELLENT; G = GOOD; F = FAIR; P = POOR; VP = VERY POOR

SERVICE TEMPERATURE RANGE CHART

This service temperature range is for reference only. In actual service environment, some specific compounds may not reach the maximum temperature as indicated in this chart. However, higher temperature may be attained if exposure is short period or intermittent.



DESIGN DATA: EXTRUSION LIMIT OF O-RING & CLEARANCE GAP

The O-ring is contained in the gland and forced to flow into the surface imperfections of the glands and any clearance gap available to it. So, O-ring can perform sealing by means of squeeze under low-pressure conditions. However, as the pressure mounts, it becomes distorted. The distortion increases the strain, and the increased strain results in more tight sealing. Under high pressure, O-ring would extrude out of the clearance gap. The extrusion will cause seal failure in a standard gland configuration. An anti-extrusion back-up ring, made of a tough, cut-resistant material such as leather, Teflon or hard rubber, is suggested. In static applications it may be possible to modify the gland design to withstand the higher pressures without the addition of a back-up ring. Anyway, care must be taken to make the extrusion as small as possible.

The extent of this extrusion depends upon the hardness of O-ring, pressure, and clearance gap. Please refer to FIG 1, FIG 2 AND TABLE 1.

FIG. 1

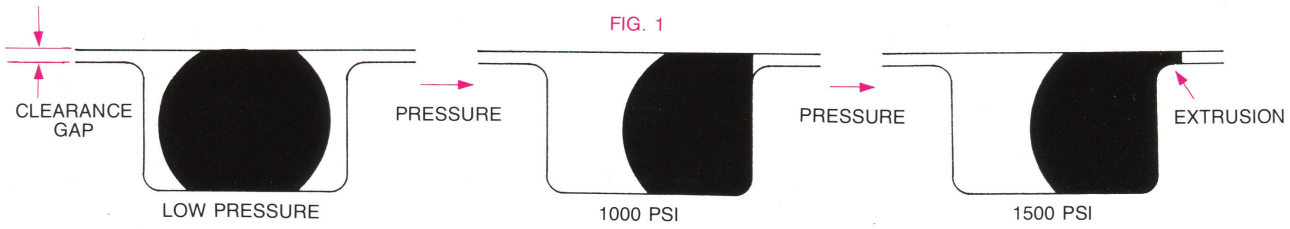


FIG. 2: EXTRUSION LIMIT OF O-RING

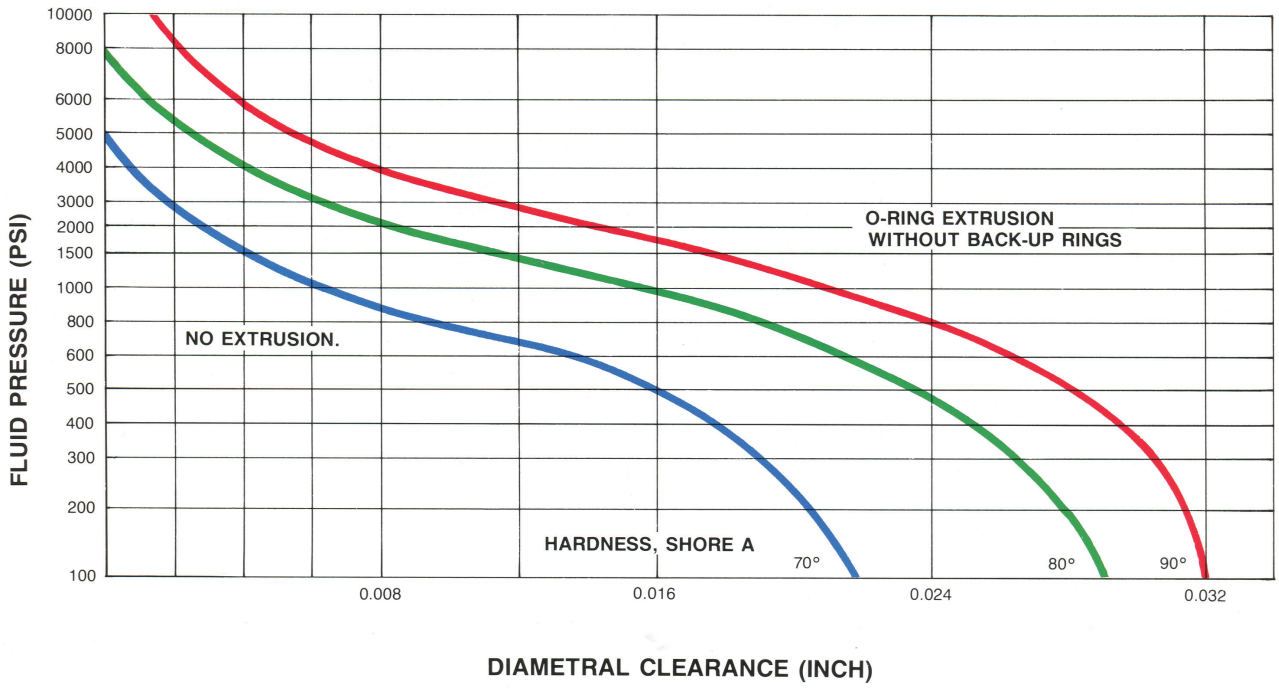


TABLE 1: LIMIT OF THE DIAMETRAL CLEARANCE (UNIT: INCH) AGAINST FLUID PRESSURE

HARDNESS, SHORE A \ PRESSURE (PSI)	UP TO 500	500-1000	1000-1500	1500-2000	2000-3000
70	0.016	0.010	0.006	0.004	0.002
90	0.028	0.024	0.020	0.016	0.010

■ EXTRUSION HAPPENS BEYOND THE LIMIT OF DIAMETRAL CLEARANCE AGAINST FLUID PRESSURE.