

Performance Data

Load, Deflection and Springback

All metal seals, except for metal wire rings, are designed to undergo both plastic and elastic deformation when installed. (Wire rings are essentially limited to plastic deformation only.)

Plastic deformation of the jacket, or O-ring tubing, enlarges the contact area, or “footprint”, to bridge across surface imperfections or tool marks in the mating surfaces. It also creates a reduced gradient in the load/deflection curve to permit a wide tolerance in the working height, resulting in a robust sealing process. High integrity sealing is ensured by the ductile outer layer or coating which, being inelastic and of low compressive yield strength, flows into and fills the mating surface crevices.

Elastic deformation provides elastic recovery or “springback” to maintain good sealing, despite separation of the mating surfaces due to the effects of thermal cycling, flange rotation, applied mechanical or hydrostatic loads or creep.

Terminology

Free Height: The cross-sectional height of an uncompressed seal. This is conventionally stated before platings or coatings.

Working Height: The cross-sectional height of an installed seal, which is equivalent to the groove depth. Many metal seals allow wide tolerance in the permissible working height to accommodate tolerance stack ups.

Seating Load: The load required to compress a seal to the working height. For convenience, all loads are conventionally stated per unit circumferential length. Generally, a higher seating load will ensure greater leak tightness.

Springback: The difference between the working height and the (reduced) free height after all applied loads have been released: this represents the total elastic recovery of the seal.

Useful Springback: That portion of the spring-back curve where the load exceeds 20-25% of the load at working height. Below this, the load may be insufficient to maintain good seal performance.

Working, Proof and Burst Pressures: The working pressures given in this design guide are the maximum for both steady-state and cyclical pressures (subject to fatigue considerations) with the groove to seal diametrical clearances recommended in Section C. Where high pressure transients are expected, or installed seals are subject to a proof test (as part of a 100% acceptance test, not a type test), designers should select a metal seal with a working pressure sufficient to accommodate such high pressure exposures.

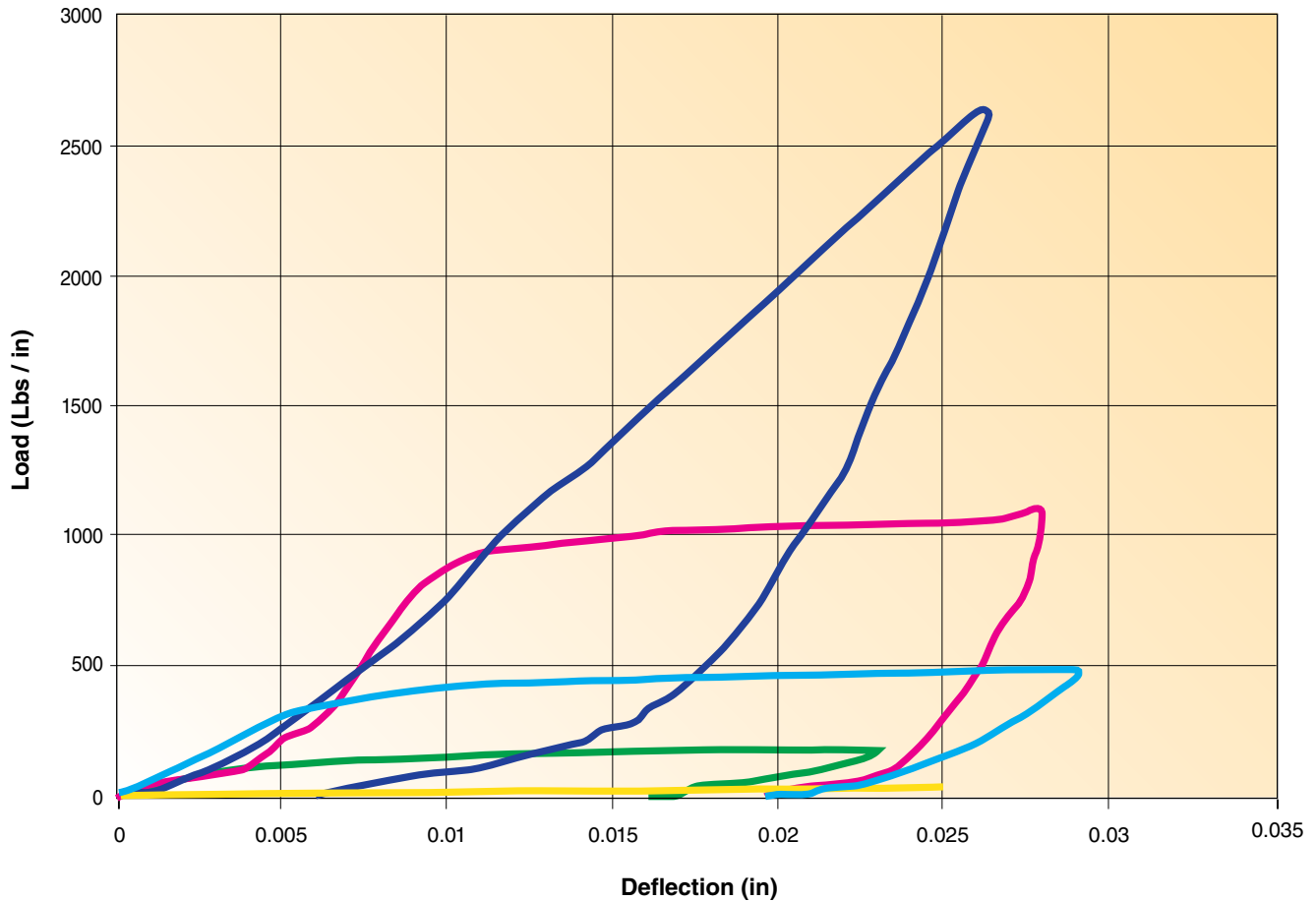
Burst testing may be performed at pressures higher than the rated working pressure. Experience has shown that pressure energized metal seals will seal effectively at pressures significantly beyond their working pressure, although some permissible permanent deformation of the seal may occur.

Leakage failure may occur at extremely high pressures, however, this is typically the result of flange or joint separation or distortion, due to the high hydrostatic loads under such conditions. The onset of leakage will be detected when such flange separation exceeds the useful springback of the seal.



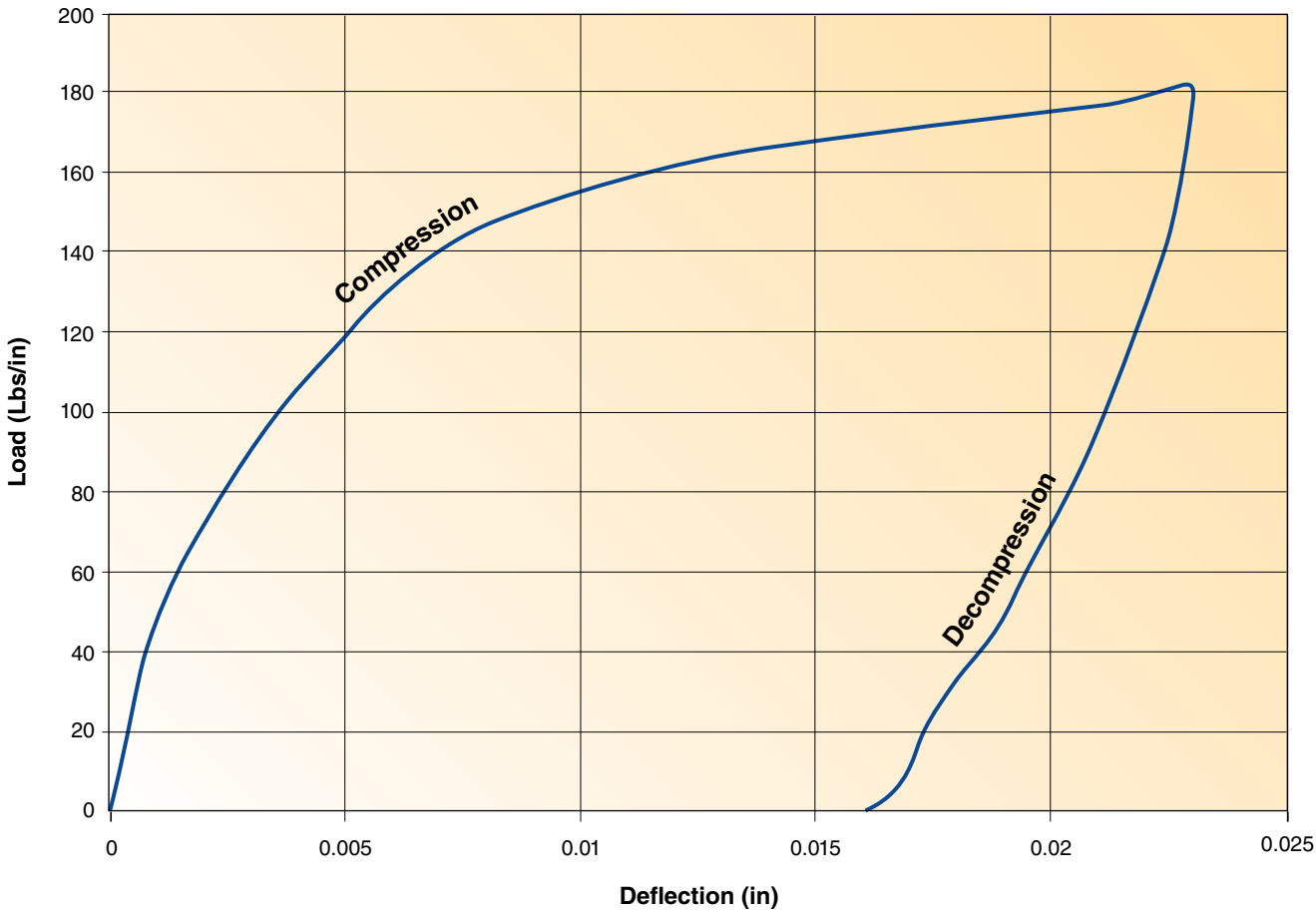
Load, Deflection and Springback

Load vs Deflection Comparison



-  **EEI: metal E-ring**
-  **ECI: metal C-Ring**
-  **ESI: spring energized metal C-ring**
-  **EOI: metal O-ring**
-  **EWI: metal wire ring**

Performance Data



Based on nominal seal dimensions, recommended cavity dimensions and ambient temperature. If working pressures exceed the above ratings consult us for recommendations.

Metal C-Ring Performance								
Nominal Cross Section	Free Height	Material Thickness	Cross Section Code	Temper Code	Material	Seating Load (pounds per inch circumference)	Springback (inches)	Working Pressure Rating (psi)
1/32	0.031	0.006	01	-6	Alloy X-750	140	0.0015	66000
					Alloy 718	160	0.0015	76000
					Waspaloy	140	0.0015	58500
		0.007	02	-6	Alloy X-750	200	0.001	86500
					Alloy 718	230	0.001	99000
					Waspaloy	200	0.001	76500
3/64	0.047	0.006	03	-6	Alloy X-750	90	0.002	36000
					Alloy 718	110	0.002	41000
					Waspaloy	90	0.002	32000
		0.008	04	-6	Alloy X-750	200	0.002	54000
					Alloy 718	230	0.002	62000
					Waspaloy	200	0.002	48000
1/16	0.062	0.006	05	-6	Alloy X-750	70	0.003	25000
					Alloy 718	80	0.003	29000
					Waspaloy	70	0.003	22500
		0.010	06	-6	Alloy X-750	250	0.002	50000
					Alloy 718	280	0.002	57000
					Waspaloy	250	0.002	44000
3/32	0.094	0.010	07	-6	Alloy X-750	140	0.005	28500
					Alloy 718	160	0.006	32500
					Waspaloy	140	0.005	25000
		0.015	08	-6	Alloy X-750	350	0.004	49000
					Alloy 718	400	0.005	56500
					Waspaloy	350	0.004	43500
1/8	0.125	0.015	09	-6	Alloy X-750	260	0.006	33000
					Alloy 718	300	0.007	38000
					Waspaloy	260	0.006	29500
		0.020	10	-6	Alloy X-750	550	0.005	49500
					Alloy 718	600	0.006	56500
					Waspaloy	550	0.005	43500
5/32	0.156	0.016	11	-6	Alloy X-750	220	0.008	27000
					Alloy 718	260	0.009	31000
					Waspaloy	220	0.008	24000
		0.024	12	-6	Alloy X-750	550	0.006	46500
					Alloy 718	600	0.007	53500
					Waspaloy	550	0.006	41000
3/16	0.188	0.020	13	-6	Alloy X-750	300	0.009	28500
					Alloy 718	350	0.010	32500
					Waspaloy	300	0.009	25000
		0.030	14	-6	Alloy X-750	650	0.007	49000
					Alloy 718	750	0.008	56500
					Waspaloy	650	0.007	43500
1/4	0.250	0.025	15	-6	Alloy X-750	350	0.011	26000
					Alloy 718	400	0.013	30000
					Waspaloy	350	0.011	23000
		0.038	16	-6	Alloy X-750	850	0.008	46000
					Alloy 718	1000	0.009	52500
					Waspaloy	850	0.008	40500
3/8	0.375	0.038	17	-6	Alloy X-750	500	0.017	26500
					Alloy 718	600	0.020	30500
					Waspaloy	500	0.017	23500
		0.050	18	-6	Alloy X-750	1300	0.013	38000
					Alloy 718	1500	0.015	43500
					Waspaloy	1300	0.013	33500
1/2	0.500	0.050	19	-6	Alloy X-750	700	0.022	26000
					Alloy 718	800	0.025	30000
					Waspaloy	700	0.022	23000
		0.065	20	-6	Alloy X-750	1500	0.017	37000
					Alloy 718	1700	0.020	42000
					Waspaloy	1500	0.017	32500

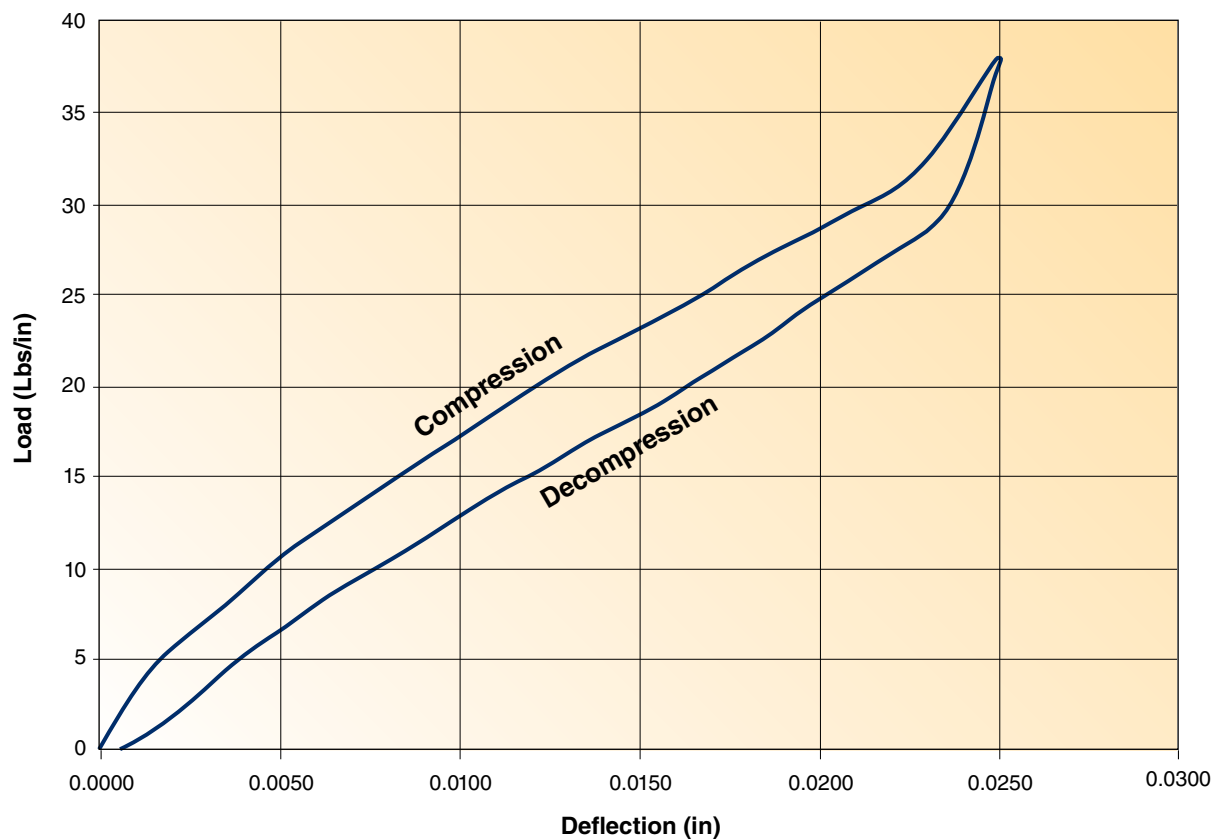
Performance Data

Metal E-Ring Performance								
Nominal Cross Section	Free Height	Material Thickness	Cross Section Code	Temper Code	Material	Seating Load (pounds per inch circum.)	Springback (inches)	Working Pressure Rating (psi)
1/16	0.074	0.005	05	-6	Alloy 718 Waspaloy	30 25	0.009 0.008	1500 1500
3/32	0.108	0.010	07	-6	Alloy 718 Waspaloy	40 35	0.018 0.015	1500 1500
		0.010	08	-6	Alloy 718 Waspaloy	90 75	0.013 0.011	5000 5000
1/8	0.139	0.012	09	-6	Alloy 718 Waspaloy	45 40	0.021 0.018	1500 1500
		0.012	10	-6	Alloy 718 Waspaloy	60 50	0.020 0.017	5000 5000
3/16	0.218	0.015	13	-6	Alloy 718 Waspaloy	50 45	0.035 0.030	2000 2000
1/4	0.295	0.020	15	-6	Alloy 718 Waspaloy	80 70	0.046 0.040	2000 2000

Based on nominal seal dimensions, recommended cavity dimensions and ambient temperature. If working pressures exceed the above ratings consult Parker for recommendations. Refer to Page E-68 for a definition of the above performance terminology.

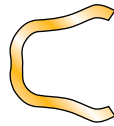


EEI Metal E-Ring Performance

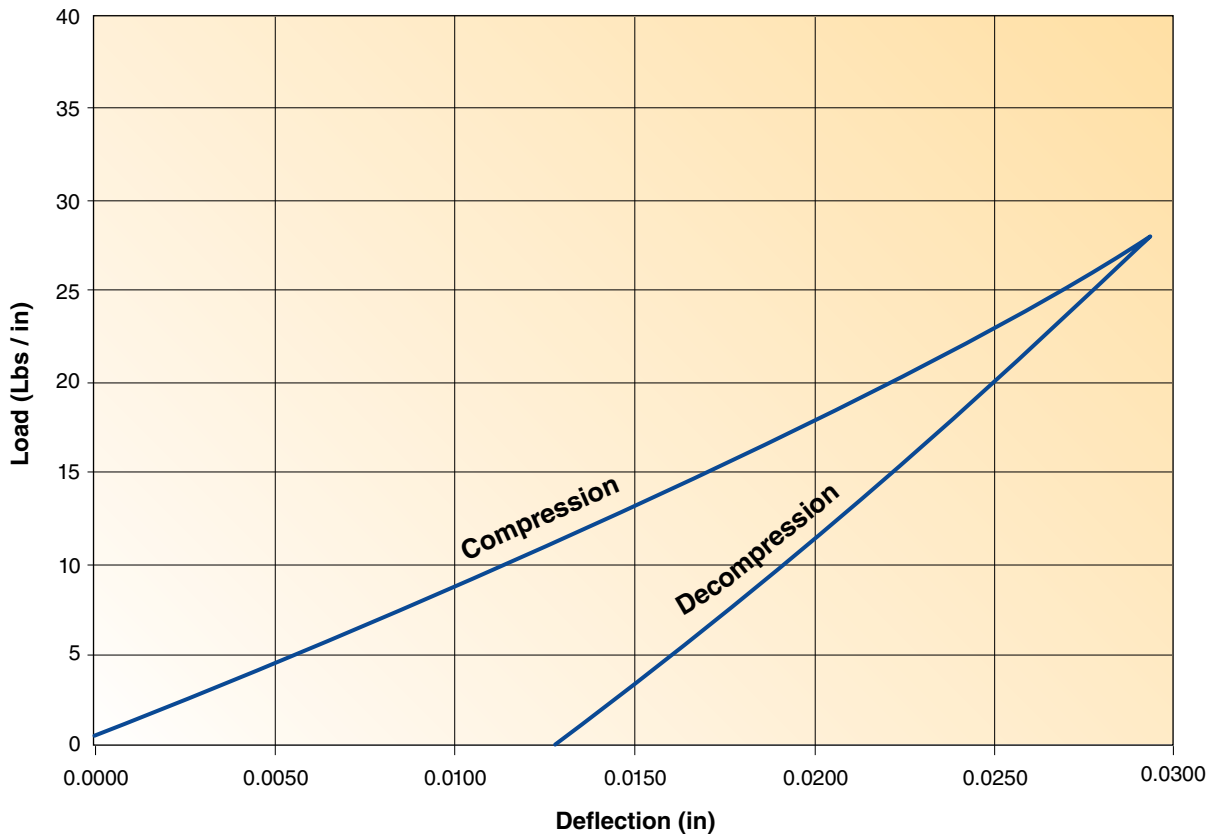


Metal U-Ring Performance								
Nominal Cross Section	Free Height	Material Thickness	Cross Section Code	Temper Code	Material	Seating Load (pounds per inch circum.)	Springback (inches)	Working Pressure Rating (psi)
1/16	0.063	0.005	05	-6	Alloy 718 Waspaloy	30 25	0.006 0.005	10000 10000
3/32	0.093	0.009	07	-6	Alloy 718 Waspaloy	40 40	0.010 0.009	12000 12000
1/8	0.125	0.012	09	-6	Alloy 718 Waspaloy	50 45	0.014 0.012	12000 12000
3/16	0.185	0.015	13	-6	Alloy 718 Waspaloy	50 45	0.020 0.017	8000 8000
1/4	0.247	0.020	15	-6	Alloy 718 Waspaloy	70 60	0.026 0.023	8000 8000

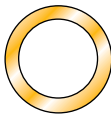
Based on nominal seal dimensions, recommended cavity dimensions and ambient temperature.



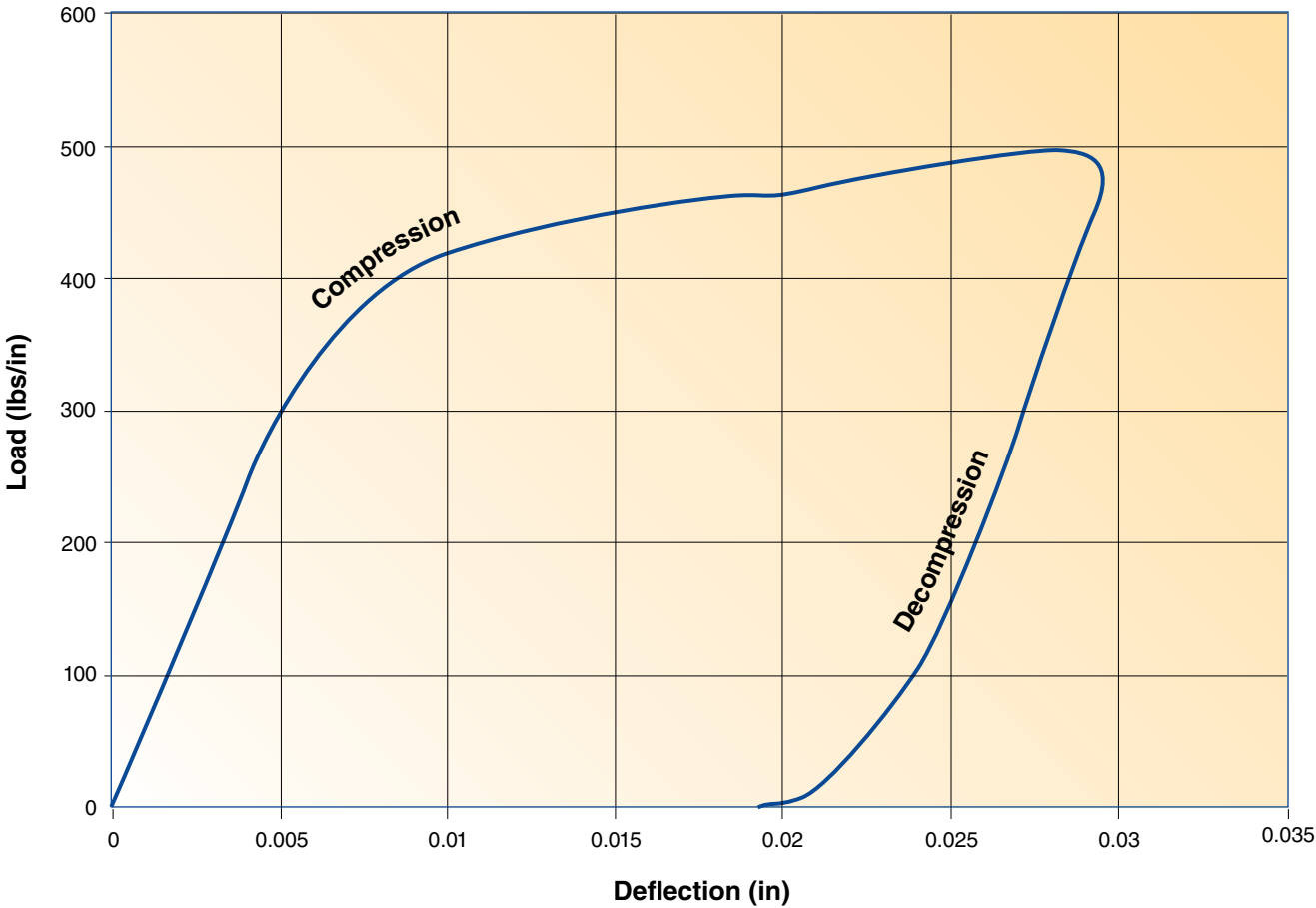
EUI Metal U-Ring Performance



Performance Data



EOI Metal O-Ring Performance



Metal O-Ring Performance									
Nominal Cross Section	Free Height	Material Thickness	Cross Section Code	Temper Code	Material	Seating Load (pounds per inch circumference)	Springback (inches)	Working Pressure Rating (psi)	
								Vented	Non-Vented
1/32	0.035	0.006	01	-1	321 SS Alloy X-750	400 550	0.0005 0.0005	10000 15000	700 1000
3/64	0.047	0.007	29	-1	321 SS Alloy X-750	400 550	0.001 0.001	7000 10000	700 1000
1/16	0.062	0.006	02	-1	321 SS Alloy X-750	260 350	0.0015 0.002	4000 6500	600 900
		0.010	03	-1	321 SS Alloy X-750	550 750	0.001 0.0015	11000 16000	700 1000
		0.012	31	-1	321 SS Alloy X-750	800 1100	0.001 0.001	14000 20000	700 1100
		0.014	08	-1	321 SS Alloy X-750	1100 1500	0.001 0.001	17000 25000	800 1200
3/32	0.094	0.006	04	-1	321 SS Alloy X-750	150 200	0.002 0.002	1400 2000	700 1000
		0.010	05	-1	321 SS Alloy X-750	300 400	0.002 0.002	4000 6500	800 1100
		0.012	32	-1	321 SS Alloy X-750	400 550	0.001 0.0015	6500 10000	800 1200
		0.018	09	-1	321 SS Alloy X-750	1200 1600	0.001 0.0015	16500 25000	900 1300
1/8	0.125	0.008	06	-1	321 SS Alloy X-750	100 140	0.004 0.005	2500 4000	500 700
		0.010	07	-1	321 SS Alloy X-750	150 200	0.003 0.004	4500 6500	500 800
		0.012	25	-1	321 SS Alloy X-750	280 400	0.002 0.003	6500 10000	600 900
		0.020	10	-1	321 SS Alloy X-750	900 1200	0.002 0.002	16500 25000	700 1000
5/32	0.156	0.016	11	-1	304 SS Alloy X-750	400 550	0.004 0.005	4000 6500	700 1000
		0.020	12	-1	304 SS Alloy X-750	750 1000	0.003 0.004	13500 20000	700 1100
3/16	0.188	0.020	13	-1	304 SS Alloy X-750	450 600	0.004 0.005	4000 6500	700 1000
		0.025	14	-1	304 SS Alloy X-750	700 950	0.003 0.004	14500 22000	700 1100
1/4	0.250	0.025	15	-1	304 SS Alloy X-750	450 600	0.005 0.006	4000 6000	700 1000
		0.032	16	-1	304 SS Alloy X-750	950 1300	0.004 0.005	13500 20500	700 1100
3/8	0.375	0.038	17	-1 -6	304 SS Alloy 718	650 1000	0.006 0.009	4000 8000	1100 1600
		0.049	18	-1 -6	304 SS Alloy 718	1100 1700	0.005 0.007	7500 14500	1300 2000
1/2	0.500	0.050	19	-1 -6	304 SS Alloy 718	1000 2400	0.009 0.017	4000 8000	1100 1600
		0.065	20	-1 -6	304 SS Alloy 718	1700 3800	0.007 0.012	7500 14500	1300 2000
5/8	0.625	0.063	21	-1 -6	304 SS Alloy 718	1400 3300	0.011 0.020	4000 8000	1100 1600

Based on nominal seal dimensions, recommended cavity dimensions, and ambient temperature. If working pressures exceed the above ratings consult us for recommendations. Refer to Page E-68 for a definition of the above performance terminology.

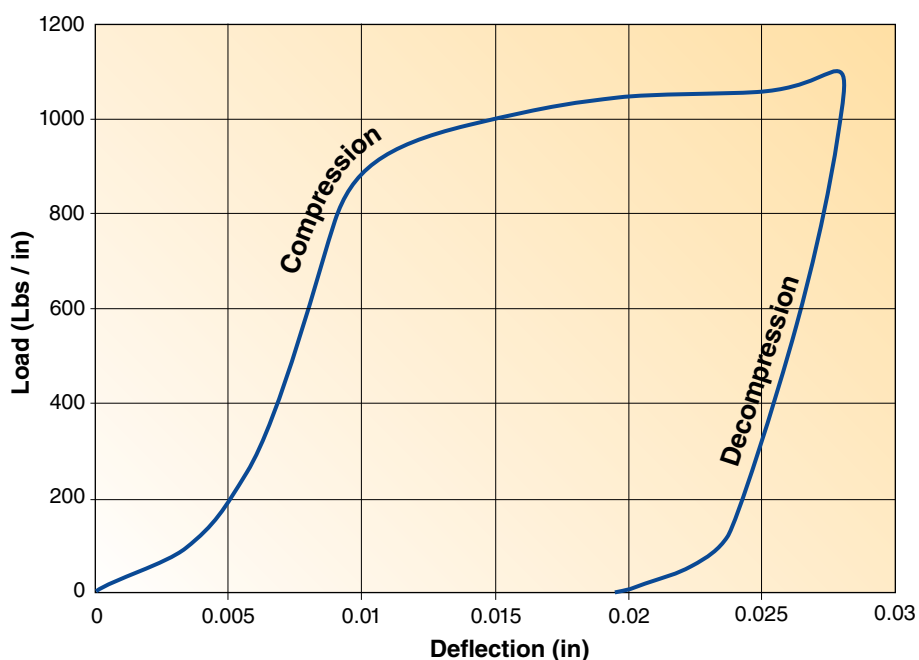
Performance Data

Spring Energized Metal C-Ring Performance							
Nominal Cross Section	Free Height	Cross Section Code	Temper Code	Material		Seating Load (pounds per inch circum.)	Springback (inches)
				Jacket	Spring		
1/16	0.062	05	-1	304 SS	304 SS	450	0.003
				Alloy X-750	Alloy X-750	500	0.003
				Alloy 718	Alloy 718	550	0.003
3/32	0.094	07	-1	304 SS	304 SS	800	0.004
				Alloy X-750	Alloy X-750	850	0.005
				Alloy 718	Alloy 718	900	0.006
1/8	0.125	09	-1	304 SS	304 SS	900	0.005
				Alloy X-750	Alloy X-750	950	0.006
				Alloy 718	Alloy 718	1000	0.007
5/32	0.156	11	-1	304 SS	304 SS	1200	0.007
				Alloy X-750	Alloy X-750	1300	0.008
				Alloy 718	Alloy 718	1400	0.009
3/16	0.188	13	-1	304 SS	304 SS	1400	0.008
				Alloy X-750	Alloy X-750	1500	0.009
				Alloy 718	Alloy 718	1600	0.010
1/4	0.250	15	-1	304 SS	304 SS	1900	0.010
				Alloy X-750	Alloy X-750	2000	0.011
				Alloy 718	Alloy 718	2100	0.012
3/8	0.375	17	-1	304 SS	304 SS	2400	0.015
				Alloy X-750	Alloy X-750	2500	0.017
				Alloy 718	Alloy 718	2600	0.018
1/2	0.500	19	-1	304 SS	304 SS	2800	0.020
				Alloy X-750	Alloy X-750	2900	0.022
				Alloy 718	Alloy 718	3100	0.024

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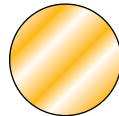


ESI Spring Energized Metal C-Ring Performance



Metal Wire Ring Performance							
Nominal Cross Section	Free Height	Cross Section Code	Temper Code	Material	Seating Load (pounds per inch circum.)	Springback (inches)	Working Pressure Rating (psi)
1/32	0.035	03	-4	Silver/Gold	900	0	7500
				Aluminum	1000	0	7500
				Copper	2400	0	15000
				Nickel	3000	0	20000
				304 Stainless Steel	4200	0	20000
1/16	0.062	05	-4	Silver/Gold	1200	0.0005	7500
				Aluminum	1400	0	7500
				Copper	3400	0	15000
				Nickel	4200	0	20000
				304 Stainless Steel	6000	0.0005	20000
3/32	0.094	06	-4	Silver/Gold	1200	0.001	7500
				Aluminum	1400	0.0005	7500
				Copper	3400	0.0005	15000
				Nickel	4200	0.0005	20000
				304 Stainless Steel	6000	0.001	20000
1/8	0.125	07	-4	Silver/Gold	1200	0.002	7500
				Aluminum	1400	0.001	7500
				Copper	3400	0.001	15000
				Nickel	4200	0.001	20000
				304 Stainless Steel	6000	0.002	20000

Based on nominal seal dimensions, recommended cavity dimensions and ambient temperature. If working pressures exceed the above ratings consult Parker for recommendations. Refer to Page E-68 for a definition of the above performance terminology.



EWE Metal E-Ring Performance

