



# DuPont™ Elvax®

## EVA resins

## For Molding, Compounding, and Extrusion

### Description

Elvax® resins are copolymers of ethylene and vinyl acetate. Commercial grades range in vinyl acetate content from 9 to 40% and in melt index from 0.3 to 500 dg/min. These specialty thermoplastic copolymers are inherently flexible, resilient, tough, and show excellent resistance to ozone and environmental stress cracking.

Elvax® resins can be used alone or as an additive to improve the performance properties of other resins and elastomers. Depending on the needs of your particular application, they can be pigmented, filled, foamed and/or cross-linked. In addition to their performance advantages, Elvax® resins can be processed using conventional thermoplastic and/or rubber handling equipment and techniques.

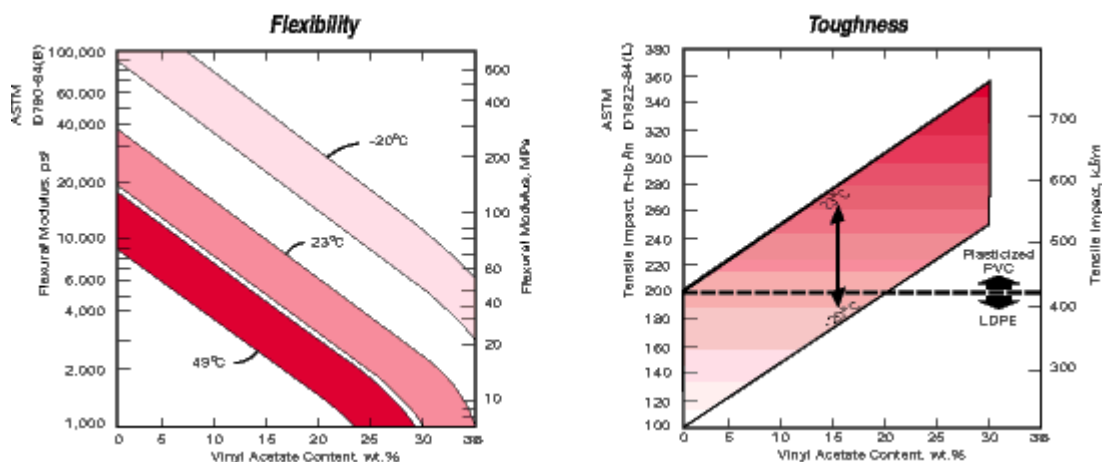
With no plasticizer to migrate and low odor, Elvax® resins offer advantages in many applications traditionally served by plasticized polyvinyl chloride and natural or synthetic rubbers.

### Commitment to Quality

DuPont utilizes its Proprietary Product Quality Management (PQM) System in the manufacture of its Molding, Compounding and Extrusion Grades of Elvax®. Elvax® has been ISO certified since 1992. The Key elements of PQM are the measurement and control advantages made possible by on aim Statistical Process Control (SPC). Because we have long product runs and large capacity mainframe computers, we use the cumulative Sum (CUSUM) measurement and correction system to minimize deviations from aim during production.

### Typical Applications

- Flexible hose and tubing
- Cap liners
- Footwear components
- Wire and cable compounding
- Toys and athletic goods
- Bearing pads
- Color concentrates
- Extruded gaskets
- Molded automotive parts
- Molded gaskets for casting plastic lenses
- Molded components for pump sprayers



## Properties

The Elvax® resins listed offer a broad spectrum of properties. Typical properties of representative grades are shown in Table 1. Flexibility, resilience, toughness and transparency increase with increasing vinyl acetate content. Within each grade series, that is, at a given vinyl acetate level, flexibility and toughness are also influenced by melt index.

### Flexibility

The flexibility of Elvax® resins is inherent in their molecular structure; there is no plasticizer to migrate. Flexibility is retained over a broad temperature range. And Elvax® excels in critical applications requiring repeated flexing. Resins in the 700 and 600 series—which contain 9% and 12% vinyl acetate, respectively—are twice as flexible as low density polyethylene (LDPE). Elvax® resins in the 500 and 400 series are three times as flexible as LDPE; 200 and 300 series resins are seven times as flexible as LDPE.

### Resilience

Elvax® resins show excellent recovery under repeated instantaneous load. Compression set can be improved by cross-linking. Resilience, like flexibility and toughness, increases with vinyl acetate content.

### Toughness

As indicated by the tensile impact values in Table 1, Elvax® resins provide exceptional toughness at low (-20°C/-4°F) as well as moderate (23°C/73°F) temperatures. For resins in the melt index range below 30, toughness increases with vinyl acetate content. Elvax® 150, which contains 32% vinyl acetate but has a melt index above 30, is still significantly tougher than LDPE.

## Processing

Elvax® resins can be processed by conventional thermoplastic processing techniques, including injection molding, structural foam molding, sheet and shape extrusion, blow molding and wire coating. They can also be processed using conventional rubber processing techniques such as Banbury, two-roll milling and compression molding.

### Cross-linking

Peroxides such as "Di-Cup" dicumyl peroxide and "Vul-Cup" a,a'-bis(t-butylperoxy)diisopropylbenzene can be used to cross-link (vulcanize) Elvax® resins.

### Injection Molding

Elvax® resins can be injection molded in screw or ram machines. Screws normally used for processing low density polyethylene are satisfactory. Injection pressures of 35-100 MPa (5,000-15,000 psi) are generally used. For molding applications where Elvax® is the sole resin, grades with a melt index below 45 are suggested. Melt temperature during molding should not exceed 220°C (420°F). Mold coolant temperatures are commonly in the range of 15-40°C (60-100°F).

Mold designs must provide for the rubber-like flexibility and resilience of Elvax® resins and their high coefficient of friction. More detailed information is available from your Du Pont Industrial Polymers representative.

### ***Extrusion***

Elvax® resins can be processed in thermoplastic extrusion equipment. Resin grades in the melt index range below 10 are generally used for extrusion. Most screw and die designs used for processing polyethylene are satisfactory. Melt temperature of Elvax® resins during extrusion should not exceed 220°C (420°F). Purging is readily accomplished using a low melt index polyethylene resin.

### ***Compounding***

As a blending resin, Elvax® improves the flexibility, resilience and toughness of many other olefinic resins and rubbers. It is easily compounded with polyethylene, polypropylene, ABS resins, thermoplastic rubbers (SBR and TPR), nitrile rubbers, natural rubber and many other elastomers and compounded rubbers. The broad compatibility of Elvax® resins with other resins and their ability to accept high pigment and filler loadings make them ideally suited for preparing color concentrates and master batches.

### ***Foaming***

Elvax® resins can be foamed (expanded) using injection molding and extrusion equipment. Either chemical blowing agents (e.g., azodicarbamides) or physical agents (nitrogen or Formacel®) may be used.

### **FDA Status**

F.D.A. regulation 177.1350 allows the use of Elvax® resins as articles or components of articles for use in contact with food, subject to the extraction limits referred to in the regulation.

## **Typical Physical Properties of Elvax® Resins for Molding, Compounding, and Extrusion<sup>a</sup>**

Product	Melt Index	Vinyl Acetate,	Density,	Melting	Vicat Softening	Hardness, Shore		Brittleness Temp., ASTM D746
	dg/min ASTM	wt%	kg/m <sup>3</sup> (g/cm <sup>3</sup> ) ASTM	Point DSC	Temp., ASTM D1525	ASTM D2240	ASTM D2240	
	D1238	TGA	D792	°C	°C	Scale A	Scale D	°C
LDPE <sup>c</sup>	1.9	-	920 (0.920)	-	97	96	55	<-100
Elvax® 880 <sup>d</sup>	1.2	7.5	930 (0.930)	99	82	96	44	<-100
Elvax® 770	0.8	9.5	930 (0.930)	96	80	98	47	<-100
Elvax® 760Q	2.0	9.3	930 (0.930)	100	82	97	46	<-100
Elvax® 750	7.0	9.0	930 (0.930)	98	75	95	47	<-100
Elvax® 670	0.3	12.0	933 (0.933)	95	79	96	45	<-100
Elvax® 660	2.5	12.0	933 (0.933)	96	74	95	44	<-100
Elvax® 650Q	8.0	12.0	933 (0.933)	95	65	93	43	<-100

Elvax® 560	2.5	15.0	935 (0.935)	92	71	92	41	<-100
Elvax® 550	8.0	15.0	935 (0.935)	85	62	92	41	<-100
Elvax® 470	0.7	18.0	941 (0.941)	89	68	90	40	<-100
Elvax® 466	1.5	18.0	941 (0.941)	87	68	91	41	<-100
Elvax® 460	2.5	18.0	941 (0.941)	88	64	90	40	<-100
Elvax® 450	8.0	18.0	941 (0.941)	86	61	88	38	<-100
Elvax® 360	2.0	25.0	948 (0.948)	78	53	87	36	<-100
Elvax® 350	19.0	25.	948 (0.948)	74	46	83	28	<-100
Elvax® 265	3.0	28.0	951 (0.951)	73	49	86	35	<-100
Elvax® 260	6.0	28.0	955 (0.955)	75	46	85	34	<-100
Elvax® 250	25.0	28.0	951 (0.951)	70	42	80	30	<-100
Elvax® 240	43.0	28.0	951 (0.951)	74	40	78	26	-68
Elvax® 150	43.0	32.0	957 (0.957)	63	36	73	24	-93

a Test specimens (except for melt index, % vinyl acetate and tensile impact) were prepared by compression molding (ASTM D1928, procedure C); tensile impact samples were injection molded.

b Test specimen = ASTM D 638, type IV; crosshead speed - 5.1 cm (2 in.)/ min.

c DuPont 20 polyethylene resin.

d Elvax® 880 contains slip and anti-block additives

**NOTE:** These data are presented to describe various grades of Elvax® and are not intended as specifications.

### Typical Physical Properties of Elvax® Resins for Molding, Compounding, and Extrusion<sup>a</sup> (continued)

Product	Tensile Strength MPa (psi) ASTM D638b			Elongation, % ASTM D638b			Tensile Impact kJ/m <sup>2</sup> (ft-lb/-in <sup>2</sup> ) ASTM D 1822	
	-20°C	23°C	49°C	-20° C	23° C	49° C	-20°C	23°C
LDPE <sup>c</sup>	23 (3,400)	14 (2,100)	14 (2,000)	500	550	500	325(155)	345(165)
Elvax® 880 <sup>d</sup>	26 (3,800)	13 (1,890)	11 (1,600)	550	580	750	-	-
Elvax® 770	32 (4,700)	19 (2,700)	12 (1,700)	500	650	750	425 (205)	450 (215)
Elvax® 760Q	30 (4,300)	17 (2,500)	11 (1,600)	450	700	700	380 (180)	485 (230)
Elvax® 750	21 (3,100)	15 (2,200)	9.6 (1,400)	450	600	550	305 (145)	400 (190)
Elvax® 670	38 (5,600)	23 (3,400)	13 (1,900)	500	700	800	470 (225)	590 (280)
Elvax® 660	32 (4,600)	18 (2,600)	8.3 (1,200)	500	750	800	450 (215)	505 (240)
Elvax® 650Q	21 (3,000)	14 (2,100)	9.0 (1,300)	500	650	600	430 (205)	460 (220)
Elvax® 560	36 (5,300)	20 (2,900)	8.8 (1,200)	500	750	800	505 (240)	545 (260)
Elvax® 550	21	14 (2,000)	6.6 (950)	500	700	650	485 (230)	505 (240)

	(3,100)							
Elvax® 470	42 (6,100)	28 (4,000)	9.7 (1,400)	500	750	850	515 (245)	610 (290)
Elvax® 466	37 (5,300)	19.6 (2,868)	8 (1,200)	540	715	830	-	752 (358)
Elvax® 460	24 (3,500)	18,(2,600)	11 (1,600)	500	750	600	485 (230)	555 (265)
Elvax® 450	28 (4,100)	15 (2,200)	5.5 (800)	450	800	750	445 (210)	525 (250)
Elvax® 360	45 (6,600)	18 (2,600)	5.5 (800)	500	800	900	590 (280)	880 (420)
Elvax® 350	19 (2,700)	8.3 (1200)	2.4 (350)	450	800	500	545 (260)	670 (320)
Elvax® 265	51 (7,400)	17 (2,500)	4.2 (600)	500	750	800	715 (340)	945 (450)
Elvax® 260	22 (3,200)	15 (2,200)	4.1 (600)	400	750	600	650 (310)	695 (330)
Elvax® 250	19 (2,700)	9.3 (1,350)	1.7 (250)	400	800	500	515 (245)	685 (325)
Elvax® 240	29 (4,200)	7.6 (1,100)	1.4 (200)	400	850	400	335 (160)	725 (345)
Elvax® 150	19 (2,700)	6.2 (900)	-	300	950	-	390 (185)	590 (280)

a Test specimens (except for melt index, % vinyl acetate and tensile impact) were prepared by compression molding (ASTM D1928, procedure C); tensile impact samples were injection molded.

b Test specimen = ASTM D 638, type IV; crosshead speed - 5.1 cm (2 in.)/ min.

c DuPont 20 polyethylene resin.

d Elvax® 880 contains slip and anti-block additives

**NOTE:** These data are presented to describe various grades of Elvax® and are not intended as specifications.

### Typical Physical Properties of Elvax® Resins for Molding, Compounding, and Extrusion<sup>a</sup> (continued)

Product	Flexural Modulus MPa (psi) ASTM D790			Stiffness MPa (psi) ASTM D747		Compression Set, % ASTM D 395, Method B	
	-20°C	23°C	49°C	-20°C	23°C	10days at 25°C	22 hrs at 70 ° C
LDPE <sup>c</sup>	800 (116,000)	155 (22,500)	86 (12,500)	414 (60,000)	128 (18,600)	45	73
Elvax® 880 <sup>d</sup>	627 (90,900)	133 (19,300)	56 (8,100)	311 (45,100)	101 (14,600)	25	80
Elvax® 770	503 (73,000)	110 (16,000)	53 (7,700)	345 (50,000)	96 (14,000)	52	84
Elvax® 760Q	448 (65,000)	96 (14,000)	50 (7,200)	276 (40,000)	90 (13,100)	33	86
Elvax® 750	363 (52,600)	86 (12,500)	46 (6,700)	205 (29,700)	74 (10,800)	46	74
Elvax® 670	365 (53,000)	77 (11,200)	34 (4,900)	241 (35,000)	72 (10,400)	53	89

Elvax® 660	317 (46,000)	70 (10,200)	31 (4,500)	207 (30,000)	64 (9,300)	39	86
Elvax® 650Q	265 (38,400)	66 (9,600)	36 (5,200)	167 (24,200)	60 (8,700)	49	90
Elvax® 560	277 (40,200)	63 (9,200)	32 (4,600)	207 (40,000)	50 (13,100)	56	91
Elvax® 550	234 (34,000)	51 (7,400)	26 (3,700)	141 (20,400)	48 (7,000)	54	91
Elvax® 470	244 (35,300)	52 (7,500)	23 (3,400)	214 (31,000)	46 (6,600)	56	94
Elvax® 466	261 (37,900)	23 (11,500)	30 (4,350)	123 (17,800)	36 (5,200)	51	104
Elvax® 460	226 (32,800)	44 (6,400)	21 (3,000)	125 (18,200)	43 (6,200)	50	80
Elvax® 450	197 (28,500)	40 (5,800)	18 (2,600)	159 (23,000)	37 (5,400)	49	90
Elvax® 360	86 (12,600)	26 (3,700)	17 (2,500)	76 (11,000)	26 (3,700)	49	100
Elvax® 350	76 (11,000)	18 (2,600)	10 (1,500)	49 (7,100)	17 (2,400)	59	115
Elvax® 265	86 (12,400)	16 (2,300)	9.7 (1,400)	55 (8,000)	19 (2,800)	49	100
Elvax® 260	84 (12,200)	14 (2,000)	8.3 (1,200)	46 (6,700)	18 (2,600)	54	112
Elvax® 250	79 (11,400)	10 (1,500)	6.9 (1,000)	45 (6,500)	13 (1,900)	62	109
Elvax® 240	62 (9,000)	9.0 (1,300)	-	37 (5,400)	9 (1,300)	57	100
Elvax® 150	58 (8,400)	6.9 (1,000)	5.5 (800)	30 (4,300)	5.5 (800)	65	91

a Test specimens (except for melt index, % vinyl acetate and tensile impact) were prepared by compression molding (ASTM D1928, procedure C); tensile impact samples were injection molded.

b Test specimen = ASTM D 638, type IV; crosshead speed - 5.1 cm (2 in.)/ min.

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