



# DuPont™ Elvax®

EVA resins

## For Adhesives, Sealants, and Wax Blends

### Description

Elvax® is the DuPont registered trademark for a broad line of ethylene-vinyl acetate copolymer resins for use in adhesives, sealants, and coatings. Elvax® blended with a petroleum wax and resin tackifier is the basis of many hot melt adhesives. In addition, Elvax® resins impart plastic-like properties that enable wax to compete effectively with high-quality polymeric coatings. In summary, Elvax® resins are key ingredients in a variety of hot melt and solvent-applied systems. They are used as:

- Resin bases for hot melt, pressure sensitive, and solvent-applied adhesives.
- Resin bases for flexible, heat-sealable, hot melt coatings with excellent water vapor and gas barrier properties.
- Additives to wax to impart toughness, flexibility, and adhesion.
- Permanent plasticizer-like resins to impart flexibility to brittle materials.

### Commitment to Quality

DuPont utilizes its proprietary Product Quality Management (PQM) system in the manufacture of its adhesive and sealant grades of Elvax®. The key elements of PQM are the measurement and control advantages made possible by on-aim Statistical Process Control (SPC) and the Cumulative Sum (CUSUM) measurement system to minimize deviations from aim during production. Instead of manufacturing to a range of specifications and testing the product for acceptability, the DuPont CUSUM control method sets single point aim values for melt index (MI) and percent vinyl acetate (VA), and fine-tunes the process to stay on aim. For further information on this PQM system, contact your DuPont sales representative.

This selection guide is designed to aid you in selecting the type and grade of Elvax® resin best suited for a particular end use. Grades within each family of resins reflect differences in vinyl acetate content and in melt index, a convenient basis for comparing molecular weights. The grade selector charts on pages 4 and 5 show at a glance the relationship between grades. Arrows beneath and at the side of the grids indicate the direction in which key properties of the Elvax® resins, and of adhesives or coatings based on Elvax®, vary with melt index at a given vinyl acetate content and with vinyl acetate content at comparable melt index.

Grade selection within the Elvax® ethylene/vinyl acetate copolymer family is simplified by grouping the resins into series based on vinyl acetate content. Grades offering a choice of melt index at the same vinyl acetate content are available within the 200, 300, 400, 500, 600, or 700 series.

In formulating to meet specific cost/performance requirements, it is often advantageous to use a combination of Elvax® grades. For example, high and low melt index resins in the same series can be combined to achieve intermediate viscosity and functional properties, or a 400 series resin can be combined with a relatively high vinyl acetate Elvax® copolymer resin or an Elvax® acid terpolymer resin to improve adhesion and flexibility while retaining the desirable surface properties characteristic of the 400 series.

**High Vinyl Acetate Resins** (>30% VA) offer excellent adhesion to nonporous surfaces, greater solubility in organic solvents than other Elvax® resins, and broad compatibility with tackifier resins. They are particularly useful in solvent-applied adhesives and coatings, and can also be incorporated in specialty hot melt blends. Elvax® 150 (32% VA) is especially useful in hot melt adhesives for nonporous substrates. Elvax® 40W, because of its higher vinyl acetate content (40% VA), is more soluble in organic solvents and is compatible with a broader range of polar resins including nitrocellulose.

**200 Series Resins** (28% VA) provide optimum functional properties in blends with paraffin wax. They are widely used in hot melt coatings and adhesives to impart toughness, flexibility, and improved adhesion.

**300 Series Resins** (25% VA) are specifically designed for optimum utility in hot melt systems containing major quantities of microcrystalline waxes.

**400 Series Resins** (18% VA) are relatively low-cost resins designed particularly for use as wax additives and in hot melt systems where surface gloss, hardness, and resistance to blocking are the chief requirements. They are also useful in heat-sealable label adhesives and hot melt adhesives for porous substrates.

**500, 600, and 700 Series Resins** (<18% VA) may be used in hot melt systems where their low cost makes them attractive extenders or modifiers. Resins in this series may also impart higher temperature resistance where this property is required. These same resins are used for molding, compounding, and extrusion applications.

**Acid Terpolymers** offer premium performance in many uses. In wax-extended systems, these unique interpolymers of ethylene, vinyl acetate, and an organic acid offer the advantages of superior oil and grease resistance, greater hot tack, and improved adhesion to polar, nonporous substrates. Blends of the acid terpolymers with Elvax® copolymer resins provide intermediate performance levels.

**High Vinyl Acetate, Low Melt Index Resins.** These specialty Elvax® resins have high levels of vinyl acetate and a low melt index. Among the offerings are Elvax® CM 576 which has 28% VA and a 0.7 MI and Elvax® 40L03 which has 40% VA and an MI of 3. For further information ask for the data sheet on "High VA, Low MI Resins."

We urge you to run sample tests to find the most suitable and cost-effective combination for your particular application. Your DuPont Packaging and Industrial Polymers representative is ready to assist you in utilizing Elvax® resins to your best advantage. If you have polymer needs not served by any of the grades shown in this guide, we'll be glad to discuss your requirements. Call or write the nearest DuPont sales office.

### Elvax® Resin Grades---Ethylene-Vinyl Acetate Copolymers Typical Physical Properties <sup>a</sup>

Elvax® Grade <sup>b</sup>	Aim Values		Density at 23°C kg/m <sup>3</sup> (g/cc) ASTM D1505	Tensile Strength MPa (psi) ASTM D1708 <sup>d</sup>	Elongation at Break, % ASTM D1708 <sup>d</sup>	Elastic (Tensile) Modulus MPa (psi) ASTM D1708 <sup>d e</sup>	Hardness, Shore A--2 Durometer, 10 sec ASTM D2240	Softening Point Ring & Ball, °C (°F) ASTM E28	Cloud Point in Paraffin Wax, <sup>f</sup> °C (°F)
	Melt Index <sup>c</sup>	Vinyl Acetate							
40W <sup>g</sup>	52	40.0	965 (0.965)	5.2--6.2 (750-- 900)	1000--1300	3.0 (450)	40	104 (220)	154 (310) [20%]

150	43	32.0	957 (0.957)	6.9--8.3 (1000-- 1200)	900--1100	10.0 (1400)	65	110(230)	102 (215)
150W <sup>g</sup>	43	32.0	957 (0.957)	6.9--8.3 (1000-- 1200)	900--1100	10.0 (1400)	65	110(230)	102 (215)
205W <sup>g</sup>	800	28.0	951 (0.951)	2.6 (375)	400--600	12 (1700)	75	80 (176)	66 (150)
210W <sup>g</sup>	400	28.0	951 (0.951)	2.8 (400)	800--1000	12 (1700)	62	82 (180)	66 (150)
220W <sup>g</sup>	150	28.0	951 (0.951)	5.5 (800)	800--1000	16 (2300)	69	88 (190)	66 (150)
240	43	28.0	951 (0.951)	9.7 (1400)	800--1000	18 (2600)	73	110 (230)	66 (150)
240W <sup>g</sup>	43	28.0	951 (0.951)	9.7 (1400)	800--1000	18 (2600)	73	110 (230)	66 (150)
250	25	28.0	951 (0.951)	11 (1600)	800--1000	19 (2800)	75	127 (260)	66 (150)
260	6.0	28.0	955 (0.955)	24 (3500)	800--1000	26 (3800)	80	154 (310)	66 (150)
265	3.0	28.0	955 (0.955)	29 (4200)	800--1000	28 (4100)	83	171 (340)	66 (150)
350	19	25.0	948 (0.948)	14 (2000)	800--1000	25 (3600)	80	132 (270)	66 (150)
360	2.0	25.0	950 (0.950)	26 (3800)	800--1000	35 (5100)	85	188 (370)	66 (150)
410	500	18.0	934 (0.934)	4.7 (675)	600--900	33 (4800)	80	88 (190)	66 (150)
420	150	18.0	937 (0.937)	8.6 (1250)	600--900	42 (6100)	84	99 (210)	66 (150)
450	8.0	18.0	940 (0.940)	18 (2550)	600--900	51 (7400)	90	150 (302)	66 (150)
460	2.5	18.0	941 (0.941)	23 (3300)	600--900	52 (7500)	90	199 (390)	66 (150)
470	0.7	18.0	940 (0.940)	26 (3800)	600--900	63 (9100)	92	223 (434)	84 (184)
550	8.0	15.0	935 (0.935)	18 (2600)	800--900	64 (9300)	93	150 (302)	71 (160)
560	2.5	15.0	40 (0.940)	22 (3200)	800--900	74 (10700)	93	188 (370)	71 (160)
650Q	8.0	12.0	933 (0.933)	17 (2500)	750--850	85 (12300)	94	150 (302)	78 (172)
660	2.5	12.0	940 (0.940)	21 (3000)	750--850	91 (13200)	94	193 (380)	78 (172)
670	0.3	12.0	940 (0.940)	26 (3800)	750--850	100 (14500)	94	233 (452)	79 (174)
750	7.0	9.0	930 (0.930)	15 (2200)	600--750	110 (16000)	95	153 (307)	86 (186)

760Q	2.0	9.3	930 (0.930)	21 (3000)	750--850	140 (20000)	96	167 (332)	86 (186)
770	0.8	9.5	930 (0.930)	22 (3200)	750--850	160 (23200)	96	227 (440)	84 (183)

<sup>a</sup> These data are presented as a general description of properties and are not intended to be used for design specifications.

<sup>b</sup> All grades contain 190--910 ppm butylated hydroxy toluene.

<sup>c</sup> dg/min (ASTM D1238, modified).

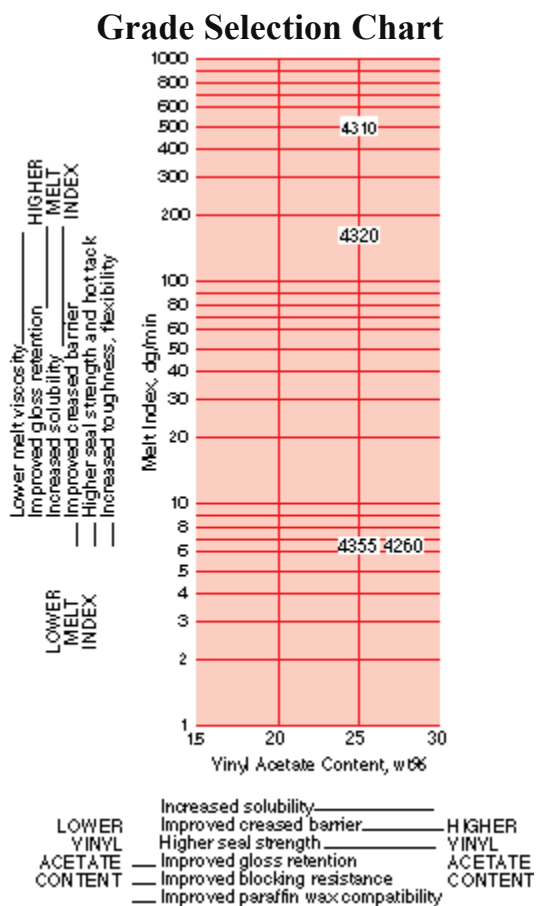
<sup>d</sup> Samples die cut from pressed films; gage dimensions 2.23 cm x 0.47 cm x 0.13 cm (0.876 in x 0.187 in x 0.050 in); crosshead speed 5.1 cm (2 in)/min. Elongation based on sample length of 1.91 cm (0.75 in).

<sup>e</sup> Modulus calculated as in ASTM D638.

<sup>f</sup> 10% Elvax® in fully refined paraffin wax, 146 AMP. Incompatible at temperatures up to 177°C (350°F).

<sup>g</sup> The "W" postscript denotes grades containing an anti-blocking additive.

## Elvax® Resin Grades---Ethylene-Vinyl Acetate/Acid Terpolymers



### Principal Properties and Uses

Grade*	
Elvax® 4260	High molecular weight resin for use in hot melt systems where improved adhesion to polar, nonporous substrates is required. In coatings, provides superior hot tack, improved grease resistance, and optimum barrier properties.
Elvax® 4310	Low molecular weight resin designed to provide improved grease resistance and adhesion in low-viscosity systems. Permits maximum <i>Elvax</i> <sup>(R)</sup> content at a given viscosity in solvent or hot melt systems.
Elvax®	Intermediate molecular weight resin higher in viscosity than <i>Elvax</i> <sup>(R)</sup> 4310 and

4320	intermediate in performance between <i>Elvax</i> <sup>(R)</sup> 4310 and 4355. Can be combined (as can <i>Elvax</i> <sup>(R)</sup> 4310) with <i>Elvax</i> <sup>(R)</sup> 4355 or 4260 to optimize performance at a desired viscosity level.
Elvax® 4355	High molecular weight resin preferred in high hot-tack systems. Most effective of the 4300 series resins in imparting toughness, flexibility, and seal strength in blends with wax.

\*All grades contain 190--910 ppm butylated hydroxy toluene.

### Typical Properties <sup>a</sup>

	<b>Elvax® 4260</b>	<b>Elvax® 4310</b>	<b>Elvax® 4320</b>	<b>Elvax® 4355</b>
Melt Index <sup>b</sup> Aim	6.0	500	150	6.0
Vinyl Acetate, % Aim	28.0	25.0	25.0	25.0
Acid Number <sup>c</sup>	4--8	4--8	4--8	4--8
Density at 23°C kg/m <sup>3</sup> (g/cc) ASTM D1505	955 (0.955)	945 (0.945)	947 (0.947)	952 (0.952)
Tensile Strength MPa (psi) ASTM D1708 <sup>d</sup>	19 (2700)	2.0 (300)	5.2 (750)	19 (2800)
Elongation at Break, % ASTM D1708 <sup>d</sup>	1000	600	900	1000
Elastic (Tensile) Modulus, MPa (psi) ASTM D1708 <sup>d,e</sup>	10 (1500)	6.2 (900)	8.3 (1200)	14 (2000)
Hardness, Shore A-2 Durometer, 10 sec ASTM D2240	80	68	72	83
Softening Point, Ring & Ball, °C (°F) ASTM E28	158 (316)	83 (181)	91 (195)	151 (304)
Cloud Point in Paraffin Wax, <sup>f</sup> °C (°F)	99 (210)	88 (190)	88 (190)	88 (190)

<sup>a</sup> These data are presented as a general description of properties and are not intended to be used for design specifications.

<sup>b</sup> dg/min (ASTM D1238, modified).

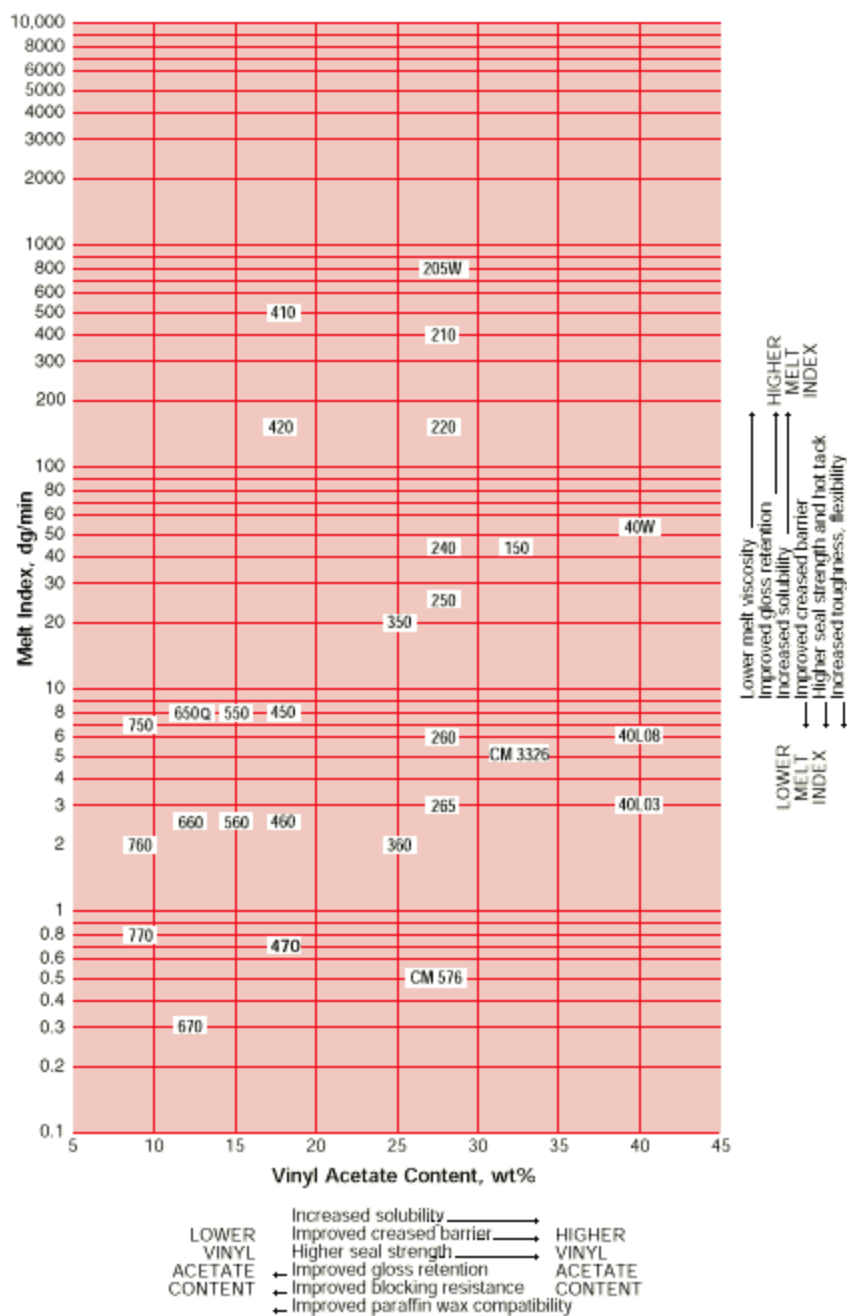
<sup>c</sup> Milligrams potassium hydroxide per gram polymer.

<sup>d</sup> Samples die cut from pressed films; gage dimensions 2.23 cm × 0.47 cm × 0.13 cm (0.876 in × 0.187 in × 0.050 in); crosshead speed 5.1 cm (2 in)/min. Elongation based on sample length of 1.91 cm (0.75 in).

<sup>e</sup> Modulus calculated as in ASTM D638.

<sup>f</sup> 10% Elvax® in fully refined wax, 146 AMP.

### *Elvax*<sup>(R)</sup> Resin Grades---Ethylene-Vinyl Acetate Copolymers Grade Selection Chart



### High VA, Low MI Grades of Elvax®

For many years DuPont has made specialty grades of Elvax® that have the unusual combination of high vinyl acetate levels and low melt indexes. Due to the high VA content, the polymers have low crystallinity and are relatively polar. Combined with a high molecular weight (low MI), the polymers are almost "rubbery" in nature.

These polymers can be blended with hydrocarbon waxes to give blends with unusual properties. The blends are mostly wax so they have excellent barrier properties to water as measured by MVTR. They are also relatively high in viscosity, due to the low MI of the polymer, so the blends have good physical properties.

The high VA level means that these polymers are also soluble in organic solvents. The low MI gives them good heat resistance and this can be seen in the high Ring and Ball numbers.

These polymers also can be used in other end-use markets that need the combination of high vinyl acetate and high molecular weight. One drawback is that the polymers are higher in gel than the standard grades of Elvax® so they cannot be used in some film markets.

### Physical Properties of High VA, Low MI Elvax®Resins

	<b>CM 576</b>	<b>CM 3326</b>	<b>40L03</b>	<b>40L08</b>	<b>CM 4875</b>
% Vinyl Acetate by weight	28	33	40	40	28
% Methacrylic Acid (MAA) by weight					1
Melt Index, dg/min, ASTM D1238	0.7	5	3	6	0.5
Tensile Strength, psi, ASTM D1708	3200	1600	1500	1400	3800
% Elongation at Break, ASTM D1708	980	1030	1270	1200	970
Hardness, Shore A-2 Durometer 10 sec, ASTM D1706	78	64	48	47	80
Density at 23°C (73°F) (g/cm <sup>3</sup> ), ASTM D792	0.950	0.955	0.966	0.967	0.954
Softening Point, R&B, °C	>210	150	155	147	209
Ring and Ball, °F, ASTM E28	>410	302	311	297	408
Cloud Pt., °C, 10% poly/90% wax Melt Point of Wax, 64°C (147°F)	68	91	Not Compatible	Not Compatible	110
DSC, ASTM D3418					
Melt Point, °C	71	60	58	53	70
Freeze Point, °C	47	37	26	29	47



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Home



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