

DuPont™ Elvax® EVA resins for Adhesives, Sealants and Wax Blends

Description

DuPont™ Elvax® ethylene vinyl acetate (EVA) copolymer resins are often used 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 including:

- 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 a 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.

Resins Grades, Properties and Typical Uses

This 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 (VA) content and in melt index (MI), a convenient basis for comparing molecular weights. The grade selector charts in this document show 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 combine Elvax® grades. For example, high- and low-MI 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-VA 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.



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DUPONT™ ELVAX® EVA RESINS FOR ADHESIVES, SEALANTS AND WAX BLENDS

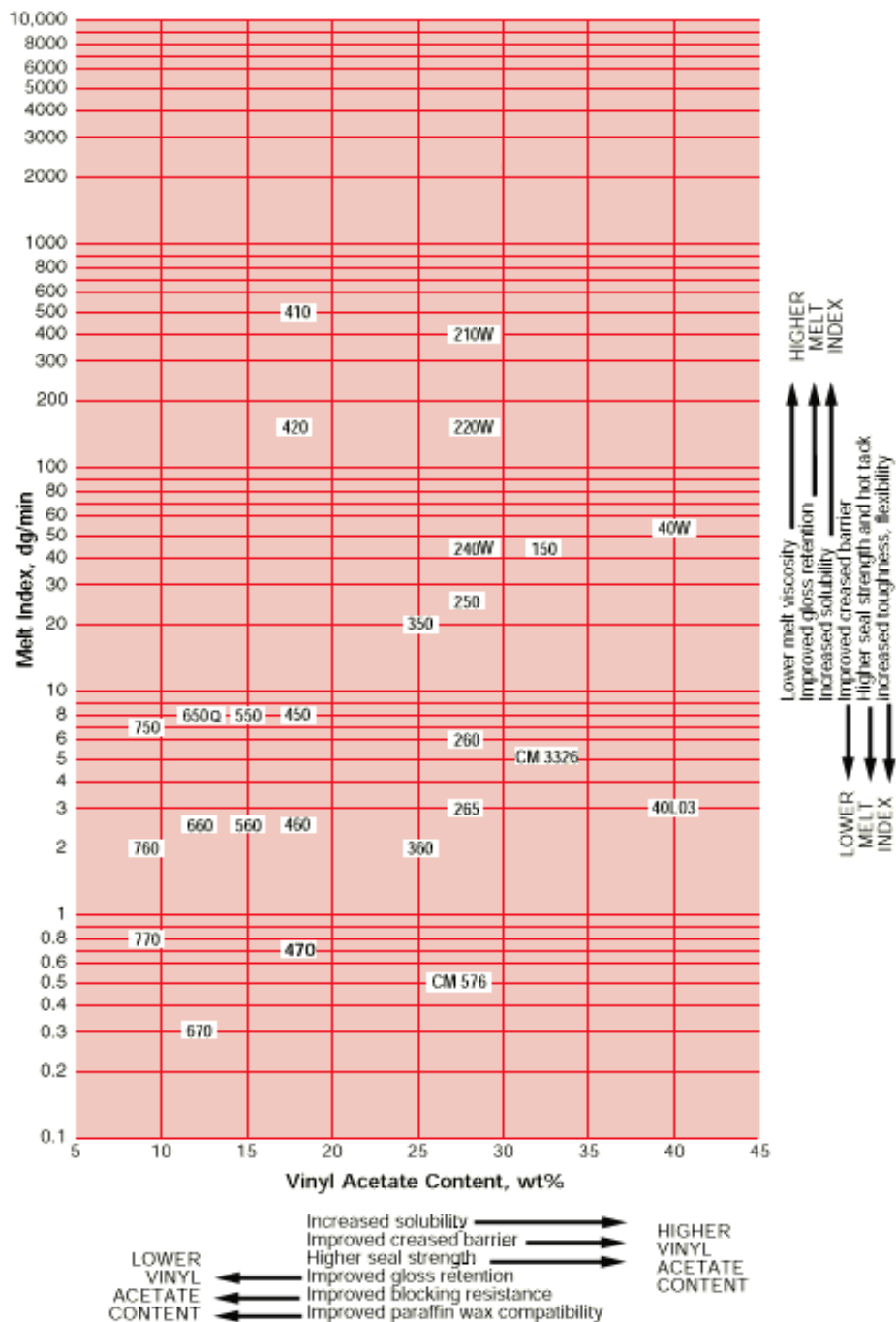
High Vinyl Acetate Resins (>30% VA) offer excellent adhesion to nonporous surfaces, greater solubility in organic solvents than other Elvax® resins, and broad compatibility with tackifier resins. They are particularly useful in solvent-applied adhesives and coatings, and can also be incorporated in specialty 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.



DuPont™ Elvax® ethylene-vinyl acetate (EVA) copolymers Resin Grades and Typical Physical Properties ^(a)

Elvax® Grade ^(b)	Aim Values		Density at 23°C kg/m ³ (g/cc) ASTM D1505	Tensile Strength, MPa (psi) ASTM D1708 ^(d)	Elongation at Break, % ASTM D1708 ^(d)	Elastic (Tensile) Modulus, MPa (psi) ASTM D1708 ^(d,e)	Hardness, Shore A–2 Durometer, 10 sec ASTM D2240	Softening Point Ring & Ball, °C (°F) ASTM E28	Cloud Point in Paraffin Wax, ^(f) °C (°F)
	Melt Index ^(c)	Vinyl Acetate							
40W ^(g)	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 ^(g)	43	32.0	957 (0.957)	6.9–8.3 (1000– 1200)	900–1100	10.0 (1400)	65	110(230)	102 (215)
210W ^(g)	400	28.0	951 (0.951)	2.8 (400)	800–1000	12 (1700)	62	82 (180)	66 (150)
220W ^(g)	150	28.0	951 (0.951)	5.5 (800)	800–1000	16 (2300)	69	88 (190)	66 (150)
240W ^(g)	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)

^(a) These data are presented as a general description of properties and are not intended to be used for design specifications.

^(b) All grades contain 190–910 ppm butylated hydroxy toluene.

^(c) dg/min (ASTM D1238, modified).

^(d) 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).

^(e) Modulus calculated as in ASTM D638.

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

^(g) The “W” postscript denotes grades containing an anti-blocking additive.

Elvax® EVA Acid Terpolymers

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.

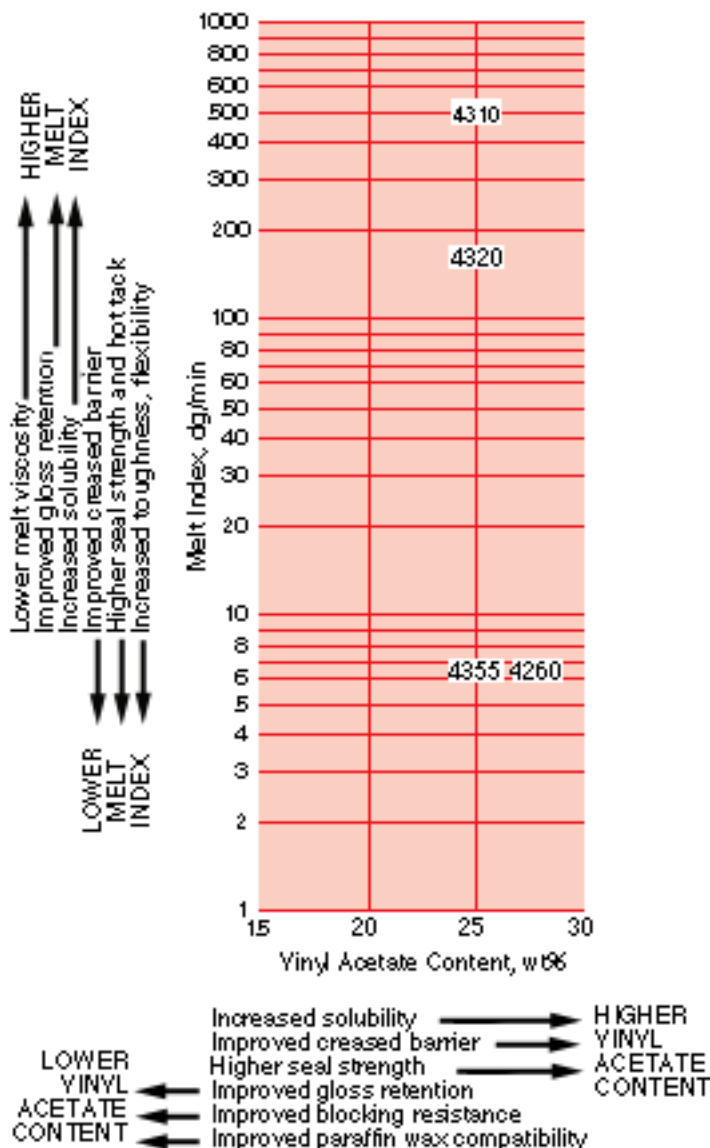
Elvax® 4260 — High molecular weight resin for use in hot melt systems where improved adhesion to polar, nonporous substrates is required. In coatings, provides superior hot tack, improved grease resistance, and optimum barrier properties.

Elvax® 4310 — Low molecular weight resin designed to provide improved grease resistance and adhesion in low-viscosity systems. Permits maximum Elvax(R) content at a given viscosity in solvent or hot melt systems.

Elvax® 4320 — Intermediate molecular weight resin higher in viscosity than Elvax(R) 4310 and intermediate in performance between Elvax(R) 4310 and 4355. Can be combined (as can Elvax(R) 4310) with Elvax(R) 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.



High-VA, Low-MI Grades of Elvax® EVA

For many years DuPont has made specialty grades of Elvax® that have the unusual combination of high vinyl acetate levels and low melt indexes. Among these specialty Elvax® resins 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.

Due to their 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.

Physical Properties of DuPont™ Elvax® EVA / Acid Terpolymer Resins

Typical Properties ^(a)	Elvax® 4260	Elvax® 4310	Elvax® 4320	Elvax® 4355
Melt Index ^(b) Aim	6.0	500	150	6.0
Vinyl Acetate, % Aim	28.0	25.0	25.0	25.0
Acid Number ^(c)	4–8	4–8	4–8	4–8
Density at 23°C kg/m ³ (g/cc) ASTM D1505	955 (0.955)	945 (0.945)	947 (0.947)	952 (0.952)
Tensile Strength MPa (psi) ASTM D1708 ^(d)	19 (2700)	2.0 (300)	5.2 (750)	19 (2800)
Elongation at Break, % ASTM D1708 ^(d)	1000	600	900	1000
Elastic (Tensile) Modulus, MPa (psi) ASTM D1708 ^(d,e)	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, ^(f) °C (°F)	99 (210)	88 (190)	88 (190)	88 (190)

^(a) These data are presented as a general description of properties and are not intended to be used for design specifications.

^(b) dg/min (ASTM D1238, modified).

^(c) Milligrams potassium hydroxide per gram polymer.

^(d) 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).

^(e) Modulus calculated as in ASTM D638.

^(f) 10% Elvax® in fully refined wax, 146 AMP.

Physical Properties of High-VA, Low-MI DuPont™ Elvax® EVA Resins

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

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The high VA level also means that these polymers are soluble in organic solvents. The low MI gives the resins good heat resistance, which 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. Because the polymers are higher in gel than the standard grades of Elvax®, they are not suited to some film markets.

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.

Worldwide DuPont Sales and Support

DuPont supplies and supports Elvax® customers from research, manufacturing and sales locations worldwide.

REGIONAL CONTACT CENTERS

FOR DUPONT™ ELVAX®

DuPont Packaging and Industrial Polymers

Wilmington, Delaware U.S.A.

Telephone +1 302 774 1161

Toll-free (USA) 800 438 7225

Fax +1 302 892 7390

DuPont do Brasil, S.A.

Barueri, Sao Paulo Brasil

Telephone +55 11 4166 8542

Fax +55 11 4166 8720

DuPont China Holding Co., Ltd.

Pudong New District, Shanghai

Telephone +86 21 3862 2888

Fax +86 21 3862 2889

DuPont de Nemours Int'l. S.A.

Geneva, Switzerland

Telephone +41 22 717 51 11

fax +41 22 717 55 00

elvax.dupont.com

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