AOC®
World Leader in Resin Technology

Vipel®
F010 Series
Bisphenol A Epoxy
Vinyl Ester Resins

Product Information

Vipel® Corrosion Resistant Bisphenol A, Epoxy Vinyl Ester Resins

TYPICAL PROPERTIES OF CURED RESIN * **

Test	Units of Measure	Nominal	Test Method
Tensile Strength,	psi/MPa	12,800/88	ASTM D 638
Tensile Modulus,	psi/GPa	460,000/3.2	ASTM D 638
Tensile Elongation,	%	6.2	ASTM D 638
Flexural Strength,	psi/MPa	22,000/153	ASTM D 790
Flexural Modulus,	psi/GPa	500,000/3.5	ASTM D 790
Heat Distortion Temp.	°F/°C @ 264 psi	248/120	ASTM D 648
Barcol Hardness, Ultimate		39	ASTM D 2583
Compressive strength at yield,	psi/MPa	17,600/121	ASTM D 695
Glass Transition Temp.	Tg(°F/°C)	266/130	DIN 53445
Critical Strain Energy Release Rate (G_{1C})	$J \cdot M^{-2}$	100	ASTM E 399
Stress Intensity Factor (K_{1C})	$MPa \cdot m^{1/2}$	0.6	ASTM E 399
Dielectric Dissipation Factor			
Dry/	@ 60 Hz	$2.5/3.7 \times 10^{-3}$	DIN 53483
after 24 hrs in drinking water	@ 1 KHz	$2.2/3.3 \times 10^{-3}$	DIN 53483
	@ 1 MHz	$1.6/2.3 \times 10^{-3}$	DIN 53483
Dielectric Constant			
Dry/	@ 60 Hz	3.4/3.5	DIN 53483
after 24 hrs in drinking water	@ 1 KHz	3.4/3.5	DIN 53483
	@ 1 MHz	3.3/3.4	DIN 53483
Surface Resistivity	ohm	$>10^{13}$	DIN 53482
Volume Resistivity			
Dry/	ohm • cm	$>10^{16}/>10^{16}$	DIN 53482
after 24 hrs in drinking water			
Dielectric Strength			
0.7mm Specimen Thickness	KV/mm	120	DIN 53481

DESCRIPTION

AOC's Vipel F010 series is a bisphenol A epoxy-based vinyl ester resin dissolved in styrene. The Vipel F010 series is ideally suited for use in hand lay-up, spray-up, filament winding, SMC, and pultrusion processes where outstanding mechanical properties and excellent resistance to chemicals and heat are required.

*Based on tests of Vipel F010-CNT-00 at 77°F/25°C and 50% relative humidity. All thixotropic resins should be mixed well prior to use. The use of thixotropy degrades the corrosion performance of a resin in some chemical environments such as sodium chloride. All tests on unreinforced cured resin. Castings were post cured.

**Typical properties are not to be construed as specifications.

BENEFITS

Versatile

Wide formulating capabilities allow for use in many processes and for optimization of cost/performance.

Unique composition produces a tough and versatile resin with excellent crack and craze resistance in molded parts.

Vipel F010 is suitable for moldings that are subjected to particularly high static or dynamic loads, such as pipe, tanks, duct work and flooring applications. Vinyl ester resins have excellent resistance to sustained heat.

Corrosion Resistant

Vipel F010 highly resistant to hydrogen peroxide, and alkalis, and performs well in various stages of hypochlorite and chlorine production. Refer to AOC's "Corrosion Resistant Resin Guide" for corrosion resistance information or for questions regarding suitability of a resin to any particular chemical environment contact AOC.

Food and Drug

All resins in this datasheet are manufactured from raw materials that are listed in FDA regulation Title 21 CFR 177.2420. It is the fabricator's responsibility to also be sure that the final composite is well cured. All composites used for FDA applications should be post cured at 180°F/82°C for at least 4 hours. After post curing it should be washed with soap and water and rinsed.

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Tensile Properties of Vipel Laminates at Different Temperatures**

Temperature, °F/°C	Tensile Strength, psi/MPa	Tensile Modulus, psi/GPa	Elongation,%
77/25	22,000/151	2,000,000/13.8	1.6
200/93	21,000/145	1,760,000/12.1	1.5
250/121	17,300/119	1,300,000/9.0	1.6
300/149	10,000/69	850,000/5.9	1.6
325/163	7,500/52	765,000/5.3	2.0

Laminate construction: VMM, MRMRM V-glass veil, M-chopped strand mat 1.5 oz per square foot (450 grams per square meter), R-Woven Roving 24 oz per square yard (814 grams per square meter). Laminates were 0.25 inches (6.4 mm) thick and post cured at 212°F/100°C

Typical Liquid Resin Properties Of Various Versions Of Vipel F010**

Version	Viscosity, Cps	Thix Index	Gel Time, minutes	Gel to Peak Exotherm, minutes	Peak Exotherm, °F/°C	Specific Gravity	Styrene Content,%
F010-BNT-00	3200[1]	NA	17[2]	10	330/166	1.1	27
F010-CNL-00	200[3]	NA	21[2]	16	350/177	1.02	42
F010-CNM-00	300[3]	NA	20[2]	10	356/180	1.05	39
F010-CNP-25	300[3]	NA	25[4]	7	370/188	1.05	39
F010-CNT-00	400[3]	NA	20[2]	9	350/177	1.06	38
F010-INL-00	130[9]	NA	47[10]	60	175/80	1.01	43
F010-LKB-35	500[5]	2.5[6]	35[7]	9	370/188	1.01	42
F010-TBN-28	500[5]	2.0[6]	28[4]	5	350/177	1.01	43
F010-TBP-25	500[5]	2.5[6]	25[8]	17	320/160	1.01	43

NA- Not applicable
**Typical properties are not to be construed as specifications.

1) 77°F/25°C Brookfield RV viscosity spindle 3 at 20 rpm
2) 77°F/25°C Gel time with 0.25% cobalt 6% and 1.25% MEKP
3) 77°F/25°C Brookfield RV viscosity spindle 2 at 20 rpm
4) 77°F/25°C Gel time with 1.25% MEKP
5) 77°F/25°C Brookfield LV viscosity spindle 3 at 60 rpm
6) 6/60 Thix Index
7) 77°F/25°C Gel time 1.5% MEKP
8) 77°F/25°C Gel time 1.0% MEKP
9) 77F/25C Brookfield LV viscosity spindle 2 at 60 rpm
10) 77F/25C Gel time with 0.25% Cobalt-6% and 1.75% Cummene Hydroperoxide (90%)

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Typical Formulations and Gel Times of Select Vipel Resins ** ***

	DMA						DEA					
Resin Temperature (°F) ➔	**60s**		**70s**		**90s**		**60s**		**70s**		**90s**	
10 – 20 min.	**19**		**16**		**13**	**18**	**17**		**15**		**12**	**15**
MEKP,%	1.25		1.25		1.25	1.25	1.25		1.25		1.25	1.25
CoNAP,%	0.3		0.3		0.1	0.1	0.3		0.3		0.1	0.1
DMA,%	0.05		0.05		0.05	0.05						
DEA,%							0.2		0.1		0.1	0.1
2,4-P,%					0.01						0.01	
TBC,%						0.01						0.005
20 – 40 min.	**26**	**32**	**29**	**25**	**38**	**32**	**29**	**36**	**34**	**27**	**29**	**30**
MEKP,%	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
CoNAP,%	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1
DMA,%	0.05	0.05	0.05	0.05	0.05	0.05						
DEA,%							0.1	0.1	0.1	0.1	0.1	0.1
2,4-P,%	0.02		0.05		0.05		0.02		0.05		0.04	
TBC,%		0.01		0.015		0.025		0.01		0.015		0.02
40 – 60 min.	**43**	**43**	**50**	**52**	**51**	**46**	**47**	**49**	**44**	**51**	**48**	**51**
MEKP,%	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
CoNAP,%	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1
DMA,%	0.05	0.05	0.05	0.05	0.05	0.05						
DEA,%							0.1	0.1	0.1	0.1	0.1	0.1
2,4-P,%	0.05		0.08		0.1		0.05		0.07		0.06	
TBC,%		0.017		0.03		0.04		0.016		0.03		0.035

Benzoyl Peroxide Catalyst (BPO) with DMA and alternative DEA [For laminates less than 3/16 inches (4.8 mm) thick] ** ***

Resin Temperature (°F) ➔		**60s**		**70s**		**90s**	
10 – 20 min.		**17**	**16**	**17**	**18**	**13**	**13**
	BPO,%	1	1	1	1	1	1
	DMA,%	0.3		0.2		0.1	
	DEA,%		0.6		0.45		0.3
20 – 40 min.		**36**	**35**	**27**	**30**	**38**	**25**
	BPO,%	1	1	1	1	1	1
	DMA,%	0.1		0.1		0.05	
	DEA,%		0.3		0.25		0.15
40 – 60 min.		**54**	**44**	**57**	**52**	**48**	**52**
	BPO,%	1	1	1	1	1	1
	DMA,%	0.07		0.05		0.04	
	DEA,%		0.2		0.15		0.1

CODE	
BPO:	Benzoyl Peroxide – 98% active (Adjust addition level for other concentrations)
CoNAP:	Cobalt Naphthenate 6% Solution
DEA:	N,N Diethylaniline
DMA:	N,N Dimethylaniline
MEKP:	Methyl Ethyl Ketone Peroxide
2,4-P:	2, 4-Pentainedione
TBC:	Tertiary butyl catechol 85%

**Typical properties are not to be construed as specifications.

*** The gel times shown are typical but may be affected by catalyst, promoter, inhibitor concentration, resin, mold, and shop temperature. Variations in gelling characteristics can be expected between different lots of catalysts and at extremely high humidities. Pigment and/or filler can retard or accelerate gelation. It is recommended that the fabricator check the gelling characteristics of a small quantity of resin under actual operating conditions prior to use.

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PERFORMANCE GUIDELINES

A. Keep full strength catalyst levels between 1.0% - 2.0% of the total resin weight.

B. Maintain shop temperatures between 65°F/18°C and 90°F/32°C and humidity between 40% and 90%. Consistent shop conditions contribute to consistent gel times and will help the fabricator make a high quality part.

C. Finished part surfaces that have been cured at room temperature in contact with air should be relatively tack free. They may not, however, be fully cured and are thus not as resistant to chemicals as a fully cured part. If no further laminating is planned, a 10% solution of 5% paraffin wax solution (MP 115-118°F/46-48°C) in styrene may be added to the last resin layer to provide a tack free surface.

D. Optimum cure and performance may be obtained by post curing room temperature cured laminates for two hours at 158-212°F/70-100°C.

E. Room temperature curing by means of cobalt acceleration should be completed with low hydrogen peroxide content MEKP catalyst to minimize foaming.

SAFETY

See appropriate Material Safety Data Sheet for guidelines.

ISO 9001:2008 CERTIFIED

The Quality Management Systems at every AOC manufacturing facility have been certified as meeting ISO 9001:2008 standards. This certification recognizes that each AOC facility has an internationally accepted model in place for managing and assuring quality. We follow the practices set forth in this model to add value to the resins we make for our customers.

STORAGE STABILITY

Vipel F010-CNP-25, F010-LKB-35, F010-TBN-28 and F010-TBP-25 are stable for 3 months from the date of manufacture when stored in the original containers, away from direct sunlight or other UV light sources and at or below 77°F (25°C). All other Vipel F010 products are stable for 6 months from the date of manufacture when stored in original containers, away from direct sunlight or other UV light sources an at or below 77°F (25°C).

Storage stability of two months or less should be anticipated if the storage temperature exceeds 86°F (30°C).

After extended storage, some drift may occur in the product viscosity and gel time.

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