

Technical Datasheet

Ashland Performance Materials



HETRON® FR 998/35 Flame Retardant Epoxy Vinyl Ester Resin

HETRON FR998/35 resin is a low viscosity, unpromoted, flame retardant⁽¹⁾ patented epoxy vinyl ester with F-Cat technology. This patented technology results in a resin that exhibits no foaming, excellent exotherm control, and industry leading storage stability. Laminates made with HETRON FR998/35 resin have achieved a flame spread of <25 (ASTM E-84) without antimony trioxide. HETRON FR998/35 resin also contains <35% styrene.

Equipment fabricated with HETRON FR998/35 resin exhibit:

- Excellent flame retardancy
- Excellent thermal shock resistance
- Excellent corrosion resistance to acids and oxidizers
- Excellent thermal properties
- Fast wet-out, low drainage

APPLICATIONS AND USE

HETRON FR998/35 resin can be used for corrosion resistant, reinforced thermosetting plastic equipment including filament wound, hand lay-up and spray-up tanks, pipes, ducts, stacks, scrubbers, linings or other equipment handling corrosive gases, vapors or liquids where a high degree of flame retardancy is required. The product is well suited for the caustic/chlorine and power industry applications.

HETRON 980/35 epoxy vinyl ester resin is a non-flame retardant product suitable for many similar environments. HETRON FR998/35 resin would offer many of the benefits of HETRON 197ATP resin (now discontinued) while not requiring antimony trioxide. Recommendations for specific services and environments can be provided by contacting us at hetron@ashland.com.

TYPICAL LIQUID RESIN PROPERTIES

Property ⁽²⁾ at 25°C (77°F)	Value	Unit
Viscosity, Brookfield # 2 spindle @ 30 rpm	475	mPa·s (cps)
Percent Solids	66	%
Color	<10	Gardner
Specific Gravity	1.21	gm/cc

(1) HETRON polyester resin will burn if provided with a sufficient amount of heat and oxygen. The degree of flame retardancy of the cured polyester resin is characterized by the ASTM E-84 tunnel test. This test is performed under strictly controlled conditions where a flame spread rating is assigned according to comparisons with test set-point materials. The behavior of the cured composite under these controlled conditions can vary from an actual fire situation.



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(2) Properties are typical values based on material tested in our laboratories. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

TYPICAL CURING CHARACTERISTICS

MEKP Cure System

Typical⁽²⁾ geltimes at different temperatures using different pre-acceleration systems and curing with Delta⁽³⁾ X-9, Lupersol⁽³⁾ DDM-9, Hi-Point⁽⁴⁾ 90, and Cumene Hydroperoxide catalysts⁽⁵⁾.

CAUTION: Thoroughly mix promoters with resin before adding catalyst.

Temperature / Catalyst	DMA	Co-nap6%	Delta X-9	DDM-9	HiPoint 90	HiPoint 90/CHP 50/50
18°C (65°F) / 1.25 phr	0.05 phr	0.2 phr	7 min.	11 min.	10 min.	27 min.
	0.025 phr	0.2 phr	12 min.	15 min.	15 min.	37 min.
	0.01 phr	0.2 phr	25 min.	27 min.	27 min.	66 min.
25°C (77°F) / 1.25 phr	0.05 phr	0.25 phr	4 min.	6 min.	6 min.	13 min.
	0 phr	0.3 phr	20 min.	22 min.	22 min.	47 min.
	0 phr	0.15 phr	31 min.	35 min.	35 min.	76 min.
29°C (85°F) / 1.25 phr	0 phr	0.3 phr	18 min.	19 min.	19 min.	41 min.
	0 phr	0.2 phr	22 min.	22 min.	23 min.	49 min.
	0 phr	0.1 phr	38 min.	41 min.	41 min.	85 min.

BPO/DMA Cure System

Temperature / BPO Paste 50%	DMA	Gel Time
18°C (65°F) / 2.0 phr	0.2 phr	20 min.
	0.15 phr	27 min.
	0.1 phr	43 min.
24°C (75°F) / 2.0 phr	0.2 phr	14 min.
	0.15 phr	20 min.



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	0.1 phr	31 min.
29°C (85°F) / 2.0 phr	0.15 phr	12 min.
	0.1 phr	18 min.
	0.05 phr	46 min.

(3) Registered trademark of Atofina Chemicals Inc.

(4) Registered trademark of Witco Chemical Corporation.

(5) All levels are based on parts per hundred resin (phr)

Effect of Copper Naphthenate

Exotherm control formulations - When laminates require a lower exotherm, copper naphthenate⁽⁶⁾ (Cu-nap 8%) may be incorporated to achieve the desired reduction. High hydrogen peroxide catalysts, such as CADOX⁽⁷⁾ M-50 or DELTA X-9, should be used to avoid dramatic moves in gel times. The catalyst used below is Delta X-9 at 1.25 phr.

CAUTION: Thoroughly mix promoters with resin before adding catalyst.

Temperature / Cu-nap 8%	Co-nap6%	Gel Time	Gel-Peak	Peak Exo
18°C (65°F) / 0 phr	0.3 phr	31 min.	13 min.	163°C (325°F)
18°C (65°F) / 0.04 phr	0.3 phr	35 min.	30 min.	132°C (270°F)
25°C (77°F) / 0 phr	0.25 phr	26 min.	13 min.	160°C (320°F)
25°C (77°F) / 0.04 phr	0.25 phr	35 min.	25 min.	132°C (270°F)
29°C (85°F) / 0 phr	0.2 phr	25 min.	13 min.	160°C (320°F)
29°C (85°F) / 0.04 phr	0.2 phr	33 min.	25 min.	132°C (270°F)
35°C (95°F) / 0 phr	0.1 phr	38 min.	15 min.	160°C (320°F)
35°C (95°F) / 0.04 phr	0.1 phr	45 min.	21 min.	132°C (270°F)



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(6) Can be acquired by Akcros Chemical, Inc., Huls America Inc., or O.M. Group Inc. More than 500 ppm of 8% copper naphthenate may be detrimental to cure.

(7) Registered trademark of Akzo Nobel
Effect of Copper Levels at 25°C (77°F)

Copper Naphthenate (Cu-nap 8%) will influence Gel Time, Gel-to-Peak and Peak Exotherm at 25°C (77°F). Catalyst used below is Delta X-9 at 1.25 phr.

CAUTION: Thoroughly mix promoters with resin before adding catalyst.

Cu-naphthenate 8%	Co-nap6%	Gel Time	Gel-Peak	Peak Exo
0 phr	0.25 phr	28 min.	14 min.	160°C (320°F)
0.01 phr	0.25 phr	32 min.	15 min.	155°C (310°F)
0.02 phr	0.25 phr	33 min.	17 min.	143°C (290°F)
0.03 phr	0.25 phr	33 min.	22 min.	138°C (280°F)
0.04 phr	0.25 phr	35 min.	25 min.	132°C (270°F)

For all surfaces that will be exposed to air during fabrication (top-coating, lining, patching, exterior surfaces, etc.) the addition of 0.4% paraffin wax to the final resin layer is recommended. A waxed surface may interfere with secondary bonding adhesion.

Flame retardant vinyl ester resins do not demonstrate ultraviolet stability equivalent to non-halogenated vinyl ester resins. Ultraviolet stability may be improved by adding 1.0% CYASORB⁽⁸⁾ UV-9 ultraviolet screener to the exterior exposed surfaces where aesthetic appearance is desired.

TYPICAL MECHANICAL PROPERTIES

Property ⁽²⁾ of a cured casting ⁽⁹⁾ at 25°C (77°F)	Value (SI)	Value (US)	Method
Barcol Hardness	40	40	ASTM D2583
Tensile Strength	93 MPa	13,500 psi	ASTM D638
Tensile Modulus	3.7 GPa	5.4 psi x 10 ⁵	ASTM D638
Tensile Elongation at break	4.0%	4.0%	ASTM D638
Flexural Strength	152 MPa	22,000 psi	ASTM D790
Flexural Modulus	3.9 GPa	5.7 psi x 10 ⁵	ASTM D790
Heat Distortion Temperature	135°C	275°F	ASTM D648



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(8) Registered trademark of Cytec Industries

(9) Catalyzed with 1.0% BPO, cured two hours at 71°C (160°F), then one hour at 93°C (200°F), post-cured two hours at 138°C (280°F).

TYPICAL FLAME RETARDANCY OF LAMINATES⁽¹¹⁾

Tested Material	Class	ASTM E-84 Flame Spread
HETRON FR998/35 resin laminate without 3% antimony trioxide	I	<25
Cement Asbestos Board (control)	I	0
Red Oak (control)	III	100

(11) Properties are typical values, based on material tested in our laboratories, but varies from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items. Laminate thickness = 3.18 mm (0.125 in.) with approximately 27% glass content.

Master Batch Guide

Cobalt Naphthenate 6% Quantity for:	Drum	5-Gal (19 kg, 41 lbs)
0.2 phr	13.5 fl.oz/400 cc	1.2 fl.oz/36 cc
0.3 phr	20.3 fl.oz/600 cc	1.8 fl.oz/54 cc
0.4 phr	27.9 fl.oz/800 cc	2.4 fl.oz/72 cc
DMA Quantity for:		
0.05 phr	3.6 fl.oz/106 cc	0.32 fl.oz/9.5 cc
0.10 phr	7.2 fl.oz/212 cc	0.65 fl.oz/19 cc
0.15 phr	10.8 fl.oz/318 cc	0.97 fl.oz/28.6 cc
Copper Naphthenate 8% Quantity for:		
0.02 phr	1.0 fl.oz/40 cc	0.10 fl.oz/3 cc
0.03 phr	2.0 fl.oz/60 cc	0.16 fl.oz/6 cc
0.04 phr	3.0 fl.oz/80 cc	0.25 fl.oz/7 cc



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9% MEKP Quantity for:	0.95 liter (1 quart)	2kg (5 lbs)
1.25%	0.39 fl.oz/11.4 cc	0.90 fl.oz/26.2 cc

CERTIFICATES AND APPROVALS The manufacturing, quality control and distribution of products, by Ashland Performance Materials, comply with one or more of the following programs or standards: Responsible Care, ISO 9001, ISO 14001 and OHSAS 18001.

STANDARD PACKAGE Non-Returnable Drum with Net Weight of 230 Kgs (507 Lbs)
DOT Label Requirement: Flammable Liquid

COMMERCIAL WARRANTY Six months from date of shipment, when stored in accordance with the conditions stated below.

STORAGE Drums - Store at temperatures below 25°C (77°F). Storage life decreases with increasing storage temperature. Avoid exposure to heat sources such as direct sunlight or steam pipes. To avoid contamination of product with water, do not store outdoors. Keep containers sealed to prevent moisture pick-up and monomer loss. Mild mixing is recommended after prolonged storage. Rotate stock.

Bulk - See Ashland's Bulk Storage and Handling Manual for Polyesters and Vinyl Esters. A copy of this may be obtained from Ashland Performance Materials at +1.614.790.3333 or 800-523-6963.

All other conditions being equal, higher storage temperatures will reduce product stability and lower storage temperatures will extend product stability.

Notice All information presented herein is believed to be accurate and reliable, and is solely for the user's consideration, investigation and verification. The information is not to be taken as an express or implied representation or warranty for which Ashland assumes legal responsibility. Any warranties, including warranties of merchantability or non-infringement of intellectual property rights of third parties, are herewith expressly excluded.

Since the user's product formulations, specific use applications and conditions of use are beyond the control of Ashland, Ashland makes no warranty or representation regarding the results which may be obtained by the user. It shall be the responsibility of the user to determine the suitability of any of the products mentioned for the user's specific application.



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The HETRON logo consists of the word "HETRON" in a bold, white, sans-serif font, set against a blue rectangular background. A thin red horizontal line is positioned below the blue background.

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Ashland requests that the user reads, understands and complies with the information contained herein and the current Material Safety Data Sheet.



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