

**HETRON® 800
FURAN RESIN****JANUARY 1998**COMPOSITE POLYMERS • DIVISION OF ASHLAND CHEMICAL CO. • DIVISION OF ASHLAND INC.
BOX 2219, COLUMBUS, OHIO 43216 • (614) 790-3333**FURAN RESIN**

DESCRIPTION: HETRON 800 resin is a thermosetting furan polymer derivative of furfuryl alcohol and furfural. HETRON 803L-1 catalyst is used to cure this resin. When cured, fiberglass reinforced plastic (FRP) laminates made with HETRON 800 furan resin exhibit excellent corrosion resistance properties. These properties include resistance to alkali, solvents and corrosive combinations of acid and solvent media - environments which would be unsuitable for FRP equipment made with polyester resins.

HETRON 800 furan resin has limited resistance to oxidizing chemicals and should not be used for FRP equipment which will be in service for chromic and nitric acids, peroxides or hypochlorites.

SUGGESTED USES: HETRON 800 resin can be used for corrosion resistant FRP equipment including pipes, tanks, fume hoods, ducts, linings, and flake-glass coatings where fire retardancy is not required.

TYPICAL * LIQUID PROPERTIES AT 77°F (25°C)

Pounds Per Gallon	10.1
Color	Dark Brown
Specific Gravity	1.21
Viscosity - Brookfield, cps	240
pH	6.5
Flash Point Range, °F	154

** 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.*

STANDARD PACKAGE: 55-gallon drum, Non-Returnable, Net Wt. 550 lbs.
DOT LABEL REQUIRED: Flammable Liquid
CODE: 566-400

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HETRON® 800 Resin (continued)

TYPICAL* MECHANICAL PROPERTIES

TEST	VALUE	TEST METHOD
Barcol Hardness	40	
Tensile Strength, psi (MPa)	5,200 (35)	ASTM D-638
Tensile Modulus, psi x 10 ⁵ (GPa)	5.7 (3.8)	ASTM D-638
Tensile Elongation, %	1.0	ASTM D-638
Flexural Strength, psi (Mpa)	10,500 (71)	ASTM D-790
Flexural Modulus, psi x 10 ⁵ (GPa)	5.8 (3.9)	ASTM D-790
Heat Deflection Temperature, °F (°C)	212 (100)	ASTM D-648

TYPICAL* PERFORMANCE PROPERTIES

TYPICAL HETRON 800 RESIN GEL TIMES (MINUTES) WITH HETRON 803L-1 CATALYST:

HETRON 803L-1 Resin, phr ¹	65°F (18.5°C)	77°F (25°C)	90°F (32°C)
2.5	33.0	17.5	10.0
3.0	27.5	15.0	8.5
4.0	19.0	11.5	6.5
5.0	16.0	10.0	5.5

Although fiberglass reinforced equipment will normally cure to a rigid state within 24 hours, HETRON 800 resin cure is dependent upon both ambient air and mold temperatures and the amount of HETRON 803L-1 catalyst used.

HETRON 800 RESIN CATALYZATION WITH HETRON 803L-1 RESIN:

Resin Quantity	Level, %	Catalyst Volume	
		cc	Fluid Ounce
1-Pint; 1.26 lb. (572 grams)	2.5	10.7	.27
	3.0	13.0	.32
	4.0	17.3	.42
	5.0	21.5	.53
1-Quart; 2.53 lb. (1,148 grams)	2.5	21.4	.54
	3.0	26.0	.64
	4.0	34.6	.84
	5.0	43.0	1.06
1-gallon; 10.1 lb. (4,585 grams)	2.5	85.0	2.16
	3.0	104.0	2.56
	4.0	138.0	3.36
	5.0	172.0	4.24

CURING OF FURAN RESINS: The nature of their chemistry makes furan resins very reactive to acidic catalysis. This causes spontaneous polymerization which generates heat. Unlike polyester resins which also polymerize exothermically, furan resins polymerize with the formation of water during the exothermic reaction, which can vaporize rapidly unless carefully controlled. Vapor formation can result in delamination and blistering within the FRP laminate.

¹Parts by weight per 100 grams of resin; 300 grams used per gel time test

HETRON® 800 Resin (continued)

The furan condensation polymerization reaction is more sensitive to temperature effects and over-catalysis than the corresponding polymerization reaction of polyester resins. Low fabrication temperatures (60°F-65°F) (15.5-18.5°C) usually result in a composite which may take extensive periods of time to cure and may not develop satisfactory corrosion resistance. At low temperatures, the use of increased levels of catalyst will result in only minor improvements in cure; therefore, it is recommended that furan resin fabrication not be attempted at temperatures below 65°F (18.5°C).

Higher ambient temperatures (85°F-90°F) (29.5-32°C) may present other problems such as reduced pot life or working time, or the blistering and delamination of the thicker sections of the laminate. In spite of the highly exothermic nature of the curing reaction, furan resins do not cure very rapidly at room temperature in thinner films. To achieve optimum strength and corrosion resistance, applications must undergo a post-cure schedule at carefully selected temperatures depending on the laminate thickness.

CATALYST: HETRON 803L-1 catalyst is specifically developed for use with HETRON 800 furan resin. This system has a limited gel time range at temperatures between 65 and 90°F (16.5-32°C) as shown in Table 1. It is recommended that HETRON 803L-1 catalyst be used between 2.5 and 5.0 parts per 100 parts by weight of resin and that no more than three gallons (11 liters) of HETRON-800 resin be catalyzed at one time. Refer to Table 2 for proper levels of HETRON 803L-1 catalyst in cc's or fl. oz. for resin volumes. Once mixed, the resin should be dispensed as rapidly as possible onto the mold or mandrel surface. The short pot life, however, will not be encountered once the catalyzed resin is dispensed over the mold surface. This will allow for sufficient working time followed by a rapid gel and cure development. In hot climates, HETRON 800 resin should be cooled prior to use.

Catalyzation of large amounts of resin can result in an uncontrollable exothermic reaction which could pose a hazard to workers and the workplace. However, exotherming resin in a pot may be effectively controlled by total immersion in a container of water.

HANDLING: Used together the HETRON 800 furan resin and HETRON 803L-1 catalyst are adaptable for spray-up applications similar to those of polyester resin; however, some corrosive wear may develop in the spray gun and/or catalyst injection mechanism. The VENUS² Furan Resin System is designed for spraying furan resin and catalyst.

All furan resin FRP fabrications using 10 mil (18 gr/m²) C-glass surfacing veil in the liner must be post-cured to a Barcol hardness development above 45 prior to placing any FRP equipment into service. Synthetic surfacing veil is not recommended in the liner. As soon as the fabrication attains structural stability (this will depend on the part design and thickness), it should be removed from the mandrel or mold to allow the inner furan surface to be exposed to the air. Surface condensate retards curing and for this reason, air and heat must be allowed to carry off any moisture buildup. Under ambient conditions the exposed laminate surfaces will cure first and register higher Barcol values than the laminate interior. For these reasons, furan resin fabrications must be post-cured or literally "baked" to drive out reaction condensate to promote full cross-linking and cure. Post-curing is generally carried out in 40°F (4.5°C) temperature increments starting at 120°F (49°C), particularly on green or new fabrications to avoid delaminations and blistering. Furan fabrications that are several weeks old and have developed an initial Barcol hardness under ambient conditions can generally be post-cured immediately at 180°F (82°C) to attain optimum performance characteristics. Length of post cure will depend upon part thickness. For process conditions not covered in this technical data sheet, contact your Ashland technical representative.

HETRON® 800 Resin (continued)

HANDLING: HETRON 800 resin and HETRON 803L-1 catalyst contain ingredients which could be harmful if mishandled. Contact with skin and eyes should be avoided and necessary protective equipment and clothing should be worn. Always keep HETRON 803L-1 catalyst above freezing and below 100°F (38° C) to prolong its useful life.

Ashland Chemical Company maintains Material Safety Data Sheets on all of its products. Material Safety Data Sheets contain health and safety information for your development of appropriate product handling procedures to protect your employees and customers.

Our Material Safety Data Sheets should be read and understood by all of your supervisory personnel and employees before using Ashland Chemical Company's products in your facilities.

RECOMMENDED STORAGE:

Drums - Store at temperatures below 80°F (27°C). Storage life decreases with increasing storage temperature. Avoid exposure to heat sources such as direct sunlight or steam pipes. Keep containers sealed to prevent moisture pickup and monomer loss. Rotate stock.

Bulk - Store in stainless steel tanks or tanks lined with epoxy or phenolic coatings. Observe precautions against heat and moisture (see above). An inert gas or nitrogen blanket may be desirable.

SHELF LIFE: This product has a limited shelf life. When stored in accordance with the above conditions, this product has a minimum shelf life of three months.